



## Project Management Plan

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for the Smart Columbus  
Demonstration Program

FINAL REPORT | April 30, 2019



Produced by City of Columbus  
Columbus, Ohio

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## Acknowledgement of Support

This material is based upon work supported by the U.S. Department of Transportation under Agreement No. DTFH6116H00013.

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# Version History

Version #	Date	Author(s)	Reviewer(s)	Summary of Changes
1.0	12/8/16	City of Columbus	USDOT	Final
1.1	1/30/17	City of Columbus	USDOT	Final – Updated Quarterly Submission
2.0	11/28/17	City of Columbus	USDOT	Revised
2.1	2/1/18	City of Columbus	USDOT	Revised – Updated Quarterly Submission
2.2	11/27/18	City of Columbus	USDOT	Revised – Updated Quarterly Submission
2.3	4/30/19	City of Columbus	USDOT	Revised – Updated Quarterly Submission



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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 (the Operating System) 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 PMP 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 precedent. 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<sup>1</sup>, 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.

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<sup>1</sup><https://ops.fhwa.dot.gov/publications/seitsguide/index.htm>

## 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





# 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. The city is 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:

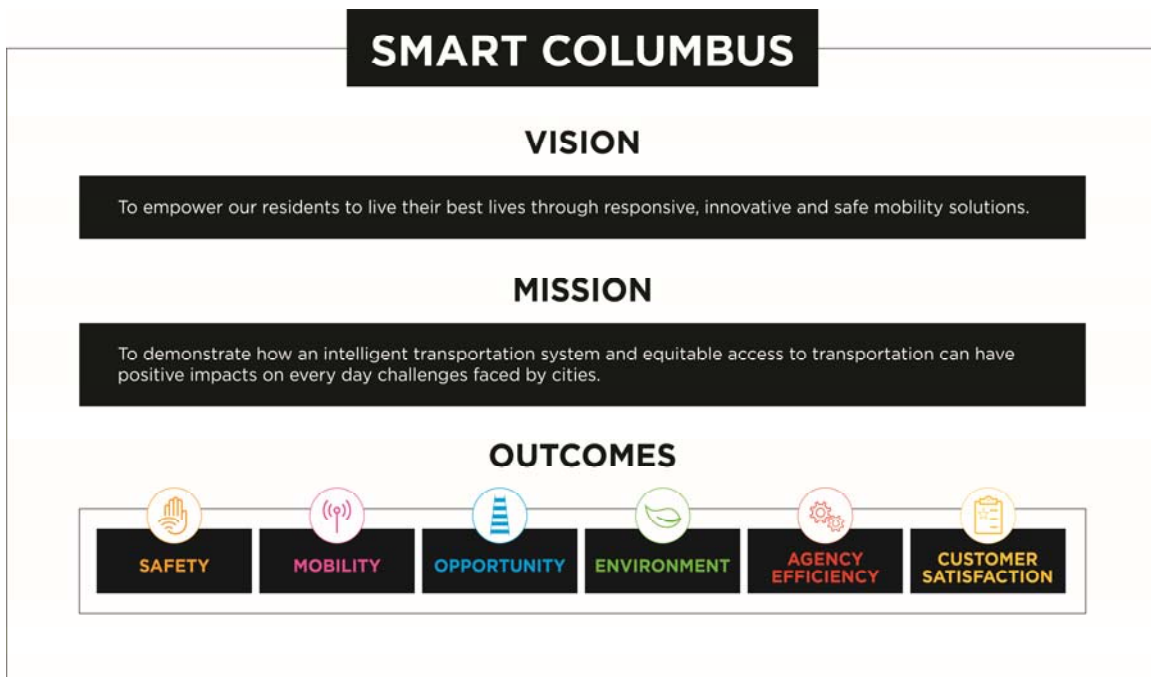
To demonstrate how an ITS and equitable access to transportation can have positive impacts on every day challenges faced by cities.

### 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

Figure 1. Smart Columbus Vision

## 2.1 PROGRAM OVERVIEW

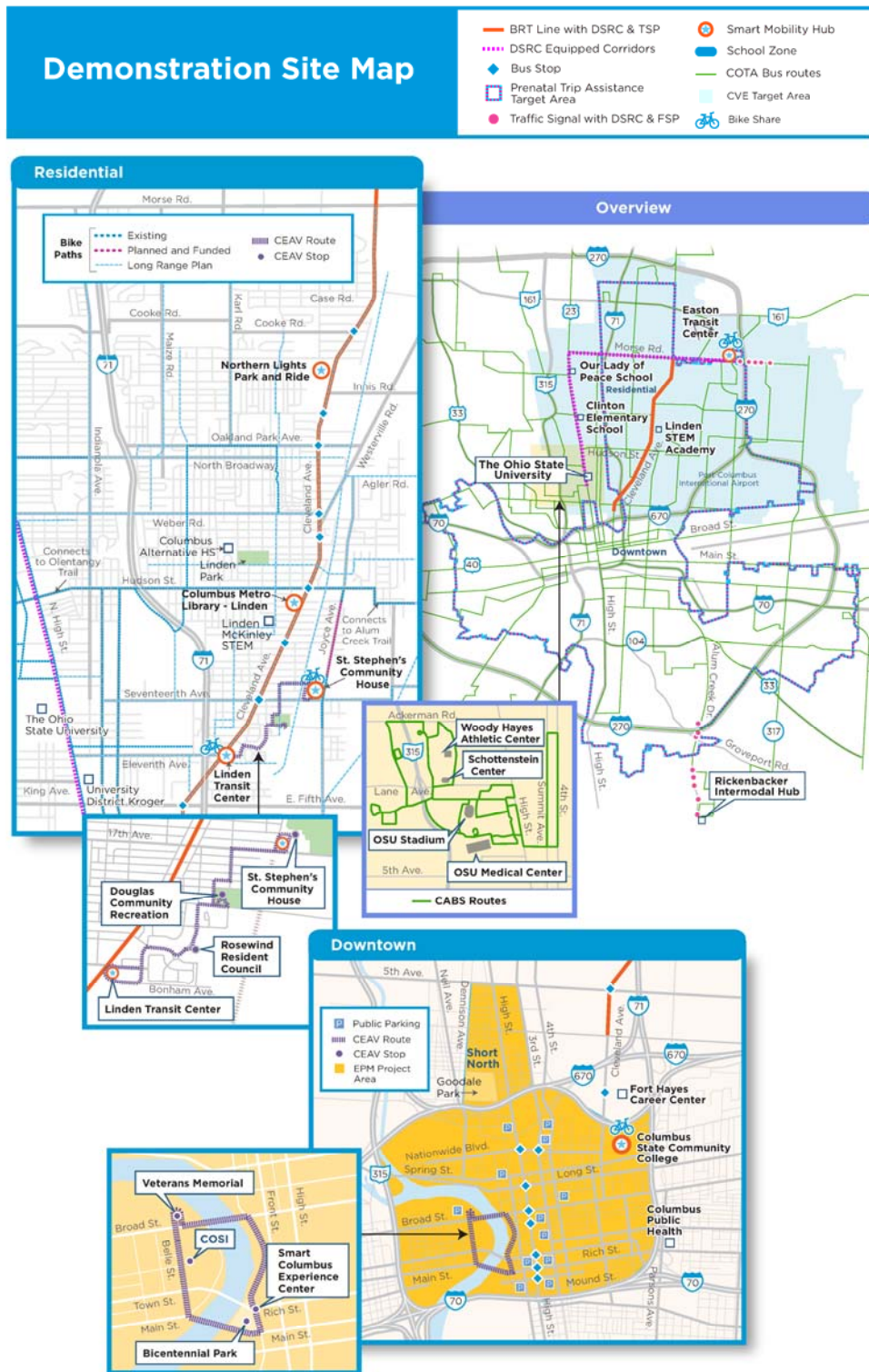
### 2.1.4. City Challenges

Smart Columbus will demonstrate effective implementation of a comprehensive portfolio of connected technologies that solve focused, relatable city issues and enhance mobility across the region. The challenges the city seeks to solve were selected based on the opportunity to provide a unique problem-solving proving ground which creates a foundation of nationwide scalability. A few of the representative challenges include:

1. *A lack of access to transportation options:* many residents in the city 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. In particular, Linden is a high-opportunity Columbus neighborhood for some of the Smart Columbus projects, due to its numerous socio-economic challenges, including low household income, lack of major employers and high infant mortality rates.
2. *Reduced mobility and lack of first mile-last mile (FMLM) transportation options:* despite having areas of high-traffic retail and jobs, some areas of Columbus are accessed primarily by light-duty vehicles and some bus service operating along the fringes of the area. While these areas offer a major source of employment, 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. Non-vehicle mobility solutions can assist in solving these challenges, improving mobility yet reducing emissions and their sources through a reduction in single occupancy vehicles and/or enhanced existing transit service.
3. *Lack of parking availability and information:* although 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. *Freight-induced congestion and queuing:* with Columbus the 10<sup>th</sup> most active logistics hub in America, there 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 is along Alum Creek Drive on the south side of Rickenbacker Logistics Park.

#### **An overview of the deployment area is shown in**

Figure 2. While some projects will be deployed within specific areas of the city, many projects will be deployed citywide and be designed in an integrated manner with the Smart Columbus Operating System (the Operating System) being the integral backbone and heart of all current and future smart city projects.



Source: City of Columbus, April 2019

Figure 2. Smart Columbus Deployment Map

The 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 because 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.

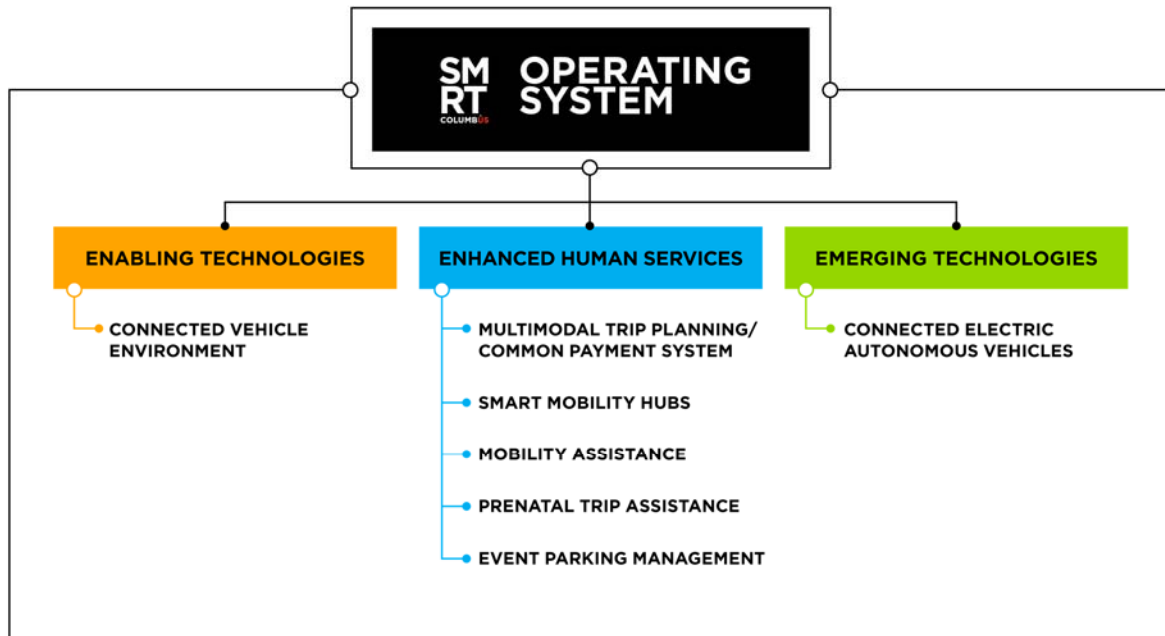
The method of themes demonstrates an integrated and holistic approach to delivering the Smart Columbus program.

## 2.1.5. Project Descriptions

Figure 3 summarizes the Smart Columbus Operating System and portfolio of USDOT projects. It depicts the criticality of the Operating System 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.

### 2.1.5.1. SMART COLUMBUS OPERATING SYSTEM (THE OPERATING SYSTEM)

The Operating System 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 Operating System 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 Operating System 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 Operating System will be scalable and demonstrate the potential for serving city and private sector needs well beyond the life of the SCC Award period.



Source: City of Columbus, April 2019

### Figure 3. Smart Columbus Framework

#### 2.1.5.2. ENABLING TECHNOLOGIES

##### 2.1.5.2.1 Connected Vehicle Environment (CVE)

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

- 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 motorist's adherence to red lights
- Improve adherence to speed limits in school zones
- Improve reliability of transit vehicle schedule adherence
- Reduce truck wait (delay) time at signalized intersection

### 2.1.5.3. ENHANCED HUMAN SERVICES

#### 2.1.5.3.1 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:

- Provide a single point of access to multimodal trip planning information to plan, book, and pay for a multimodal trip.
- Increase access to jobs and services
- Improve customer satisfaction

### **2.1.5.3.2 Mobility Assistance for People with Cognitive Disabilities (MAPCD)**

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:

- Improve access and use of COTA fixed route bus service for MAPCD participants
- Improve independence of travelers with cognitive disabilities by using fixed route bus service
- Reduce COTA expenditures

### **2.1.5.3.3 Prenatal Trip Assistance (PTA)**

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.

The City of Columbus identified the following objectives to evaluate the measurable impact that the PTA project is intended to provide:

- Examine pregnant women's improved access to NEMT trip in those assigned to PTA project compared to those assigned to usual transportation services.
- Increase usage of the NEMT benefits
- Improve customer satisfaction



#### 2.1.5.3.4 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:

- Improve physical access to multimodal trip planning and payment options
- Improve customer satisfaction of SMH Users

#### 2.1.5.3.5 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

## 2.1.5.4. EMERGING TECHNOLOGIES

### 2.1.5.4.1 Connected Electric Autonomous Vehicles (CEAV)

The use of connected and autonomous shuttles has been widely proposed as a solution to the first mile, last mile problem. Therefore, this project will address, investigate and develop solutions to the social and technical challenges associated with the use of connected and autonomous electric vehicle technology for safer and more efficient access to jobs in a smart city. Social challenges are how to gradually introduce an expand such a solution for best results, how to develop and improve user acceptance and user benefits, how to integrate with the rest of the transportation network for improving mobility and how to increase the user perception of safety and reliability. The technical challenges that will be focused on in this project are: 1) determination of penetration rates for improved mobility, 2) mixed traffic problems at higher speed urban roads, 3) autonomous shuttles right of way problems at intersections, 4) pedestrian and bicyclist safety, 5) all weather operation of autonomous shuttles, 6) latency and high network traffic problems in connectivity through V2X to other road users and infrastructure and to the data management hub, 7) handling uncertainty due to unpredictable operation of non-autonomous vehicles, other road users and environmental conditions.

Although the above technical challenges will be addressed, the most important technical problem blocking the deployment of connected autonomous shuttles in a smart city to enhance mobility is that no certification, testing and rating system for safe pre- deployment evaluation methods for these shuttles exists, forcing city officials and shuttle developers to rely on public road testing for the determination and solution of technical challenges like the ones above. This project will introduce and develop holistic modeling and simulation tools that will enable a priori determination and solution of connected and autonomous mobility technical challenges including the actual route and other vehicles and mobility improvements. This will be followed by proof-of-concept work and pilot deployments to demonstrate that connected and autonomous mobility can be used to improve the first mile, last mile access to jobs in a smart city.

The CEAV project will be conducted with partners from the Ohio Department of Transportation (ODOT), The Ohio State University (OSU), Central Ohio Transit Authority (COTA) and The Columbus Partnership to plan, implement and evaluate the deployment of autonomous vehicles in the City. Working with these partners allows for the generation of various use cases, which will result in the deployment of CEAVs in various settings including a university and corporate campuses. These entities would jointly issue a request for proposals for CEAVs in various settings aimed at solving various community transit challenges. Partnering with our private, academic and public-sector partners presents the best opportunity to mitigate deployment risks and ensure successful deployment. Additionally, it presents the best opportunity for community learning and addressing challenges faced by those seeking to deploy autonomous technology. Including those related to safety, interoperability and user acceptance.

This project provides an opportunity for residents and visitors to access cutting edge mobility technologies to solve FMLM challenges. The City of Columbus is in the process of finalizing specific objectives to be evaluated in terms of measuring the impact of the CEAV project; however, the project identified the following preliminary objectives:

- Provide convenient, reliable FMLM transit option.
- Provide more access to jobs and services to residents from underserved communities.
- Improve the User experience.

## 2.2 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 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 Operating System 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**

SMART COLUMBUS PROJECTS	SMART COLUMBUS OUTCOMES					
	Safety	Mobility	Opportunity	Environment	Agency Efficiency	Customer Satisfaction
The Smart Columbus Operating System					P	P
Connected Vehicle Environment	P	P, S		S		
Multimodal Trip Planning Application/Common Payment System		P, S	P, S	S		P
Mobility Assistance for Cognitive Disabilities		P	P		P	P

SMART COLUMBUS PROJECTS	SMART COLUMBUS OUTCOMES					
	Safety	Mobility	Opportunity	Environment	Agency Efficiency	Customer Satisfaction
Prenatal Trip Assistance		P	P			P
Smart Mobility Hubs		P	S			P
Event Parking Management		S		S		P
Connected Electric Autonomous Vehicles		P, S	P, S			P

*P – Indicates project level outcome; S – indicates program-level outcome the above table reflects the most recent decisions by the project teams. The PMP will be reviewed, so that any changes to project outcomes presented in PfMP will be updated in the PMP.*

Source: City of Columbus

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 Operating System 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

### 3.1.1. 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 PMO has been established at the Smart Columbus Experience Center, 170 South Civic Center Drive, Columbus Ohio 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 also has a deputy PgM (DPgM), Andy Wolpert. He is responsible for serving as back up to the PgM and managing partnerships, aligning program needs with right fit partners. Additionally, this position is also responsible for ensuring the necessary policies are in place to support the program initiatives.

The PMO efforts are supported by various consulting teams including HNTB, Accenture (formerly Pillar Technologies) and Michael Baker, International. A summary of their support is below:

- HNTB provides program management and systems engineering support to the PMO. Their staff includes a Consultant Program Manager, subject matter experts and technical project leads to manage several of the Smart Columbus projects. The HNTB consultants report in through the consultant PgM, Diane Newton. The Consultant PMO reports in through the Smart Columbus PgM.
- Accenture provides management of the Operating System development efforts and reports in through the Smart Columbus PgM.
- Proteon Software provides development resources to support the delivery of the Operating System. In addition, Brian King serves as staff extension for the city in the role of Chief Architect.
- Michael Baker, International (MBI) provides program management and staff extension resources to the Smart Columbus PMO. They report in through the Smart Columbus PgM.

There are dedicated city project managers (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, Ryan Bollo, and Jeff Kupko (MBI) are three PMs with strong technical experience in transportation and engineering. In addition, the city has two PMs, Brian King (Proteon) and Kevin Dwinnell (Taivara), who have strong information technology backgrounds; each brings experience in Agile methodologies, data delivery, software development, systems integrations and productization. The final PM, Alyssa Chenault provides expertise in communications and partner/stakeholder engagement.

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. In most cases the PM is city staff, except for the Operating System, for which the PMO lead has assigned a proxy from the product team. 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**

		Project Leadership Team			
Theme	Project / USDOT Task	PMO Lead	Business Owner	PM (City)	Project Lead (Consultant)
All	Data Management	Mandy Bishop	Michael Stevens (City)	Tammy Chellis (Accenture)	Sherry Kish (HNTB)
All	Data Privacy	Mandy Bishop	Michael Stevens (City)	Tammy Chellis (Accenture)	Sherry Kish (HNTB)

		Project Leadership Team			
Theme	Project / USDOT Task	PMO Lead	Business Owner	PM (City)	Project Lead (Consultant)
All	Performance Measures	Mandy Bishop	Michael Stevens (City)	Andy Wolpert (City)	Vijay Varadarajan (HNTB)
Enabling Technologies	CVE	Mandy Bishop	Reynaldo Stargell (City)	Ryan Bollo (City)	Tom Timcho (WSP)
Operating System	Operating System	Mandy Bishop	Michael Stevens (City)	Katie Robinson (Accenture)	Eric Flecher (Accenture)
Enhanced Human Services	MMTPA/CPS	Andy Wolpert	Michael Stevens (City)	Andy Wolpert (City) Kevin Dwinell (Taivara)	Alex Kavanaugh (HNTB)
Enhanced Human Services	SMH	Mandy Bishop	Micheal Carroll (COTA)	Jeff Kupko (MBI)	Matt Graf (HNTB)
Enhanced Human Services	MAPCD	Mandy Bishop	Micheal Carroll (COTA)	Andy Wolpert (City)	Alex Kavanaugh (HNTB)
Emerging Technologies	CEAV	Mandy Bishop	Micheal Carroll (COTA)	Jeff Kupko (MBI)	Tom Timcho (WSP)
Enhanced Human Services	EPM	Mandy Bishop	Robert Ferrin (City)	Ryan Bollo (City)	Alex Kavanagh (HNTB)
Enhanced Human Services	PTA	Andy Wolpert	Erika Jones (CelebrateOne)	Andy Wolpert (City)	Sherry Kish (HNTB)

Source: City of Columbus

### 3.1.1.1. CONSULTANT TEAMS

#### 3.1.1.1.1 HNTB

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, MAPCD and EPM.
- 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 PTA project and provide stakeholder coordination for EPM. She will also lead the development of the Data Management and Data Privacy Plans, with inputs from the Operating System development team.
- Matt Graf (HNTB) will lead the design, development, deployment, and testing of the SMH project.
- Marie Keister (Engage-Murphy Epsom) 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.

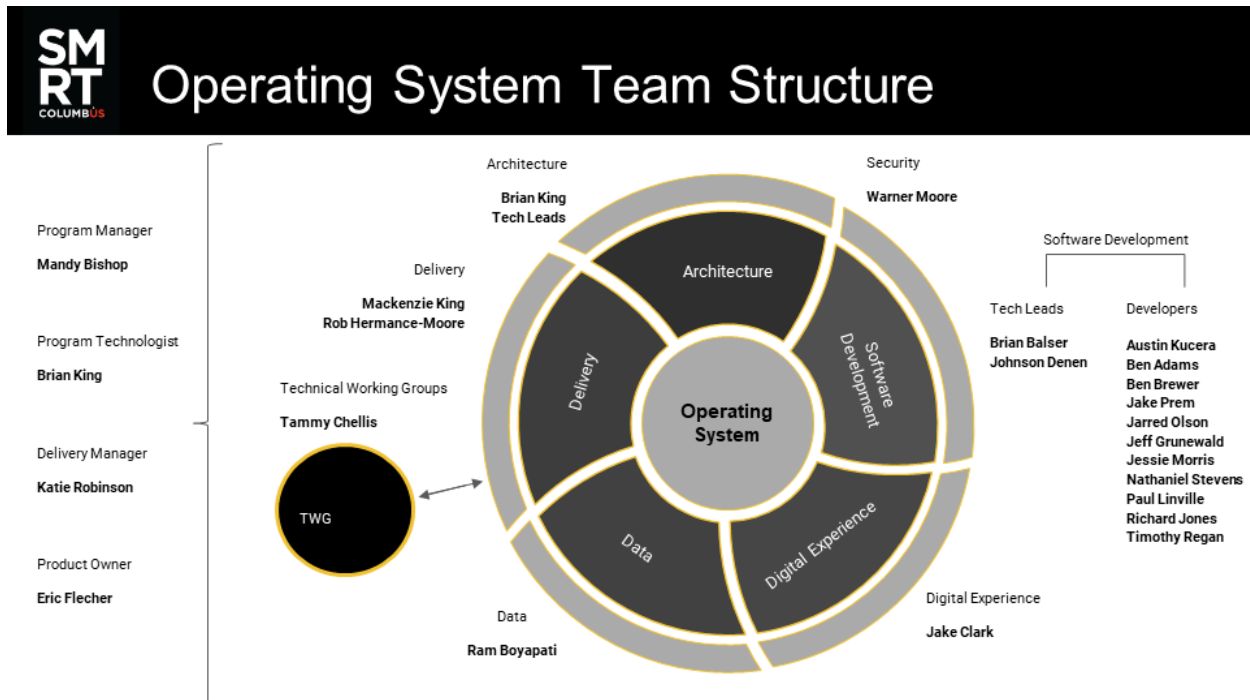
#### **3.1.1.1.2 Accenture (formerly Pillar Technology) and Operating System Development Team**

The Accenture team, augmented by development and architecture support from HNTB, Proteon Software and ODOT, is contracted to build, deploy and operate the Smart Columbus Operating System. Overall project deliverables and team management is provided by Katie Robinson. Eric Flecher, as Product Owner, translates the vision and requirements for the Operating System into prioritized, manageable work for the team. Other positions include:

- Experience Architect (XA) supplies digital experience and design from the user perspective.
- Delivery Lead acts in a role that is the combination of Scrum Master and Executive Consultant.
- Technical Artisan supplies both technical leadership and individual developer support.

The Operating System development team organization is summarized in Figure 4.





Source: City of Columbus

Figure 4. Operating System Development Team Organizational Chart

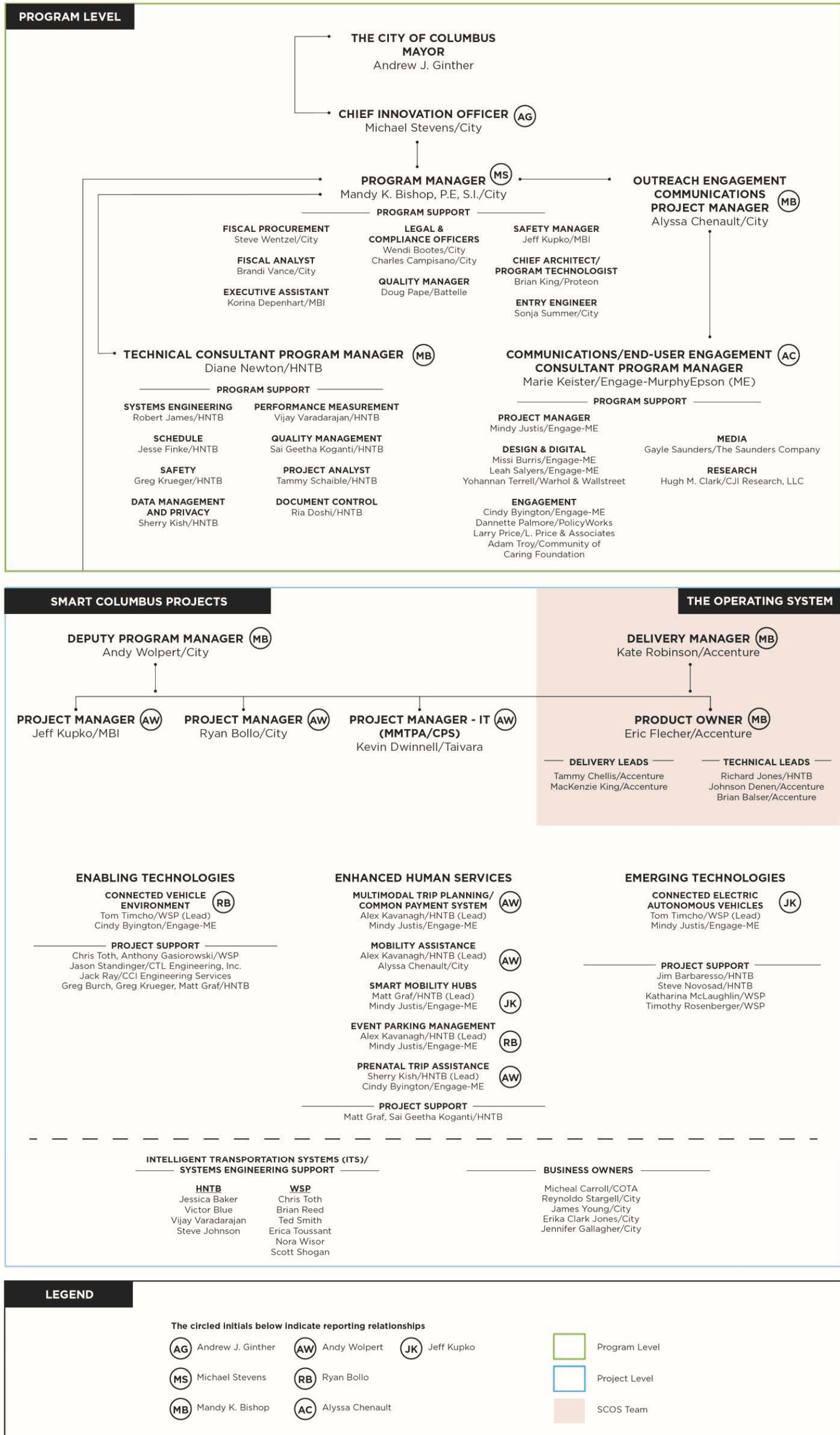
### 3.1.1.1.3 Michael Baker International

The Michael Baker team is contracted as an extension of City staff and provides project management, systems engineering expertise, and executive administrative assistance on its behalf.

- Jeff Kupko (Michael Baker) is responsible for team management as the consultant team project lead and performs daily duties as a City project manager. He is responsible for managing the CEAV and SMH projects.
- Kevin Dwinnell (Taivara) services as a City project manager for the CPS project.
- Korina Depenhart (Michael Baker) is the executive administrative assistant and is responsible for managing calendars and schedules, organizing vendor outreach, and preparing presentations.
- Doug Pape (Battelle) is responsible for providing program-level QA for consistency and quality purposes.
- Matthew Windholtz (Battelle) is responsible for providing systems engineering experience as well as agile process support.

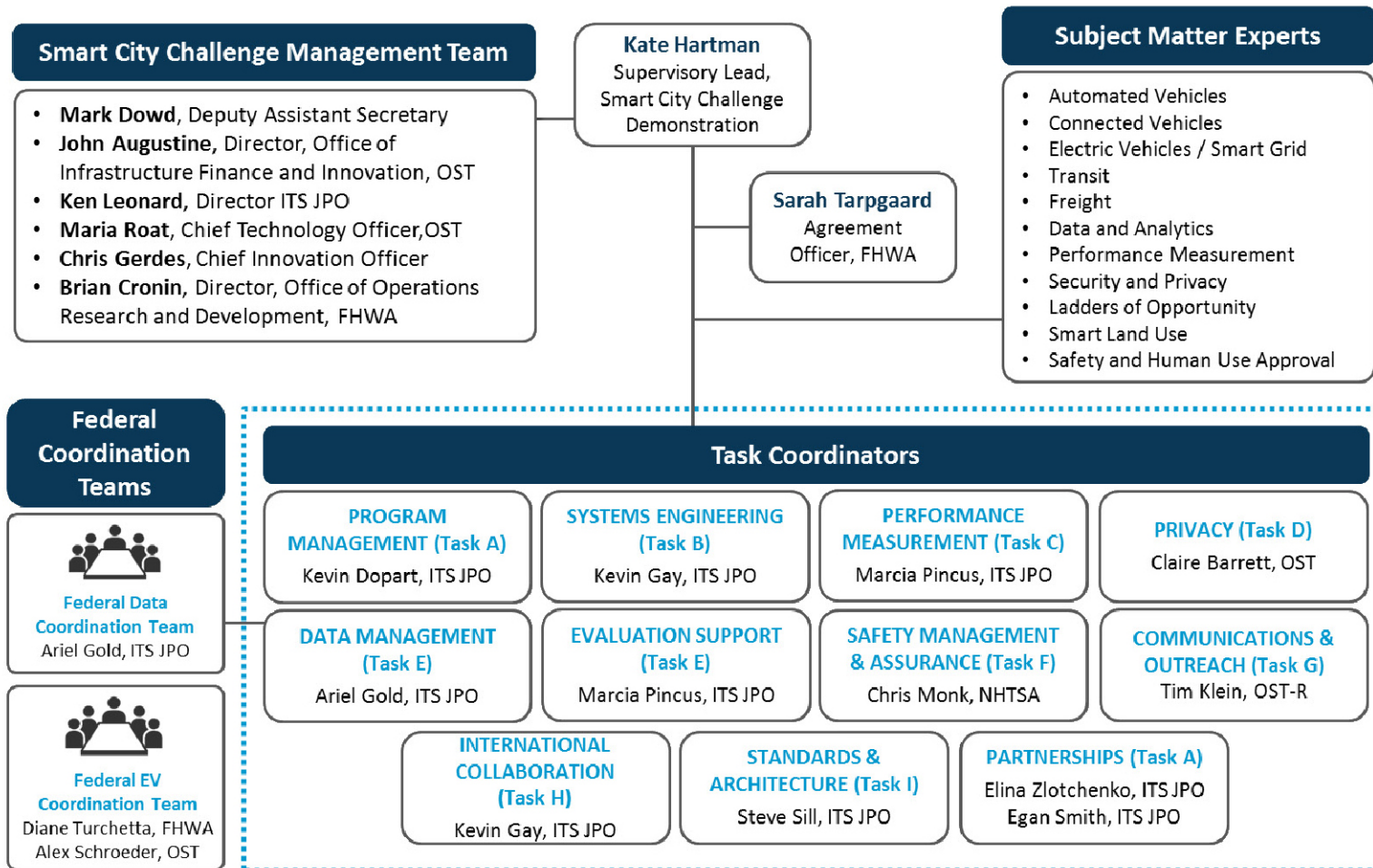
### 3.1.2. USDOT

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).



Source: City of Columbus, April 2019

Figure 5. Smart Columbus Program Management Office Structure



Source: USDOT, September 2017

Figure 6. USDOT Organization Chart

### 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**

Individual/Group	Responsibilities
USDOT AOR	<ul style="list-style-type: none"> <li>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)</li> </ul>
USDOT AO	<ul style="list-style-type: none"> <li>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.</li> </ul>
Mayor	<ul style="list-style-type: none"> <li>Provides accountability for the entire Smart Columbus program. Responsible for articulating city priorities and communicating them to CINO and PMO staff.</li> </ul>
CINO/Program Owner (City)	<ul style="list-style-type: none"> <li>Provides accountability 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.</li> </ul>
PgM (City)	<ul style="list-style-type: none"> <li>Responsible for overall delivery of the program. This includes adding expertise to the team as needed to ensure delivery.</li> <li>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.</li> <li>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.</li> <li>Responsible for delivery of Operating System, 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.</li> <li>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.</li> </ul>
DPgM (City)	<ul style="list-style-type: none"> <li>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</li> </ul>

Individual/Group	Responsibilities
	<p>solutions; oversee development of procedures for legislation and procurement; serve as escalation point for partner and vendor issues to PMO.</p> <ul style="list-style-type: none"> <li>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 Operating System project team, 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.</li> </ul>
Delivery Manager (Operating System, Consultant)	<ul style="list-style-type: none"> <li>Responsible for delivery of Operating System, 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 Chief Architect is responsible for engaging the Data Working Group to assist with the evolution of the Operating System. 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 Chief Architect is responsible for updating PMO on project status.</li> </ul>
Communications PM (City)	<ul style="list-style-type: none"> <li>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.</li> </ul>
Product Owner (Operating System, Consultant)	<ul style="list-style-type: none"> <li>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.</li> </ul>
Chief Architect (City)	<ul style="list-style-type: none"> <li>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.</li> <li>The Chief Architect is responsible for engaging the Data Working Group to assist with the evolution of the Operating System. The Chief Architect is responsible for updating PMO on project status.</li> </ul>
Quality Manager (Consultant)	<ul style="list-style-type: none"> <li>Serves 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 conformance with the QMP, and ensuring the QMP is followed, and compiling and maintaining documentation.</li> </ul>

Individual/Group	Responsibilities
Fiscal/ Procurement Officer (City)	<ul style="list-style-type: none"> <li>The designated fiscal/procurement officer for the city will provide fiscal oversight and delegate coordination authority to the fiscal analyst.</li> </ul>
Fiscal/ Procurement Analyst (City)	<ul style="list-style-type: none"> <li>The Fiscal Analyst provides direct oversight of any procurement processes, and interacts with the City PMs, DPgM and PgM as needed to complete procurements.</li> </ul>
PM (City)	<ul style="list-style-type: none"> <li>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.</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>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.</li> </ul>
Delivery Lead (Consultant)	<ul style="list-style-type: none"> <li>The Delivery Lead ensures Operating System teams create, improve, and adhere to processes maximizing incremental value delivery. They work with the Product Owner and Technical Leads to facilitate the movement of incremental work through the team, identifying and tracking continuous improvement efforts designed to increase the speed of work through the team. The Delivery Lead manages the Agile process and facilitates activities such as Retrospectives and Sprint Reviews that create feedback loops and improvement opportunities. The Delivery Lead also provides Big and Visible reporting as required by the team or DPgM - Technology.</li> </ul>
Technical Lead (Consultant)	<ul style="list-style-type: none"> <li>The Technical Lead drives team level execution on technical work. Working with the Delivery Lead, they provide team level management of members and deliverables, helping to prepare and size work for developers to consume. The Technical Lead will also work with architects and user experience designers to ensure the best technical and user-focused paths are chosen for work.</li> </ul>
Delivery Manager (Consultant)	<ul style="list-style-type: none"> <li>The Delivery Manager works across the Operating System teams to ensure a combined effort to deliver value as quickly as possible with superior quality. They work in tandem with the DPgM to address team blockers, aggregate reporting for stakeholder purposes, and to guide the teams in incremental delivery. The Delivery Manager provides guidance and mentorship in the Agile process and to members and leads of the team.</li> </ul>

Source: City of Columbus

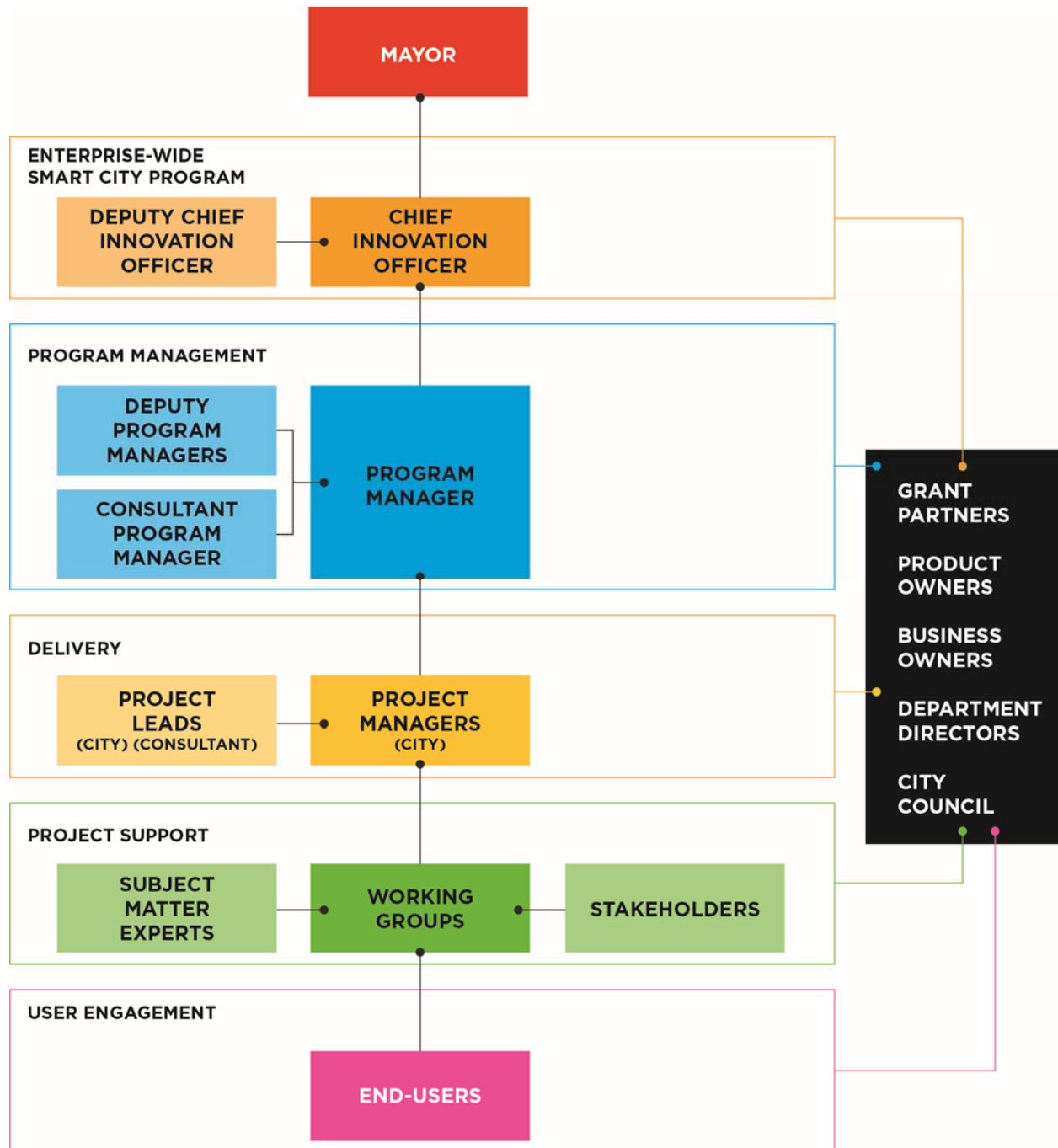
**Table 4. Staff by Task**

Task	Name	USDOT	City or City Representative	Consultant
A	Program Management	Kate Hartman	Mandy Bishop	Diane Newton (HNTB)
B	Systems Engineering	Ed Fok	Mandy Bishop	Bob James (HNTB)
C	Performance Measures	Elina Zlotchenko	Andy Wolpert	Vijay Varadarajan (HNTB)
D	Data Privacy	Claire Barrett	Tammy Chellis	Sherry Kish (HNTB)
E	Data Management	Ariel Gold	Tammy Chellis	Sherry Kish (HNTB)
F	Safety Management	Chris Monk	Jeff Kupko	Greg Krueger (HNTB)
G	Communications and Outreach	Tim Klein	Alyssa Chenault	Marie Keister (ME/Engage)
H	International Collaboration	Kevin Gay	Mandy Bishop	Diane Newton
I	ITS Architecture and Standards Development	Steve Sill	Ryan Bollo	Bob James
J	Final Reporting	Kate Hartman	Mandy Bishop	Diane Newton

Source: City of Columbus

### 3.4 PROJECT GOVERNANCE

Figure 7 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.



Source: City of Columbus, October 2017

Figure 7. Smart Columbus Governance Structure



### 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 progressed through systems engineering development, many working groups served their purpose of assisting with goals, objectives, performance metrics, technical advisory, policy, operations, etc. The rosters for the working groups initiated in 2016 were archived, so that the project teams may still engage with the members to assist and contribute to document reviews and input during project development.

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 Electrification Working Group. The Data Technical Working group is sponsored by the City of Columbus (represented by Tammy Chellis, Accenture, representing the City of Columbus) and chaired by Ben Blanquera, from the Columbus Collaboratory. The key members of the Data Technical Working group and their breakout tracks are presented below in Table 5.

**Table 5. Smart Columbus Data Technical Working Group Organization**

Breakout Topic	Sponsor	Facilitator	Product Owner Representative
Policy	Dennis Hirsch (OSU)	Tom Harris (HMB) Tammy Chellis (Pillar)	Sherry Kish (HNTB)

Breakout Topic	Sponsor	Facilitator	Product Owner Representative
Technical	Venki Rao (CAS)	Jim Perry (CAS) Veejay Yadav (independent) Sharon Wilhelm (independent)	Brian King (City) Mihail Chirita (ODOT) Jeff Lutz (Pillar)
Data Analytics and Use Cases	Aaron Schill (MORPC) Ryan McManus (Ride Share)	Mackenzie King (Pillar) Aaron Schill (MORPC) Ryan McManus (Ride Share)	Rama Boyapati (Battelle) Andy Wolpert (City)

Source: City of Columbus

### 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 Philanthropies (Vulcan). As background, the five Vulcan priorities include 1) decarbonization, 2) electric vehicle fleet adoption, 3) transit, autonomous, and multimodal systems, 4) consumer electric vehicle adoption, and 5) 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 (the Operating System) – Vulcan priority 2-5

The work for the three USDOT projects is 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 Operating System 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.

### 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 6. Team Directory**

Name	Agency/Firm	E-mail	Phone
<i>USDOT Team</i>			
Ken Leonard	USDOT	Ken.leonard@dot.gov	202-366-9536
Kate Hartman	USDOT	Kate.hartman@dot.gov	202-366-2742
Sarah Tarpgaard	USDOT	Sarah.tarpgaard@dot.gov	202-366-5750
Kevin Dopart	USDOT	Kevin.dopart@dot.gov	202-366-5004
Ed Fok	FHWA	Edward.fok@dot.gov	415-744-4848
Elina Zlotchenko	USDOT	Elina.zlotchenko@dot.gov	202-366-1697
Claire Barrett	Office of the Secretary of Transportation (OST)	Claire.barrett@dot.gov	
Ariel Gold	USDOT	Ariel.gold@dot.gov	202-366-4374
Chris Monk	National Highway Transportation Safety Administration (NHTSA)	Chris.monk@dot.gov	202-366-5195
Tim Klein	USDOT	Timothy.klein@dot.gov	202-366-0075
Steve Sill	USDOT	Steve.sill@dot.gov	202-366-1603
Egan Smith	USDOT	Egan.smith@dot.gov	202-366-9224
Diane Turchetta	FHWA	Diane.turchetta@dot.gov	202-493-0158
J.D. Schneeberger	Noblis	John.schneeberger@noblis.org	202-551-1171
<i>City of Columbus PMO</i>			
Michael Stevens	City of Columbus	mhstevens@columbus.gov	614-325-1030
Mandy Bishop	City of Columbus	mkbishop@columbus.gov	614-645-7723
Ryan Bollo	City of Columbus	rjbollo@columbus.gov	614-645-3946
Andy Wolpert	City of Columbus	adwolpert@columbus.gov	614-645-2872

Name	Agency/Firm	E-mail	Phone
Bud Braughton	City of Columbus	nlbraughton@columbus.gov	614-645-8241
Kevin Dwinnell	Taivara	kdwinnell@taivara.com	614-300-7374 x 702
Brian King	Proteon Software	bjking@columbus.gov	614-724-2887
Jeff Kupko	Michael Baker International	jeffrey.kupko@mbakerintl.com	717-856-7907
Alyssa Chenault	City of Columbus	anchenault@columbus.gov	614-493-7253
<i>Consultant Delivery</i>			
Diane Newton	HNTB	dnewton@hntb.com	317-332-3020
Tom Timcho	WSP	Tom.timcho@wsp.com	614-791-5189
Alex Kavanagh	HNTB	akavanagh@hntb.com	312-798-0225
Matt Graf	HNTB	mgraf@hntb.com	614-493-5516
Sherry Kish	HNTB	skish@hntb.com	614-493-5510
Marie Keister	Engage Public Affairs	mkeister@engagepublicaffairs.com	614-221-2885
Katie Robinson	Accenture	katherine.robinson@accenture.com	614-507-2741

Source: City of Columbus

### 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 Chapter 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.<sup>2</sup> 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 7. Roles and Responsibilities for Scope Management**

Individual/Group	Responsibilities
USDOT AOR	<ul style="list-style-type: none"><li>• Verify scope requirements have been met for submitted deliverables</li><li>• Provide written acceptance of deliverables to PM</li><li>• Provide written comments of deliverables to PM</li><li>• Send and receive written request of scope variance with the PgM</li><li>• Communicate with USDOT AO on scope variances</li></ul>
USDOT AO	<ul style="list-style-type: none"><li>• Review and approve any changes to the scope, schedule or budget</li></ul>
USDOT Technical Support Team	<ul style="list-style-type: none"><li>• Support verification of scope for USDOT AOR with written comments on deliverables submitted</li></ul>
PgM (City)	<ul style="list-style-type: none"><li>• Verify that scope requirements have been met with deliverables</li></ul>

<sup>2</sup> A Guide to the Project Management Body of Knowledge (PMBOK Guide), *Sixth Edition, 2017 Project Management Institute.*

Individual/Group	Responsibilities
	<ul style="list-style-type: none"> <li>• Maintain written record of submittals, acceptances and change requests from USDOT</li> <li>• Review and consider identified variances of the scope from the PM</li> <li>• Provide written requests for scope variances to the AOR</li> </ul>
PM (City)	<ul style="list-style-type: none"> <li>• Verify scope requirements have been met for deliverables to be submitted</li> <li>• Identify variances of the scope and submit a technical memorandum for Smart Columbus leadership for review</li> <li>• Lead the development and review deliverables</li> <li>• Submit deliverables to USDOT AOR after concurrence from Smart Columbus program leadership</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>• Review deliverables to ensure scope requirements are met</li> <li>• Identify possible scope changes for elevation to PM</li> </ul>
Scrum Master / Delivery Lead (Consultant)	<ul style="list-style-type: none"> <li>• Lead the Scrum process and oversee how it should be applied</li> <li>• Calculate team velocity and work estimation metrics to provide visibility on progress toward completion of scope to the Product Owner</li> <li>• Ensure that the Business Owner and development team stay within the Scrum process</li> <li>• Coach the other team members on how to use Scrum in the most effective manner</li> </ul>
Product Owner (Consultant)	<ul style="list-style-type: none"> <li>• Responsible for defining the work that needs to be completed and prioritizing that work</li> <li>• Provide direction and goals for the team</li> <li>• Participate in daily Scrum meetings throughout each sprint. 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.</li> <li>• Provide approval of all user stories/sprint setup. Responsible for confirming business owner's view is represented. 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</li> </ul>
Technical Team / Technical Lead (City and Consultant)	<ul style="list-style-type: none"> <li>• Develop deliverables following the project scope</li> <li>• Assist Product Owner in planning and estimating the size of thin slices of scope</li> </ul>
Delivery Manager (Consultant)	<ul style="list-style-type: none"> <li>• Ensure team practices across all Operating System squads maximize the speed to deliver valuable scope as designated by the Product Owner</li> </ul>

Source: City of Columbus

## 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.

### 4.1.1. 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]
- Project Management Plan (PMP) [P2]
- Project Schedule (including quarterly updates) [P3]
- Partnership/Stakeholder Status Summary [P4]
- Quarterly Progress Reports and Briefings [P5], to include:
  1. Updated project schedule
  2. Schedule risk narrative
  3. Technical risk narrative
  4. Partnership risk narrative
  5. Retrospective risk narrative
  6. 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.

#### 4.1.1.1. 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.

#### 4.1.1.2. 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.

#### **4.1.1.3. QUARTERLY SCHEDULE (SCS) UPDATES [P3]**

In conjunction with the submittal of the quarterly progress report, the city will provide an updated version of the Smart Columbus schedule. It is expected that a total of 12 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.

#### **4.1.1.4. 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. Updates are included in the quarterly 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.

#### **4.1.1.5. MONTHLY INVOICING [P5]**

The city will deliver monthly invoices to USDOT for the duration of the Award period.

#### **4.1.1.6. 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.

### **4.1.2. 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. 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:

- Systems Engineering Management Plan (SEMP) [S1.1]
- Concept of Operations (ConOps) [S2.X.1]
- Demonstration Site Map and Installation Schedule (SITE) [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 Plan (O&MP) [S2.X.6]

The following are additional deliverables related to vendor-provided solutions:

- Technical Memo [S3.X.1]
- Installation Plan [S3.X.3]
- Product Vision [S4.X.2]

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]

#### **4.1.2.1. SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP) [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.

#### **4.1.2.2. 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.

#### **4.1.2.3. DEMONSTRATION SITE MAP AND INSTALLATION SCHEDULE (SITE) [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)

#### **4.1.2.4. 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.

#### **4.1.2.5. 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.

#### 4.1.2.6. SYSTEM ARCHITECTURE AND STANDARDS PLAN (SASP) [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.

#### 4.1.2.7. 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.

#### **4.1.2.8. INTERFACE CONTROL DOCUMENT (ICD) [S2.X.3]**

For those projects identified as requiring such, the city will prepare and submit a draft and final 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.

#### **4.1.2.9. 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.

#### **4.1.2.10. 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.

#### 4.1.2.11. 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.

#### 4.1.2.12. 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.

#### 4.1.2.13. 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.

#### 4.1.2.14. 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.

#### 4.1.2.15. 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 8. Software Tools for the Agile Approach**

Software Platform	General Use	Smart Columbus Projects
Jira/Confluence	Agile project management software	The Smart Columbus program will use Jira/Confluence to manage all Scrum backlog and sprint progress by the development team.

Software Platform	General Use	Smart Columbus Projects
<b>SharePoint</b>	Smart Columbus document management and collaboration portal	The Smart Columbus program has already established a SharePoint Portal <sup>3</sup> on the program. This platform will be used for storing and sharing all development artifacts throughout the development process.
<b>Github</b>	Code management and repository	The Smart Columbus program will establish a repository on Github for centralized storage and sharing of any code developed on the program.

Source: City of Columbus

#### 4.1.2.16. 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 is 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 stored in its current form in a designated team shared folder.

**Table 9. Timeframes for Product Roadmaps and Release Plans**

Artifact	Characteristics	Planning Horizon	Contents
<b>Product Roadmap</b>	Strategic Plan	12 months or more	Release goals, high-level features / product capabilities
<b>Release Plan</b>	Tactical Plan	3 to 6 months	Product backlog items, organized into themes and epics

Source: City of Columbus

#### 4.1.2.17. USER STORY DEFINITION [S4.X.5]

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

<sup>3</sup> [smartcolumbusprogram.sharepoint.com](http://smartcolumbusprogram.sharepoint.com)

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 Owner 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.

#### 4.1.2.18. 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 one-week or two-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 Jira)
- Product Increment (viewable in real time from Jira)
- Sprint Backlog (viewable in real time from Jira)
- Sprint Planning (documented and posted to Confluence at the beginning of each sprint)
- Sprint Review (documented and posted to Confluence at the end of each sprint)
- Sprint Retrospectives (documented and posted to Confluence at the end of each sprint)

### 4.1.3. 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 (PfMP) [D1]
- Response to USDOT Deployment Tracking Surveys (as required) [D2]

#### 4.1.3.1. PERFORMANCE MEASUREMENT PLAN (PFMP) [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.

#### **4.1.3.2. 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 2016. 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.

#### **4.1.4. 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 (DPP) [D3]

##### **4.1.4.1. 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.

#### **4.1.5. 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 Support Plan (IESP) [D4]
- Data to support USDOT's IE



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

#### 4.1.5.1. 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/creatingaDMP.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.

#### 4.1.5.2. INDEPENDENT EVALUATION SUPPORT PLAN (IESP) [D4]

USDOT has hired an Independent Evaluation (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; some of which 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 Operating System 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.

#### 4.1.5.3. 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 monthly.

#### **4.1.5.4. DATA PROVIDED TO THE USDOT'S ITS CONNECTED DATA EXCHANGE**

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 ITS Connected Data Exchange<sup>4</sup>. No PII will be submitted to the USDOT ITS Connected Data Exchange. Sensitive data may be transmitted to the IE team via the USDOT's Secure Data Commons.

#### **4.1.6. 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 (HUA) [D6]

##### **4.1.6.1. 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 vendor/development staff, as needed. 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).

##### **4.1.6.2. HUMAN USE APPROVAL (HUA) [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.

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<sup>4</sup> <https://www.its.dot.gov/data/>

### 4.1.7. 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 four 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 SCC Website [C.2]
- Travel and participation in workshops/conferences/trade shows with at least one outside of the U.S. or in support of international cooperation [C.3]
- Participation in public webinars regarding SCC progress/performance and lessons learned. [C.4]

#### 4.1.7.1. COMMUNICATIONS AND OUTREACH PLAN (COMM. 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.

#### 4.1.7.2. WEBSITE/BLOGS [C.2]

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.

#### 4.1.7.3. WORKSHOP, CONFERENCE, TRADE SHOW PARTICIPATION [C.3]

The city will participate in workshops/conferences/trade shows 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.

#### 4.1.7.4. PUBLIC WEBINAR PARTICIPATION [C.4]

The PMO will prepare information as needed and participate in public webinars regarding progress/performance and lessons learned. The webinars will focus on the deliverables provided to USDOT as part of the grant and must be approved by USDOT.

### 4.1.8. Task H – International Collaboration (Optional)

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. Under this optional task, 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 optional 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.5] Participation would be approved by USDOT before being executed.

#### **4.1.8.1. INTERNATIONAL COLLABORATION MEETING [C.5]**

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.

### **4.1.9. Task I – Participation in Relevant ITS Architecture and Standards Development Efforts (Optional)**

Under this optional task, 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 optional deliverables:

- Attendance at six architecture and standards meetings, of which four are expected to be held outside of the United States [S1.4]. Participation in these meetings would be approved by USDOT before being planned.
- Architecture and Standards Meeting Trip Reports [S1.4]

#### **4.1.9.1. ATTENDANCE AT ARCHITECTURE AND STANDARDS MEETINGS**

Per Amendment #3 of the award, in-person participation is optional at six meetings 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 execution phase of the Award. In addition to the in-person meetings, support may 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 provided in advance by USDOT.

#### **4.1.9.2. 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.

### **4.1.10. Task J – 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 Final Report [P6]

#### 4.1.10.1. ANNUAL INTERIM REPORTS [P6]

The PMO delivered the initial Smart Columbus Interim Report to USDOT after completion of the first year of the Award. The annual Interim Reports provided the progress to date and summarized issues and opportunities, what was accomplished, the benefits and costs and lessons learned. The first Smart Columbus Interim Report was submitted on September 29, 2017. Following delivery of this initial annual report, USDOT removed the requirement and the PMO will not provide this going forward.

#### 4.1.10.2. 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.

#### 4.1.11. 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.

#### **4.1.11.1. ENGINEERING DESIGN**

City policy dictates that construction projects shall be accompanied by detailed engineering plans that include proposed modifications, environmental 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.

#### **4.1.11.2. 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 for the USDOT and PMO. Procurement procedures are further detailed in Section 12.

#### **4.1.11.3. 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.

#### **4.1.11.4. 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.

#### **4.1.11.5. 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.

#### 4.1.11.6. OPERATIONS SUPPORT

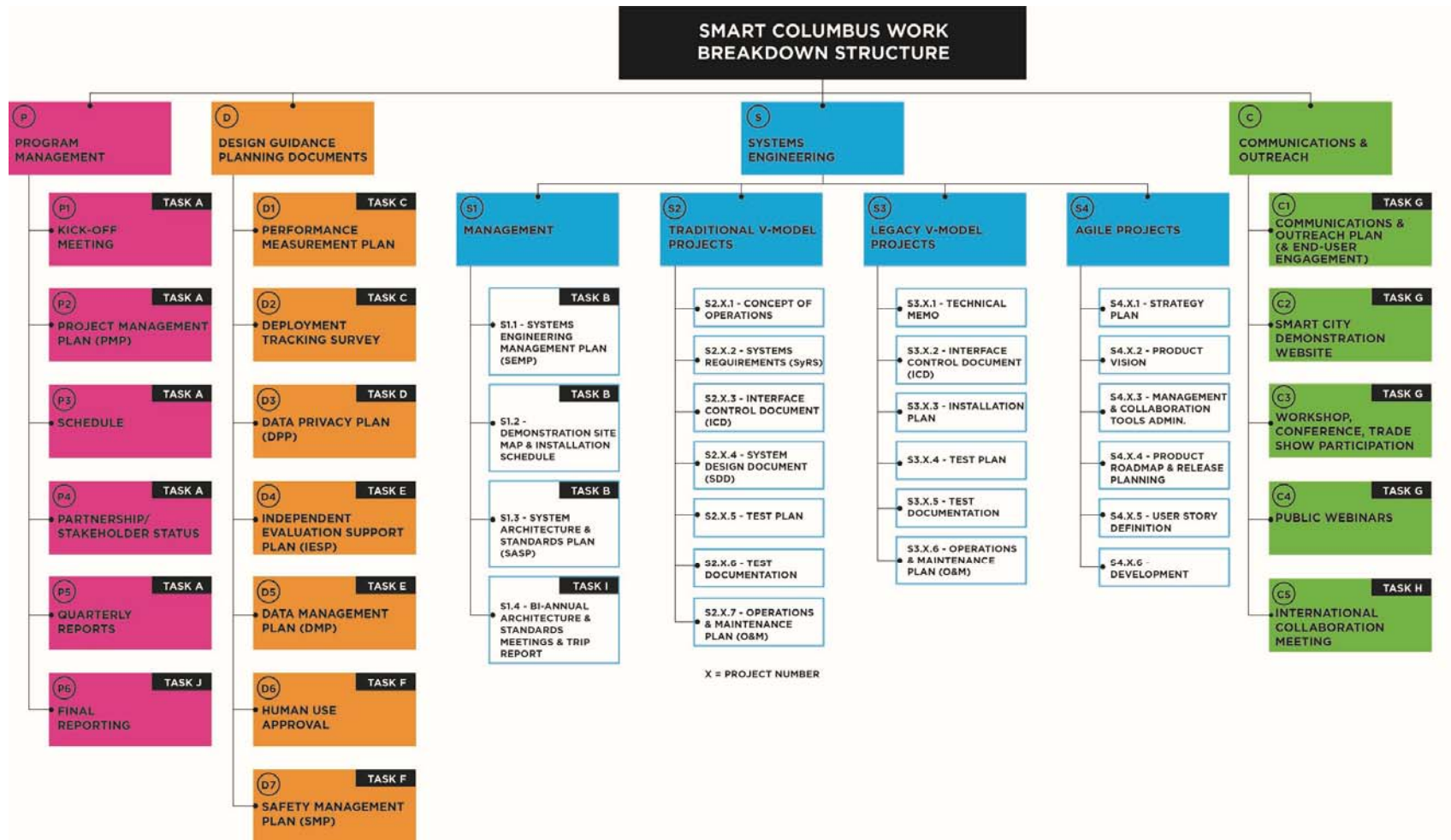
Upon successful initiation of the operational periods for each of the proposed projects, the PMO will operate and maintain each component of the initiative in accordance with the approved O&M Plans. This will include transferring responsibilities of several components of the system to various departments, and related agencies within the City of Columbus, as well as partner organizations. For instance, the Operating System 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.

#### 4.1.11.7. 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 8 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 8 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.



Source: City of Columbus, April 2019

Figure 8. Smart Columbus WBS



## 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, final, updates) are associated with each deliverable and notes the completion criteria.

**Table 10. WBS Dictionary and Deliverable Table**

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
<b>P</b>	<b>A</b>	<b>Program Management</b>	Activities required to manage the program					
P1	A	Kick-Off Meeting*	Prepare for and facilitate kick-off meeting					Meeting
P2	A	Project Management Plan (PMP)	Documents plans and process to manage the program	X		X	X	Project Close-out
P3	A	Schedule	Detailed program schedule covering all deliverables	X		X	X	Project Close-out
P4	A	Partnership/ Stakeholder Status	Ongoing tracking of city/partner relationships			X	X	Project Close-out
P5	A	Quarterly Reports	Recurring reports on accomplishments, schedule, budget, and other related program activities			X	X	Quarterly
P6	J	Final Reporting (DFR)	Final report of the program for public consumption			X		Project Close-out
<b>D</b>		<b>Design Guidance Planning Documents</b>						

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
D1	C	Performance Measurement Plan (PfMP)	Criteria and method upon which the city can measure success of projects	X	X	X		Project Close-out
D2	C	Deployment Tracking Survey	City response to USDOT survey, if/when conducted.			X		Bi-Annual (as Requested)
D3	D	Data Privacy Plan (DPP)	Plan to protect PII and other privacy of data collected	X	X	X		Per SCS
D4	E	Independent Evaluation Support Plan (IESP)	Plan for how data will be shared with the IE	X		X		Per SCS
D5	E	Data Management Plan (DMP)	Plan for how data will be managed in support of program objectives	X	X	X	X	Per SCS
D6	F	Human Use Approval (HUA)	Third-party review and approval of method to collect and use data related to human subject research	X		X		Per SCS
D7	F	Safety Management Plan (SMP)	Plan to identify, implement and monitor safety elements of deployed projects	X	X	X		Per SCS
<b>S</b>	<b>B</b>	<b>Systems Engineering</b>	Activities required to implement the technical aspects of the program					
S1	B	Management	Overarching systems engineering documents					

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
S1.1	B	Systems Engineering Management Plan (SEMP)	Documents the plans and process related to the design of the projects	X	X	X	X	Per SCS
S1.2	B	Demonstration Site Map and Installation Schedule (SITE)	Identifies locations of technology installation and schedule for deployment	X		X	X	Per SCS
S1.3	B	System Architecture and Standards Plan (SASP)	Document to consolidate architecture including use of regional ITS Architecture, CVRIA and standards	X	X	X	X	Per SCS
S1.4	I	Bi-Annual Architecture and Standards Meetings+ Attendance and Trip Report	Support ongoing USDOT standards development activities as relates to Smart Columbus needs and findings	X		X		TBD
S2		Traditional V-Model Projects	Work elements associated with the selection of the traditional V-Model SE process					
S2.X.1	B	Concept of Operations (ConOps)	High-level concept for system including user needs and use cases. Intended for stakeholder concurrence.	X	X	X	X	Per SCS
S2.X.2	B	System Requirements Specification (SyRS)	Detailed breakdown of needs into functions and features the system must exhibit	X	X	X	X	Per SCS

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
S2.X.3	B	Interface Control Document (ICD)	Defines external interfaces of the system	X	X	X	X	Per SCS
S2.X.4	B	System Design Document (SDD)	Detailed description of how the system requirements are expected to be met	X	X	X	X	Per SCS
S2.X.5	B	Test Plan (TP)	Plan to verify and validate system functions meet requirements and needs	X	X	X		Per SCS
S2.X.6	B	Test Documentation	Results of TP conducted	X	X	X		Per SCS
S2.X.7	B	Operations and Maintenance Plan (O&MP)	Instructions on how to operate the system post-deployment	X	X	X		Per SCS
S3		Vendor-provided V-Model Projects	Work elements associated with the selection of a stream-lined SE process when vendor solutions are being implemented					
S3.X.1	B	Technical Memo	Comparison of technical alternatives and cost feasibility	X	X	X		Per SCS
S3.X.2	B	Interface Control Document (ICD)	Defines external interfaces of the system	X	X	X	X	Per SCS
S3.X.3	B	Installation Plan	Instructions for deployment of projects not	X	X	X		Per SCS

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
			requiring engineering plans					
S3.X.4	B	Test Plan (TP)	Plan to verify and validate system functions meet requirements and needs	X	X	X		Per SCS
S3.X.5	B	Test Documentation	Results of TP conducted	X	X	X		Per SCS
S3.X.6	B	Operations and Maintenance Plan (O&MP)	Instructions on how to operate the system post-deployment	X	X	X		Per SCS
S4		Agile Projects	Work products associated with the use of the Agile process for implementing software-only projects					
S4.X.1	B	Strategy Plan**	Detailed plan for how various engineering and non-engineering tasks will be integrated					Per SCS
S4.X.2	B	Product Vision	Reflects the needs and attributes of the system to be developed	X	X	X	X	Per SCS
S4.X.3	B	Management and Collaboration Tools Administration	Ongoing administration and use of the tools as defined	X		X		Per SCS
S4.X.4	B	Product Roadmap and Release Planning	Initial and ongoing refinement of the	X		X		Per SCS

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
			roadmap and release plan					
S4.X.5	B	User Story Definition	Continual user story capture, refinement and management through implementation	X		X		Per SCS
S4.X.6	B	Development	Application/ software development and the implementation of the Scrum process	X		X		Per SCS
<b>C</b>		<b>Communications &amp; Outreach</b>						
C.1	G	Communications & Outreach Plan (Comm. Plan)	Approach to facilitate internal and external communications, outreach, marketing, end-user engagement, etc.	X	X	X	X	Per SCS
C.2	G	Smart City Demonstration Website	Tool to inform public and stakeholder about program	X	X	X	X	Monthly
C.3	G	Workshop, Conference, Trade Show Participation <sup>+</sup>	Supporting USDOT national outreach efforts for smart city programs					TBD
C.4	G	Public Webinars <sup>+</sup>	Sharing of successes and lessons learned with interested parties in public forums					TBD

WBS	Task	Task/Deliverable	Definition	Draft	Webinar	Final	Updates	Completion
C.5	H	International Collaboration Meetings <sup>+</sup>	Supporting USDOT international outreach efforts for smart city programs					TBD (optional)

Source: City of Columbus

## 4.5 SCOPE CONTROL AND VERIFICATION

### 4.1.12. 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.

### 4.1.13. 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](mailto: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. Access to the site will be controlled through secure login information.

This site is structured to meet projects needs 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 preview – these documents are mainly in the “Deliverables” folders for the various tasks.

The Smart Columbus PMO developed a User Guide<sup>5</sup> that helps 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.

Sections:

- Task A – PROGRAM MANAGEMENT
  - Task A: Working
  - Task A: Deliverables
  - Task A: Program Bootcamp
- Smart Columbus Operating System

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[https://smartcolumbusprogram.SharePoint.com/\\_layouts/15/guestaccess.aspx?docid=1d69e30f6a8fb4dfcb452bc7e847a8711&authkey=AV8Q1bUW8ggsjzvcZUXPBBA](https://smartcolumbusprogram.SharePoint.com/_layouts/15/guestaccess.aspx?docid=1d69e30f6a8fb4dfcb452bc7e847a8711&authkey=AV8Q1bUW8ggsjzvcZUXPBBA)

- SCOS: Architecture
- SCOS: Data
- SCOS: Digital Experience
- SCOS: Project Controls
- SCOS: Scope
- SCOS: Working Documents
- SCOS: Deliverables
- Task B – PROGRAM SYSTEM ENGINEERING
  - Task B: Working
  - Task B: Deliverables
  - CVE: Working
  - CVE: Deliverables
  - MMTPA AND CPS: Working
  - MMTPA AND CPS: Deliverables
  - Mobility Hubs: Working
  - Mobility Hubs: Deliverables
  - Mobility Assistance: Working
  - Mobility Assistance: Deliverables
  - Prenatal Trip Assistance: Working
  - Prenatal Trip Assistance: Deliverables
  - CEAV: Working
  - CEAV: Deliverables
  - EPM: Working
  - EPM: Deliverables
  - Truck Platooning: Working
  - Truck Platooning: Deliverables<sup>6</sup>
- Task C – PERFORMANCE MEASUREMENT
  - Task C: Working Documents
  - Task C: Deliverables
- Task D – DATA PRIVACY REQUIREMENTS
  - Task D: Working Documents
  - Task D: Deliverables

---

<sup>6</sup> Although the Truck Platooning Project has been removed from the portfolio, the project libraries remain on SharePoint as a location to archive the work that was submitted to USDOT before removal.

- Task E – DATA MANAGEMENT & SUPPORT FOR INDEPENDENT EVALUATOR
  - Task E: Working Documents
  - Task E: Deliverables
- Task F – SAFETY MANAGEMENT & SAFETY ASSURANCE
  - Task F: Working Documents
  - Task F: Deliverables
- Task G – COMMUNICATIONS & OUTREACH
  - Task G Communications and Outreach Plan
  - Task G Videos (*note, this is flagged for removal*).
  - Task G Website
  - Task G Workshops, conferences and trade shows
  - Task G Webinars
  - Task G Meeting Minutes
  - Task G Stakeholder Registry
  - Task G Templates, Logos, Branding
  - Task G Project Outreach
- Task H – INTERNATIONAL COLLABORATIONS
  - Task H: Working Documents
  - Task H: Deliverables
- Task I – PARTICIPATION IN ARCHITECTURE & STANDARDS DEVELOPMENT
  - Task I: Working Documents
  - Task I: Deliverables
- Task J – INTERIM & FINAL REPORTING
  - Task J: Working Documents
  - Task J: Deliverables

#### Resources

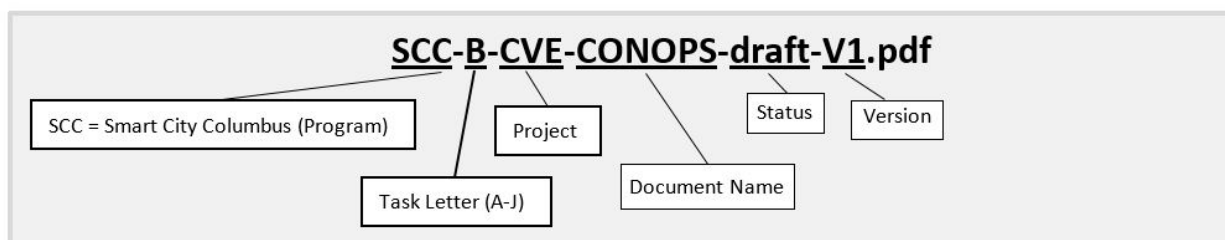
- Contact List
  - This includes contact information for team members, USDOT, stakeholders, partners and interested parties.
- Project Public Documents and References
  - This includes a variety of references related to the program including guidance and standards documents, document and quality management training materials and documents, and partnership information.

- Smart Columbus Website<sup>7</sup>
  - This link re-directs users to the Smart Columbus program website. All project deliverables specified in the Cooperative Agreement will be posted to the appropriate location on this site (for example, project specific deliverables will be posted on each project's page).

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 9.



Source: City of Columbus, October 2017

**Figure 9. Smart Columbus File Naming Convention**

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 | MMPA_CPS |
| • Smart Mobility Hubs                         | SMH      |
| • Mobility Assistance Application             | MAPCD    |
| • Connected Electric Autonomous Vehicle       | CEAV     |
| • Event Parking Management                    | EPM      |
| • 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   |

<sup>7</sup> □ <https://smart.columbus.gov/>

• Interface Control Document	ICD
• System Design Document	SDD
• Test Plan	TP
• System Architecture and Standards Plan	SASP
• Operations and Maintenance Plan	O&MP
• Performance Measurement Plan	PfMP
• Data Privacy Plan	DPP
• Data Management Plan	DMP
• Independent Evaluation Support Plan	IESP
• Safety Management Plan	SMP
• Human Use Approval Summary	HUA
• Communications and Outreach Plan	Comm. Plan
• Demonstration Final Report	DFR

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<sup>8</sup>, 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 PgM and Entry Engineer. 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 quarterly report on partnership status is generated from the Hubspot online application, which is attached to the Smart Columbus quarterly report submitted to USDOT.
- Organization of Content:
  - Private Sector, by status:
    - Contact initiated
    - Old
    - New

<sup>8</sup> <https://www.hubspot.com/>

- 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 Jira to manage scrum stories, backlog and sprint iterations; Github for version control of code, technical documentation and transparent replicability of the Operating System; and Confluence and SharePoint for overall document control, collaboration and preparation of working documentation related to the Operating System and development artifacts produced through the Scrum process. SharePoint, Github and Jira/Confluence are discussed in more detail in the subsections below.

### 5.1.3. SCOS SharePoint

The Operating System team will use the Operating System Library on the Smart Columbus SharePoint site<sup>9</sup> for documentation of USDOT deliverables, sprint artifacts and collaboration between the program and products owners, SE staff and the project teams related to the Operating System.

### 5.1.4. Github

SCOS will follow a modified approach to managing technical documents using Github Flavor Markdown within Github based on the established best practice from GitLab<sup>10</sup> as described in their documentation style-guide<sup>11</sup> and detailed below. A log in is required. !

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<sup>9</sup> <https://smartcolumbusprogram.sharepoint.com/SitePages/Home.aspx>

<sup>10</sup> <https://gitlab.com/smartcolumbus-ide/>

<sup>11</sup> [https://docs.gitlab.com/ee/development/doc\\_styleguide.html](https://docs.gitlab.com/ee/development/doc_styleguide.html)

The documentation hierarchy within Github will be structured per Table 11 to provide improved layout and organization of directories and related documentation. The document structure will be audited in Github and revised as a part of quality assurance efforts prior to any area of the Operating System being made open source.

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

**Table 11. Github Document Structure**

Directory	What Belongs Here
doc/user/	User related documentation
doc/administration/	System administration related documentation
doc/development/	Documentation related to the development of Operating System
doc/install/	Installation and configuration documentation
doc/legal/	Legal documents

Source: City of Columbus

### 5.1.5. Jira/Confluence

Jira is a straightforward project-planning tool that helps software development teams manage, prioritize and organize work; Confluence is its partner tool to provide a common place for documentation and collaboration. Jira visualizes the project in the form of stories moving through the scrum process, encouraging the team to break down epics into manageable stories and have important conversations about deliverables and scope. Jira provides a transparent team view of priorities and scope and is used to help the team keep pace and plan work, as well as adjust and change course when user priorities shift. The overall goal of the tool is to assist the team with a shared framework for measuring, prioritizing and performing work.

Confluence is used as a shared workspace for the storage of documents, meeting notes, architecture decisions, and other artifacts used internal to the development team. Its simple structure and file organization speeds the process of team members finding the materials they need and provides the ability to collaborate and provide feedback on decisions with versioning and comment capabilities.

Jira/Confluence for the Smart Columbus Operating System is currently private and requires a user login<sup>12</sup>. Alternatively, the project can be made public with read only access for the public to support total transparency. As currently deployed, users need to request access through the PMO and should contact the DPgM (Technology).

<sup>12</sup> <https://jira.smartcolumbusos.com>

## 5.4 PUBLIC FACING SITE

The city has established a public facing website<sup>13</sup> 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
- Draft deliverables for public comment
- 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 is assigned the responsibility to ensure current versions of documents are posted to the website.

## 5.5 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   | MMTPA/CPS   subject of email |
| • Smart Mobility Hubs                       | SMH   subject of email       |
| • Mobility Assistance Application           | MAPCD  subject of email      |
| • Connected Electric Autonomous Vehicle     | CEAV   subject of email      |
| • Event Parking Management                  | EPM   subject of email       |
| • Prenatal Trip Assistance                  | PTA   subject of email       |

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<sup>13</sup> <https://smart.columbus.gov/>



# 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.
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 Chief Architect, 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 Operating System 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:
  - Establish policies to meet privacy and security requirements
  - Identify technical controls:
    - Access
    - Logging and monitoring
    - Encryption
    - Database
  - 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**

Individual/Group	Responsibilities
Delivery Lead (Operating System)	<ul style="list-style-type: none"> <li>• Work with Data Working Group chair to establish agenda and objectives for meeting; follow-up meeting with minutes and action items.</li> <li>• Drive team toward DMP and DPP drafts</li> <li>• 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</li> <li>• Help establish business process to support any activities required by the DMP and DPP.</li> </ul>
Chief Architect	<ul style="list-style-type: none"> <li>• Work with DPgM and working group chairs to set objectives for discussions and desired outcomes</li> <li>• Seek regular counsel from USDOT subject matter expert to ensure best practices and USDOT expectations are being met</li> </ul>
Data Technical Working Group	<ul style="list-style-type: none"> <li>• Chairs will work with DPgM to facilitate discussions around components of data management and data privacy</li> <li>• Chairs assist in steering conversation to arrive at strong outcomes leading to inputs for the DMP and DPP</li> <li>• Group will offer their industry experience and expertise to help advise the city on building a comprehensive DMP and DPP</li> <li>• Group will help the team through compiling plans; dividing and conquering on some of the work to be done to achieve desired state</li> <li>• Chairs will serve in an advisory role and check thought process and documentation for thoroughness, quality and consistency</li> </ul>
Project Leads	<ul style="list-style-type: none"> <li>• Participate in working group discussions to represent respective projects and the respective data that will be produced, ingested and/or disseminated</li> </ul>
USDOT Subject Matter Expert	<ul style="list-style-type: none"> <li>• Participate in working group as expert resource to help drive the team toward a solid DMP and DPP</li> <li>• Advisor to the Deputy PgM and Chief Architect</li> <li>• Reviewer of draft plans for consistency, accuracy and thoroughness</li> </ul>
Technical Consultant (Data Management and Privacy)	<ul style="list-style-type: none"> <li>• Participate in the process to ensure continuity between projects and the Operating System</li> <li>• Ensure all data aspects are being effectively covered in the process</li> </ul>
Communications PM	<ul style="list-style-type: none"> <li>• Review documents for marketing and branding consistency</li> <li>• Assist with communicating the plans to stakeholders</li> </ul>

Source: City of Columbus



# 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 (CCB).

### 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.

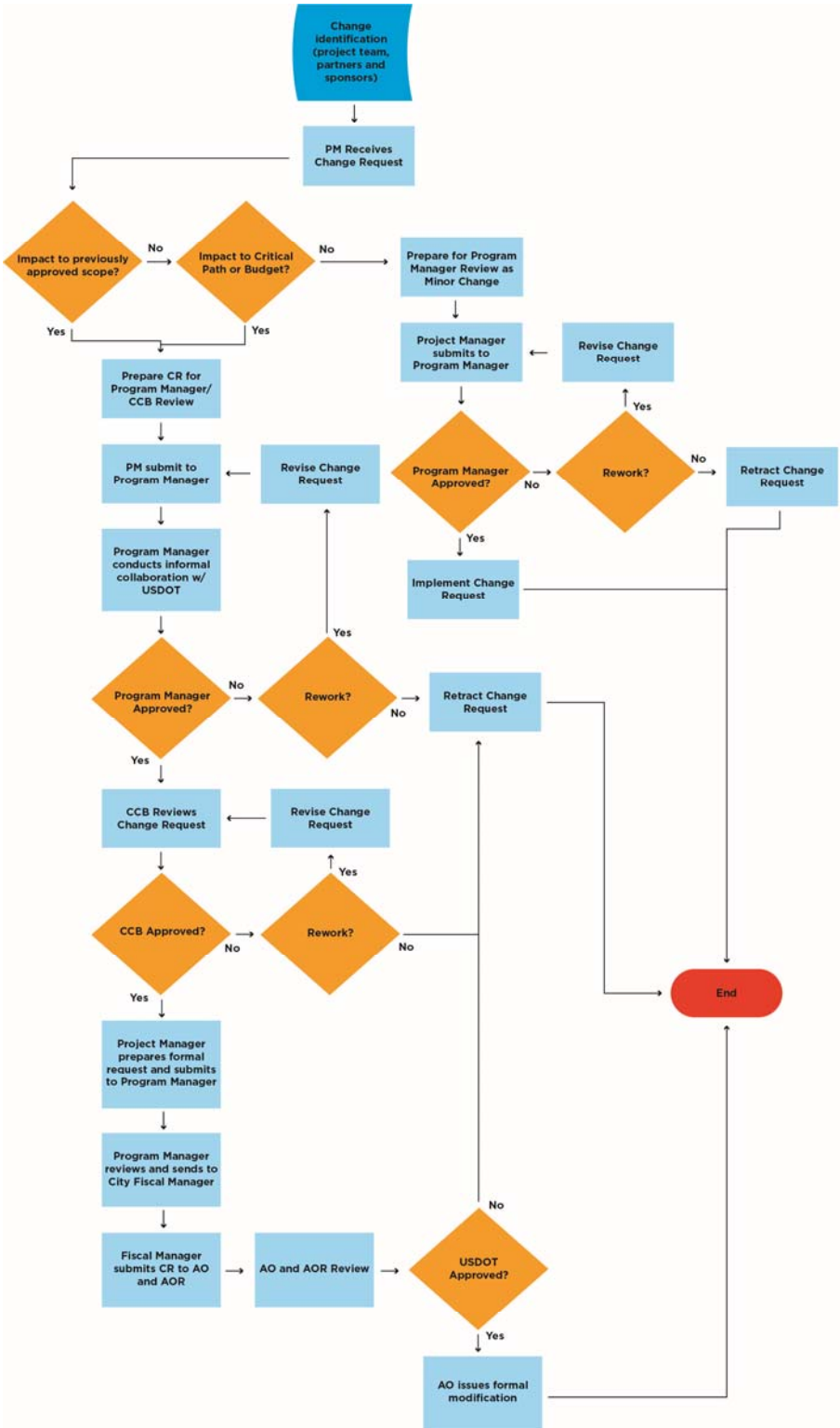
Changes to approved scope, critical path items and major budget impacts all fall purview to the CCB. Changes that do not require the CCB will be approved by the PgM; these include minor adjustments to the schedule and technical approach. It will be at the discretion of the PgM for initiating the change request with the CCB. Figure 10 outlines the city decision process for engaging the 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 President & CEO – Joanna Pinkerton
- 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



Source: City of Columbus, October 2017

Figure 10. CCB Selection Process

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.

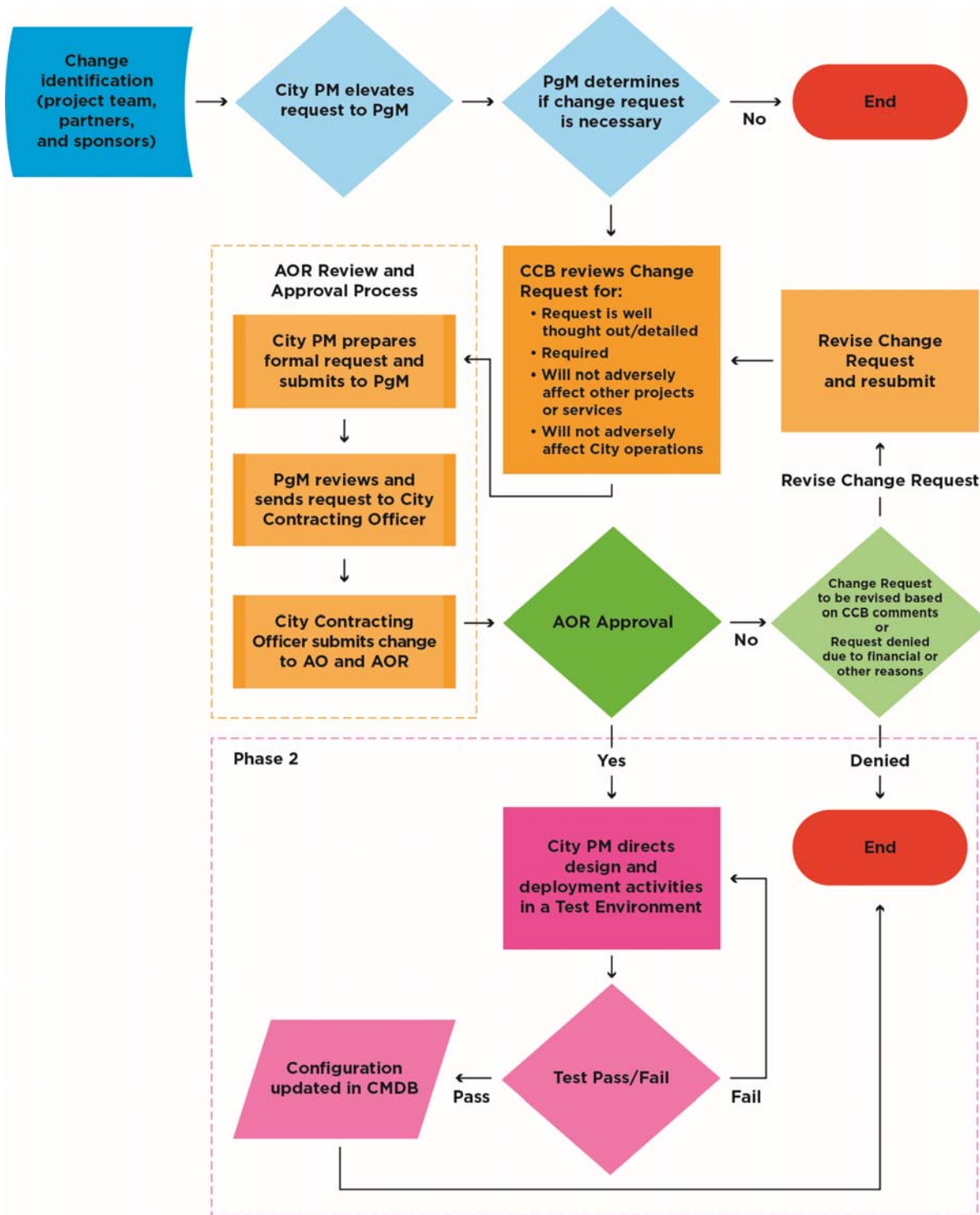
In general, components that will fall under change management will include physical assets, applications, service contracts, and subscriptions. Configuration items (CI), items that can be modified, will be maintained in a Configuration Management Database (CMDB). A standard nomenclature will be utilized 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
  - 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
  - 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 11 details the change management process for the deployment phase of Smart Columbus.



Source: City of Columbus, October 2017

Figure 11. Change Management Process

## 7.3 ROLES AND RESPONSIBILITIES

Table 13 lists the roles and responsibilities for change management.

**Table 13. Roles and Responsibilities for Change Management**

Individual/Group	Responsibilities
USDOT AO	<ul style="list-style-type: none"> <li>Review and approve any changes to deliverables and budget</li> <li>Document change requests through contract modifications</li> </ul>
USDOT AOR	<ul style="list-style-type: none"> <li>Communicate with USDOT AO on any scope changes</li> <li>Work with PgM to understand impacts of change</li> </ul>
CINO	<ul style="list-style-type: none"> <li>Communicate CCB decisions to AOR and AO</li> </ul>
Fiscal Analyst	<ul style="list-style-type: none"> <li>Designated fiscal/procurement officer for the city</li> <li>Assist in executing any contractual change requested and approved by the CCB, PMO and USDOT.</li> </ul>
CCB	<ul style="list-style-type: none"> <li>Determine if change request is approved or denied</li> </ul>
PgM	<ul style="list-style-type: none"> <li>Proactively identify any change requests to scope, budget, or costs</li> <li>Review and consider identified variances of the scope from the PM</li> <li>Send change request to the CCB</li> <li>Provide a recommendation to USDOT AOR on the decision</li> <li>Provide written requests for scope variances to the AOR &amp; AO</li> </ul>
PM	<ul style="list-style-type: none"> <li>Receive potential change request</li> <li>Determine if change request is necessary</li> <li>Document change requests through log</li> </ul>
Technical Team	<ul style="list-style-type: none"> <li>Identify potential change request</li> <li>Implement changes as directed by the PM</li> </ul>

Source: City of Columbus



# 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 Quarterly 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 14. Roles and Responsibilities for Schedule Management**

Individual/Group	Responsibilities
USDOT AO	<ul style="list-style-type: none"> <li>Responsible for approving schedule changes</li> </ul>
USDOT AOR	<ul style="list-style-type: none"> <li>Responsible for recommending approval of schedule changes</li> </ul>
CINO/Program Owner (City)	<ul style="list-style-type: none"> <li>Accountable for the entire Smart Columbus program including final approval of recommended schedule changes</li> </ul>
PgM (City)	<ul style="list-style-type: none"> <li>Responsible for overall delivery of the program. This includes responsibility for recommending schedule changes to the CINO and deputy CINO and task additions to the schedule.</li> <li>Responsible for overseeing the Operating System, DMP and DPP. Working with the Chief Architect, a WBS and schedule will need to be developed.</li> </ul>

Individual/Group	Responsibilities
DPgM (Partnerships and Policy) (City)	<ul style="list-style-type: none"> <li>Responsible for establishing schedule to negotiate and execute partnership awards</li> </ul>
Communications PM (City)	<ul style="list-style-type: none"> <li>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.</li> </ul>
PM	<ul style="list-style-type: none"> <li>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.</li> </ul>
Consultant PgM	<ul style="list-style-type: none"> <li>Responsible for management of the lead scheduler and ensuring project level coordination is occurring when schedule risks are identified</li> </ul>
Lead Scheduler (Consultant)	<ul style="list-style-type: none"> <li>Responsible for developing and maintaining the project schedule.</li> <li>Responsible for coordinating with Project Leads (consultant) to identify schedule risks and adjust WBS as needed to deliver the program</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>Responsible for elevating schedule risks to the city PMs and lead scheduler for coordination with the PgM and consultant PgM</li> </ul>

Source: City of Columbus

### 8.3 SCHEDULE BASELINE

Section 4 (Scope Management) includes an updated WBS. Appendix E contains the master schedule.

### 8.4 SCHEDULE CONTROL PROCESS

The PgM in collaboration with the city PMs and USDOT will review the schedule quarterly 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 quarterly to the AOR and AO during the period of performance of this project.

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 be engaged 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 (activities on the critical path have zero float).

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 regular basis with the submittal of the Quarterly Report. In addition, schedule for near-term deliverables is reviewed by the city and USDOT on bi-weekly coordination calls.





# 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 15.

**Table 15. Roles and Responsibilities for Cost Management**

Individual/Group	Responsibilities
CINO/Program Owner	<ul style="list-style-type: none"> <li>• Approve contract recommendations and executes contracts and awards authorized by Columbus City Council</li> <li>• Approve program budget increases for elevation to USDOT</li> <li>• Accountable for USDOT budget</li> </ul>
PgM (City)	<ul style="list-style-type: none"> <li>• Provide guidance and management regarding cost increases; works to mitigate cost increases; elevates cost increases to CINO for approval</li> <li>• Responsible for USDOT budget management</li> <li>• Supervise the fiscal analyst and assistant</li> <li>• Approve invoices for payment</li> </ul>
DPgM	<ul style="list-style-type: none"> <li>• Manage any consultants that support the Operating System including their budget</li> </ul>

Individual/Group	Responsibilities
	<ul style="list-style-type: none"> <li>Facilitate escalations regarding cost increases and budget needs to PgM; PM is responsible for updating DPgM on project and consultant contract status as it relates to the Operating System, including budget</li> </ul>
Communications PM	<ul style="list-style-type: none"> <li>Manage any communications consultants including their budget</li> <li>Facilitate escalations regarding cost increases and budget needs; PM is responsible for updating PgM on project and consultant contract status including budget</li> </ul>
PMs (City)	<ul style="list-style-type: none"> <li>Deliver the elements of the program (projects) provides oversight of deliverables; manages project budget</li> <li>Facilitate escalations including cost increases</li> <li>Responsible for updating PgM on project and consultant contract status</li> </ul>
Chief Architect (City)	<ul style="list-style-type: none"> <li>Deliver the elements of the Operating System</li> <li>Provide oversight of the Operating System deliverables and serves as an escalation point to the DPgM (Technology) on matters related to scope that may impact cost</li> <li>Responsible for updating PgM and DPgM (Technology) on project and consultant contract status</li> </ul>
PgM (Consultant)	<ul style="list-style-type: none"> <li>Monitor project team performance and budget</li> <li>Provide oversight for all deliverables</li> <li>Serve as point of escalation to PgM on matters related to scope that may impact cost</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>Accountable for project deliverables</li> <li>Manage the scope and budget</li> <li>Work with PM to establish budget and recognize policy needs</li> <li>Ensure compliance of the project team with project budgets</li> <li>Communicate budget changes to responsible PM.</li> </ul>
Fiscal Analyst	<ul style="list-style-type: none"> <li>Compile financial data and financial reports</li> <li>Conducts bids; runs procurement processes; puts contracts in place</li> <li>Monitors performance against the contract</li> <li>Escalate variances to responsible PM and PgM</li> </ul>
Executive Assistant	<ul style="list-style-type: none"> <li>Audits invoices</li> <li>Routes invoices for approval</li> <li>Assists Fiscal Analyst</li> </ul>
Fiscal Procurement	<ul style="list-style-type: none"> <li>Manages the procurement process and fiscal reporting process</li> </ul>

Individual/Group	Responsibilities
Quality Manager	<ul style="list-style-type: none"><li>• Monitors cost compliance and deviations using quality metrics</li><li>• Develops corrective action plans if needed to mitigate significant cost variances</li></ul>

Source: City of Columbus

### 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 shown in Table 16. It was most recently reported in the Annual Budget Review and Program Plan Report in June 2018.

**Table 16. Smart Columbus Program Budget**

Total Program Summary		Y1	Y2	Y3	Y4	Y5	Total	Federal Share	City Cost Share	ODOT Cost Share	Franklin Co. Cost Share	TOTAL
Direct Labor		\$ 336,214	\$ 771,889	\$ 898,880	\$ 869,671	\$ 643,509	\$ 3,520,163	\$ 3,520,163	\$ -	\$ -	\$ -	\$ 3,520,163
Indirect Costs		\$ 130,788	\$ 300,266	\$ 349,665	\$ 338,303	\$ 250,326	\$ 1,369,348	\$ 1,369,348	\$ -	\$ -	\$ -	\$ 1,369,348
Other Direct Costs		\$ 20,000	\$ 115,000	\$ 15,003,810	\$ 2,878,989	\$ 30,000	\$ 18,047,799	\$ 7,550,489	\$ 3,460,000	\$ 3,037,310	\$ 4,000,000	\$ 18,047,799
Subcontractors		\$ 2,987,000	\$ 7,810,000	\$ 17,067,000	\$ 5,737,690	\$ 2,461,000	\$ 36,062,690	\$ 27,560,000	\$ 4,540,000	\$ 3,962,690	\$ -	\$ 36,062,690
Total Program Summary		\$ 3,474,002	\$ 8,997,155	\$ 33,319,355	\$ 9,824,653	\$ 3,384,835	\$ 59,000,000	\$ 40,000,000	\$ 8,000,000	\$ 7,000,000	\$ 4,000,000	\$ 59,000,000

Source: City of Columbus

## 9.4 USDOT REIMBURSEMENT

The reimbursement from 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 Fiscal Analyst 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 Fiscal Analyst then submits task authorizations approved by the PgM via email to USDOT AO for concurrence.

With concurrence from the AO, the Fiscal Analyst will submit the task authorization letter to the CINO for signature. The Fiscal Analyst 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 Executive Assistant receives and reviews the contractor invoice, auditing the invoice against the purchase order and the contract. The Executive Assistant enters the consultant invoice into a tracking spreadsheet used to keep track of PO balances and invoice payments. The spreadsheet is maintained by the Executive Assistant 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 the PM has completed review, the PM returns the invoice to the Executive Assistant with approval or with comments to be addressed. The Executive Assistant returns the invoice with PM comments back to the contractor, who makes corrections and then resubmits the invoice for approval. The Executive Assistant 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 Executive Assistant on the city's internal network, and it is accessible by Department of Public Service fiscal staff. The Executive Assistant then sends the service invoice approved by the PM to the Fiscal Analyst.
- The Fiscal Analyst reviews the service invoice database entry and approves the payment of the invoice.
- The Executive Assistant then scans the approved invoice, initiating a voucher into the DAX system, and sends the approved invoice to the fiscal analyst for approval for payment.
- The Fiscal Analyst reviews the audit data for each invoice, compares the voucher to the invoice. If the Fiscal Analyst finds an error, the Fiscal Analyst requests the Executive Assistant to correct the error. The Fiscal Analyst then approves the voucher for payment.
- Upon approval for payment by the Fiscal Analyst, the Executive Assistant 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 Executive Assistant 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 Fiscal Analyst 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 Fiscal Analyst compiles all the documents above into one complete PDF file.
  5. The Fiscal Analyst 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 Fiscal Analyst informs the CINO, PgM and Fiscal Analyst 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 Fiscal Analyst 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 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 17.

## 10.2 ROLES AND RESPONSIBILITIES

The overall roles and responsibilities for policy management are indicated in Table 17.

**Table 17. Roles and Responsibilities for Policy Management**

Individual/Group	Responsibilities
PgM	<ul style="list-style-type: none"> <li>Account for and track the impacts of potential policy issues with respect to the management of overall program deliverables, schedule and budget</li> </ul>
CINO	<ul style="list-style-type: none"> <li>Serve as the entry point into the legislative process for city polices</li> </ul>
Communications PM	<ul style="list-style-type: none"> <li>Responsible for overall communications and community engagement. Ensure policy processes are engaged at the appropriate time and level.</li> </ul>
DPgM	<ul style="list-style-type: none"> <li>Determine if formal change to policy is required in consultation with the PgM, Project Leads, and the legal and compliance officer</li> <li>Initiate contact and define project policy needs, delivery timeline and coordinate any follow up with ODOT</li> </ul>
City PMs	<ul style="list-style-type: none"> <li>Identify and monitor potential policy risks and alert the DPgM (Partnerships and Policy) for tracking and follow up.</li> <li>Determine if formal change to policy is required in consultation with the DPgM (Partnerships and Policy) and legal and compliance officer</li> </ul>
Legal and Compliance Officer	<ul style="list-style-type: none"> <li>Identify, evaluate and manage policy, legal, liability and other risks.</li> <li>Consult with the DPgM (Partnerships and Policy) and Project Leads to determine if formal change to policy is required</li> <li>Initiate formal change to city policy or legislation</li> </ul>
City Officials	<ul style="list-style-type: none"> <li>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<sup>14</sup>), Columbus City Council (responsibilities and authorities granted in Columbus City Charter), Columbus City Attorney (chief legal authority for City of Columbus), Mayor (see</li> </ul>

<sup>14</sup> [https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=CHTR\\_THECICOOH\\_DEDI](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=CHTR_THECICOOH_DEDI)

Individual/Group	Responsibilities
	Columbus City Charter), and Columbus City Auditor (refer to Columbus City Charter for responsibilities and authority).
State Officials	<ul style="list-style-type: none"> <li>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.</li> <li>ODOT Deputy Director of Strategic Initiatives and Program serves as the city's point of contact for all program coordination at the state level</li> </ul>

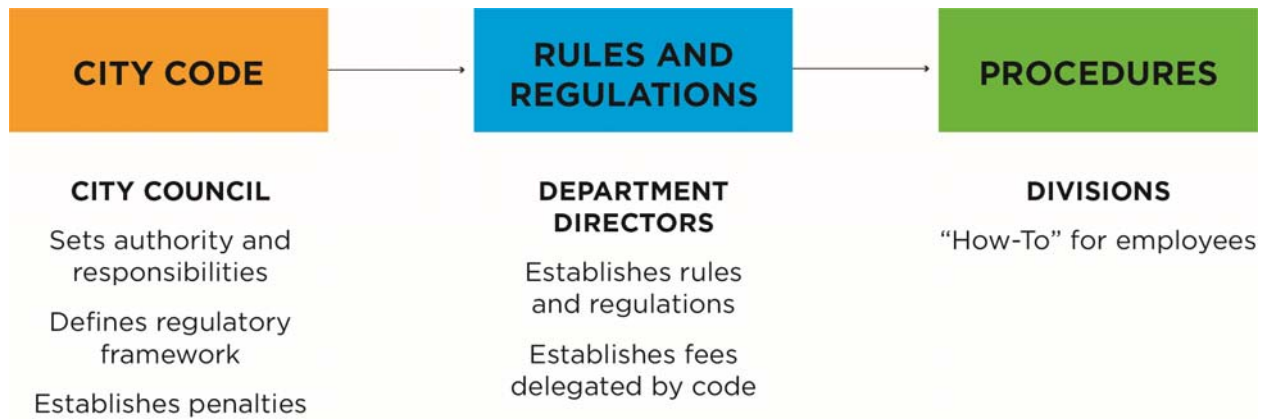
Source: City of Columbus

### 10.3 POLICY DRAFTING AND PROCESS FOR APPROVAL

Columbus City Code sets forth the process for adopting policy. Title 1<sup>15</sup> of Columbus City Code establishes the structure of the municipal government and the process for changing city code. Figure 12 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 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.

<sup>15</sup> [https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT1ADCO](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT1ADCO)

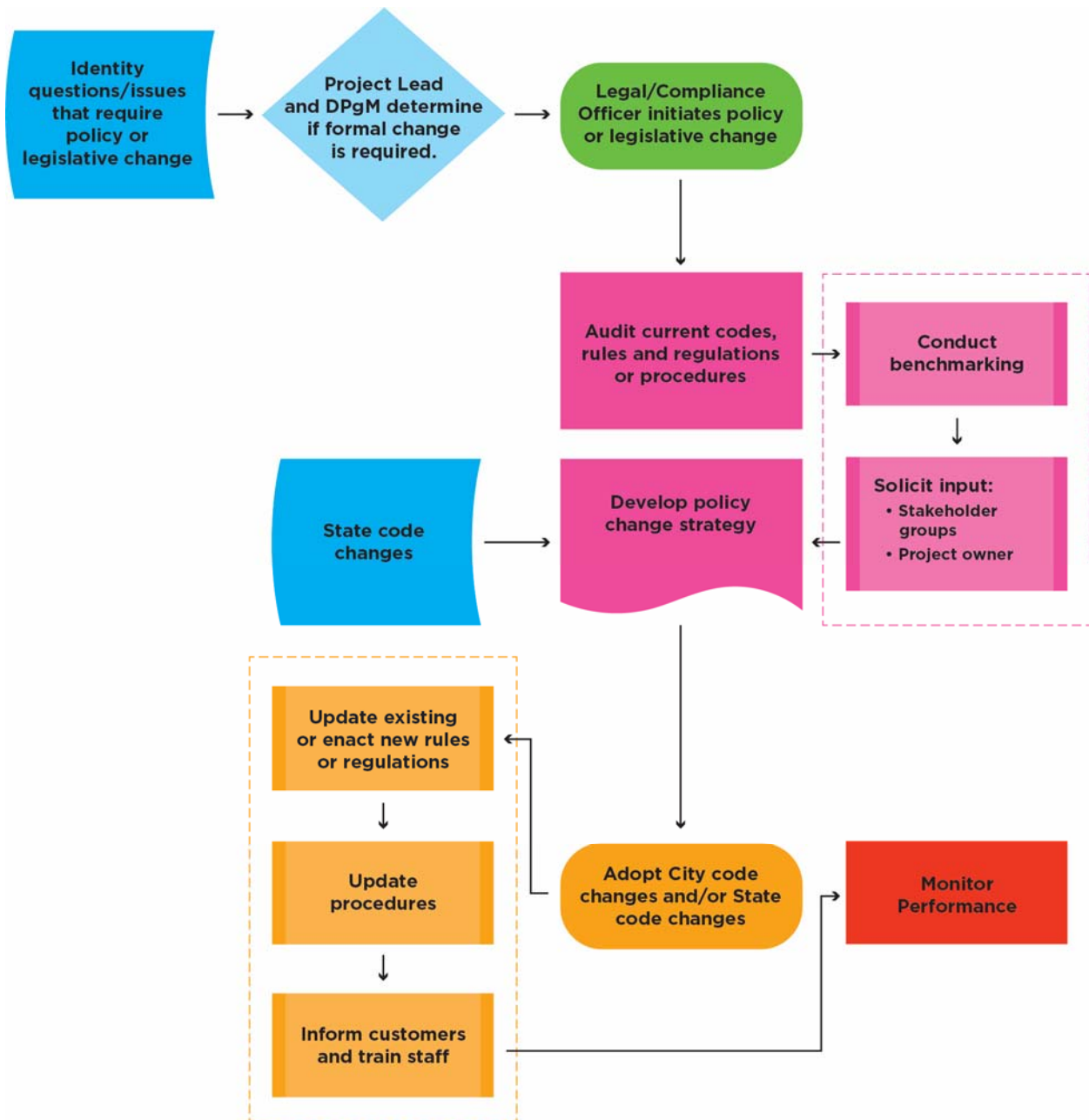


Source: *City of Columbus, October 2017*

**Figure 12. City of Columbus Policy Process**

### 10.1.1. Process for Policy Approval (City)

Figure 13 outlines the process for policy change within the City of Columbus.



Source: City of Columbus, October 2017

Figure 13. City of Columbus Policy Change Process

### 10.1.2. 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<sup>16</sup> is found online at the council website.<sup>17</sup>

### 10.1.3. 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”
- 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.

### 10.1.4. 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 the point of contact for all program coordination.

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.

<sup>16</sup> <https://www.columbus.gov/council/How-Do-I/Legislative-Process/>

<sup>17</sup> <https://www.columbus.gov/council/How-Do-I/Legislative-Process/>

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. 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. Descriptions of 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 18 lists the roles and responsibilities for human resource management.

**Table 18. Roles and Responsibilities for Human Resources Plan**

Individual/Group	Responsibilities
USDOT AO	<ul style="list-style-type: none"> <li>• Review and approve any changes to key personnel.</li> </ul>
USDOT AOR	<ul style="list-style-type: none"> <li>• Communicate with USDOT AO on any key personnel changes.</li> <li>• Work with project leadership to understand impacts of change.</li> <li>• Review and provide recommendations regarding the right to apply project resources, make decisions and make approvals regarding staffing.</li> </ul>
PgM	<ul style="list-style-type: none"> <li>• Manage staff planning, tracking and transitions for the entire program.</li> <li>• 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.</li> <li>• 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.</li> <li>• Maintain an issue log to monitor issues until closure</li> </ul>
DPgM	<ul style="list-style-type: none"> <li>• Manage staff resources and assignments at the individual project level</li> <li>• Observe team behavior, manage conflict, resolve issues and appraise team member performance and escalate issues to PgM as needed.</li> </ul>

Individual/Group	Responsibilities
City PM	<ul style="list-style-type: none"> <li>• Manage staff resources and assignments at the individual project level</li> <li>• Track and report individual team member performance (hours by month)</li> <li>• Observe team behavior, manage conflict, resolve issues and appraise team member performance and escalate issues to PgM as needed.</li> </ul>
Consultant PgM (both Technical and Communications)	<ul style="list-style-type: none"> <li>• Manage consultant staff resources and assignments at the program level</li> <li>• Coordinate with Project Leads to ensure required skill sets are made available to the projects</li> </ul>
Project Leads	<ul style="list-style-type: none"> <li>• Manage consultant resources and assignments at the individual project level</li> </ul>

Source: City of Columbus

### 11.1.1. 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 responsibility assignment matrix (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 19. This matrix tracks responsibility by project and deliverables.



Table 19. Smart Columbus RAM

Project Name	CINO + Deputy	PgM + Deputy	Comms PM	Business Owner	Business Owner/ Manager	City PM	Project Lead	Dev Team	SE	Stakeholders	Working Group
Smart Columbus Operating System	A	R	C	N/A	N/A	C – Katie Robinson	C – Eric Flecher	C	I	C	I
CVE	A	R	C	C – DPS	C – Reynaldo Stargell	C – Ryan Bollo	C – Tom Timcho	I	I	I	I
Multimodal Trip Planner-Common Payment System (MMTPA/CPS)	A	R	C	N/A	N/A	C – Andy Wolpert, Kevin Dwinnell	C – Alex Kavanagh	I	I	I	I
SMH	A	R	C	C – COTA	C – Micheal Carroll	C – Jeff Kupko	C – Matt Graf	I	I	I	I
MAPCD	A	R	C	C – COTA	C – Micheal Carroll	C – Andy Wolpert	C – Alex Kavanagh	I	I	I	I
CEAV	A	R	C	C – COTA	C – Micheal Carroll	C – Jeff Kupko	C – Tom Timcho	I	I	I	I
EPM	A	R	C	C – DPS	C – Robert Ferrin	C – Ryan Bollo	C – Alex Kavanagh	I	I	I	I
Prenatal Trip Assistance	A	R	C	C – Celebrate One	C – Erika Clark Jones	C – Andy Wolpert	C – Sherry Kish	I	I	I	I

Project Name	CINO + Deputy	PgM + Deputy	Comms PM	Business Owner	Business Owner/ Manager	City PM	Project Lead	Dev Team	SE	Stakeholders	Working Group
Task A - Program Management	A	R	C	N/A	N/A	R – Ryan Bollo, Andy Wolpert, Jeff Kupko, Kevin Dwinnell	C – Diane Newton	I	I	I	I
Task B - System Engineering (Program Level)	A	R	C	N/A	N/A	R – Mandy Bishop	C – Robert James	I	I	I	I
Task C- Performance Measures	A	R	C	N/A	N/A	R – Andy Wolpert	C – Vijay Varadarajan	I	I	I	I
Task D - Data Privacy / CyberSecurity	A	R	C	N/A	N/A	C – Tammy Chellis	C – Sherry Kish	I	I	I	I
Task E - Data Management	A	R	C	N/A	N/A	C – Tammy Chellis	C – Sherry Kish	I	I	I	I
Task F - Safety Management	A	R	C	N/A	N/A	C – Jeff Kupko	C – Greg Krueger	I	I	I	I
Task G - Communications and Outreach	A	R	C	N/A	N/A	R – Alyssa Chenault	C – Marie Keister	I	I	I	I
Task H - International Collaboration	A	R	C	N/A	N/A	R – Mandy Bishop	C – Diane Newton	I	I	I	I

Project Name	CINO + Deputy	PgM + Deputy	Comms PM	Business Owner	Business Owner/ Manager	City PM	Project Lead	Dev Team	SE	Stakeholders	Working Group
Task I - ITS Architecture and Standards Development	A	R	C	N/A	N/A	R – Ryan Bollo	C – Robert James	I	I	I	I
Task J - Interim and Final Reporting	A	R	C	N/A	N/A	R – Mandy Bishop	C – Diane Newton	I	I	I	I

Source: City of Columbus

## 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.

### 11.1.2. 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 BI-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.

### 11.1.3. Staff Tracking

On a bi-weekly basis, PMs submit timesheets to the PMO’s executive assistant. These hours are aggregated in a spreadsheet by staff member. The PMO will work with the executive assistant 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, and CINO 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.

#### 11.1.4. 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 20 identifies the contingency plan for the city team in case of unanticipated departures of key personnel. Key personnel are those staff that are specified in the USDOT agreement.

**Table 20. Leadership Contingency Plan**

Role	Current	Backup	Replacement	Rationale
PgM	Mandy Bishop	Andy Wolpert	Andy Wolpert	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.
DPgM	Andy Wolpert	Ryan Bollo	Ryan Bollo	As the project manager for CVE and EPM, as well as his long-standing position within the Department of Public Service, Ryan would be a seamless replacement in the DPgM role.

Source: City of Columbus

The city recognizes that the above contingency plan lacks depth. As the the program continues to evolve, the city will work to develop a stronger contingency plan with more depth.



# Chapter 12. Procurement Management

## 12.1 PROCUREMENT MANAGEMENT APPROACH

The procurement management approach describes the processes to purchase or acquire the goods and services needed from outside the PMO to perform the work necessary to execute the Smart Columbus program. This chapter describes all functions that pertain to the acquisition of goods and services, including description of requirements, selection and solicitation of sources, preparation and award of contract, and all phases of contract administration. 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<sup>18</sup>, 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<sup>19</sup> 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 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 the law.

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<sup>18</sup> <https://www.gpo.gov/fdsys/pkg/CFR-2014-title2-vol1/pdf/CFR-2014-title2-vol1-part200.pdf>

<sup>19</sup> [https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR)

## 12.3 ROLES AND RESPONSIBILITIES

Table 21 shows the roles and responsibilities for procurement management.

**Table 21. Roles and Responsibilities for Procurement**

Individual/Group	Responsibilities
Columbus City Council	<ul style="list-style-type: none"> <li>Awards procurement contracts per Columbus City Charter and Code of Ordinances Chapter 329</li> </ul>
CINO	<ul style="list-style-type: none"> <li>Authority to execute contracts for Smart Columbus authorized by Columbus City Council Ordinance 1901-2017<sup>20</sup></li> </ul>
PgM	<ul style="list-style-type: none"> <li>Provide input/evaluation on procurement strategy</li> <li>Lead the evaluation of bids and offers</li> <li>Coordinate procurement with other project aspects (scheduling and performance reporting)</li> <li>Serve as contract administrator for the CINO (Code of Ordinances Section 329.10)</li> </ul>
DPgM	<ul style="list-style-type: none"> <li>Engage with vendors</li> <li>Report status of the Smart Columbus projects and upcoming procurement opportunities to partners and vendors</li> <li>Provide educational opportunities on how to do business with the city</li> </ul>
Fiscal Procurement	<ul style="list-style-type: none"> <li>Develop and manages the procurement process from opportunity to award</li> <li>Submit subcontract awards to firms</li> <li>Receive and assists the PgM in evaluating bids and offers</li> <li>Negotiate contract terms and conditions</li> <li>Close out subcontracts upon completion of the task</li> </ul>
PM (City)	<ul style="list-style-type: none"> <li>Provide input/evaluation on procurement strategy</li> <li>Negotiate contract scope and fees</li> <li>Provide input/evaluation on vendor statements of work</li> <li>Manage the contract once awarded</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>Provide input/evaluation on vendor statements of work</li> <li>Coordinate review/input from project team as needed</li> </ul>

Source: City of Columbus

<sup>20</sup> <https://columbus.legistar.com/LegislationDetail.aspx?ID=3102536&GUID=6891877D-7ACA-40FA-8F47-62D81AFF3605&Options=ID|Text|&Search=1901-2017>



## 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<sup>21</sup> 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<sup>22</sup> for all legislation presented to and acted upon by Columbus City Council.

## 12.5 PROCUREMENT TYPES

Chapter 329 of Columbus Code of Ordinances<sup>23</sup> 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
  - Provides for the negotiation of all terms, including price prior to contract award
  - May include a provision for the negotiation of Best and Final Offers
  - May be a single step or multi-step process.
- Sole Source Procurement: A situation created due to the inability to obtain competition.
  - May result because only one vendor or supplier possesses the unique ability or capability to meet the particular requirements of the solicitation
  - 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).

<sup>21</sup><http://vendors.columbus.gov/sites/public/Enterprise%20Portal/default.aspx?&WDPK=initial&WMI=EPHome&redirected=1&WCMP=COLS&WMI=EPHome>

<sup>22</sup> <https://columbus.legistar.com/Legislation.aspx>

<sup>23</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR)

- Purchases less than \$20,000 do not need Columbus City Council approval.
- Purchases that are \$20,000 or more require Columbus City Council approval.
- Direction from USDOT to Engage Resources: Allows for the 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<sup>24</sup>.

## 12.6 PROCUREMENT PROCESS

### 12.1.1. 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.

### 12.1.2. 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<sup>25</sup> - Competitive sealed bidding.
- Section 329.19<sup>26</sup> - Exceptions to competitive sealed bidding.

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<sup>24</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.19EXCOSEBI](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.19EXCOSEBI)

<sup>25</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.18COSEBI](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.18COSEBI)

<sup>26</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.19EXCOSEBI](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.19EXCOSEBI)

### 12.1.3. 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<sup>27</sup> - General provisions.
- Section 329.21<sup>28</sup> - Responsibility prequalification requirements for construction contracts.
- Section 329.211<sup>29</sup> - Responsibility prequalification criteria.
- Section 329.212<sup>30</sup> - Local preference for construction contracts. (conflicts with 2 CFR 200, so not applicable to USDOT-funded Smart Columbus contracts)
- Section 329.22<sup>31</sup> - Process for awarding construction contracts not exceeding one-hundred thousand dollars (\$100,000.00).
- Section 329.23<sup>32</sup> - Process for awarding construction contracts exceeding one hundred thousand dollars (\$100,000.00).

### 12.1.4. 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<sup>33</sup> - Process for awarding professional service contracts under twenty thousand dollars (\$20,000.00).
- Section 329.25<sup>34</sup> - Process for awarding professional service contracts equal to or exceeding twenty thousand dollars (\$20,000.00), but not exceeding fifty thousand dollars (\$50,000.00).
- Section 329.26<sup>35</sup> - Processes for awarding professional service contracts exceeding fifty thousand dollars (\$50,000.00).

<sup>27</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.20GEPR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.20GEPR)

<sup>28</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.21REPRRECOCO](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.21REPRRECOCO)

<sup>29</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.211REPRCR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.211REPRCR)

<sup>30</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.212LOPRCOCO](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.212LOPRCOCO)

<sup>31</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.22PRAWCOCONOEXONDTHTDO100000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.22PRAWCOCONOEXONDTHTDO100000.00)

<sup>32</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.23PRAWCOCOEXONHUTHDO100000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.23PRAWCOCOEXONHUTHDO100000.00)

<sup>33</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.24PRAWPRSECONOEXTWTHDO20000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.24PRAWPRSECONOEXTWTHDO20000.00)

<sup>34</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.25PRAWPRSECOEXTWTHDO20000.00BUNOEXFITHDO50000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.25PRAWPRSECOEXTWTHDO20000.00BUNOEXFITHDO50000.00)

<sup>35</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.26PRAWPRSECOEXFITHDO50000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.26PRAWPRSECOEXFITHDO50000.00)

- Section 329.27<sup>36</sup> - Awarding professional service contracts through requests for statements of qualifications.
- Section 329.28<sup>37</sup> - Awarding professional service contracts through requests for proposals.

### 12.1.5. 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<sup>38</sup> 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 prescribes the process for procuring equipment, summarized as follows:

- Section 329.29<sup>39</sup> - Process for awarding not-for-profit service contracts estimated to cost less than twenty thousand dollars (\$20,000.00).
- Section 329.30<sup>40</sup> - Process for awarding not-for-profit service contracts estimated to exceed twenty thousand dollars (\$20,000.00).

### 12.1.6. Socioeconomic Subcontracting

The PMO will ensure compliance with 2 CFR 200.321<sup>41</sup> 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 with the Chief Diversity Officer (CDO), who leads the Office of Diversity and Inclusion<sup>42</sup> 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 business levels. This advisory group will act in an advisory capacity to the Smart Columbus program Office in the areas of supplier diversity, work force development and training for the purpose of:

<sup>36</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.27AWPRSECOTHRESTQU](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.27AWPRSECOTHRESTQU)

<sup>37</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.28AWPRSECOTHREPR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.28AWPRSECOTHREPR)

<sup>38</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.01DE](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.01DE)

<sup>39</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.29PRAWNOFSECOESCOLETWTHDO20000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.29PRAWNOFSECOESCOLETWTHDO20000.00)

<sup>40</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.30PRAWNOFSECOESEXTWTHDO20000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.30PRAWNOFSECOESEXTWTHDO20000.00)

<sup>41</sup> <https://www.gpo.gov/fdsys/pkg/CFR-2014-title2-vol1/pdf/CFR-2014-title2-vol1-sec200-321.pdf>

<sup>42</sup> <https://www.columbus.gov/odi/>

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
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

### 12.1.7. Contract Administrator

According to Section 329.10<sup>43</sup> of Columbus City Code, promptly after awarding any contract for services under Sections 329.22<sup>44</sup>, 329.23<sup>45</sup>, 329.25<sup>46</sup>, 329.26<sup>47</sup>, 329.27<sup>48</sup>, or 329.28<sup>49</sup>, 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:

- To determine whether the contractor (any individual or business entity which has a contract with a city agency) follows 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.

<sup>43</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.10COADEV](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.10COADEV)

<sup>44</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.22PRAWCOCONOEXONTHDO100000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.22PRAWCOCONOEXONTHDO100000.00)

<sup>45</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.23PRAWCOCOEXONHUTHDO100000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.23PRAWCOCOEXONHUTHDO100000.00)

<sup>46</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.25PRAWPRSECOEXTWTHDO20000.00BUNOEXFITHDO50000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.25PRAWPRSECOEXTWTHDO20000.00BUNOEXFITHDO50000.00)

<sup>47</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.26PRAWPRSECOEXFITHDO50000.00](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.26PRAWPRSECOEXFITHDO50000.00)

<sup>48</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.27AWPRSECOTHRESTQU](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.27AWPRSECOTHRESTQU)

<sup>49</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.28AWPRSECOTHREPR](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.28AWPRSECOTHREPR)

### 12.1.8. City Attorney Review

Section 329.08<sup>50</sup> 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.

### 12.1.9. 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<sup>51</sup> and ODOT's Construction and Material Standards<sup>52</sup> and standard drawings<sup>53</sup> for construction procurements.

### 12.1.10. 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)<sup>54</sup> for use in equipment and construction procurements.

### 12.1.11. 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.

### 12.1.12. Contract Modifications

Section 329.09<sup>55</sup> 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.

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<sup>50</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.08CIATRESTSTCOCOCL](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.08CIATRESTSTCOCOCL)

<sup>51</sup> <https://www.columbus.gov/publicservice/Design-and-Construction/Document-Library/>

<sup>52</sup><http://www.dot.state.oh.us/Divisions/ConstructionMgt/Specification%20Files/2013%20CMS%2011142012%20FINAL.PDF>

<sup>53</sup><http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/roadway/Pages/StandardConstructionDrawing.aspx>

<sup>54</sup> <http://www.dot.state.oh.us/Divisions/ConstructionMgt/Materials/Pages/QPL.aspx>

<sup>55</sup>[https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.09COMO](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.09COMO)

### 12.1.13. 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

### 12.1.14. 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 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<sup>56</sup> 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<sup>57</sup>. 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.

### 12.1.15. 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](mailto: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

<sup>56</sup> <https://www.columbus.gov/Templates/Detail.aspx?id=2147496296>

<sup>57</sup> <https://www.columbus.gov/Templates/Detail.aspx?ekfrm=2147496318>

- 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?
- 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.

### **12.1.16. 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 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 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.

### **12.1.17. 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

### 12.1.18. Consulting Team Leadership

Table 22 provides key points of contact for the consultants already under contract on the Smart Columbus program.

**Table 22. Smart Columbus Consultant Team**

Firm Name	Lead	Role
<b>Prime Consultants</b>		
HNTB Ohio Inc.	Diane Newton	Project Management, Design Guidance Planning, Systems Engineering, Development, Integration, and Implementation
Accenture	Katie Robinson	Smart Columbus Operating System Design, Development, and Implementation
Engage Public Affairs	Marie Keister	Communications/Outreach
Michael Baker International, Inc.	Jeff Kupko	City-staffed project management
Proteon	Brian King	Technology consulting across projects
<b>Sub-Consultant to HNTB Ohio Inc.</b>		
WSP	Tom Timcho	Connected Vehicle Environment

<b>Firm Name</b>	<b>Lead</b>	<b>Role</b>
Advarra	Liz Willock	Institutional Review Board and Human Use Approval
*AEC	Jordan Steele	Power and Lighting
CTL Engineering, Inc.	Jason Standingfer	Wireless testing
*Smart Services, Inc.	Todd Stanhope	Data Collection and Survey
*CCI Engineering	Jack Ray	CADD Support
*DHDC Engineering Consulting Services	Savvas Sophocleous	SUE
<b>Sub-Consultant to Engage Public Affairs</b>		
*Murphy Epsom	Missi Burris	Media Relations/ PR/ Social Media
*Warhol & WALL ST.	Yohannan Terrell	Creative
*The Saunders Company	Gayle Saunders	Media Relations
*Policy Works LLC	Dannette Palmore	Engagement/ Outreach
*L. Price & Associates	Larry Price	Engagement/ Faith Leader
PMM Agency	Kimberly Blackwell	Conferences/ Events
Ice Miller LLP	Greg Dunn	Thought Leadership/ Telecommunications
<b>Sub-Consultant to Michael Baker International, Inc.</b>		
Battelle Memorial Institute	Matthew Windholtz	Systems Engineering Expertise
Taivara	Kevin Dwinnell	Technology and Productization Expertise
*Sterling Staffing	Kathy Moore	Executive Administrative Assistance
*Drive Engineering	Mario Toscano	Systems Engineering Expertise

\*ODOT DBE Certified

Source: City of Columbus

### 12.1.19. 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 23 lists Cost Share Contributions and Table 24 lists Key Leveraged Partners from Section B of the Award and updated contributions and new Key Leveraged Partners added since executing the Award.

**Table 23. Cost Sharing Resources**

Estimated Funding Source	Estimated Cost Share Amount	Estimated Cash/In-kind
City of Columbus	\$8,000,000	Cash
State of Ohio (ODOT)	\$7,000,000	In-kind
Franklin County	\$4,000,000	\$1,000,000 cash, \$3,000,000 in-kind
Total	\$19,000,000	

Source: City of Columbus

Table 24. Key Leverage Partner Resources

Key Partner	Description of Resources	Estimated Amount
Paul Allen's Vulcan, Inc.	Funding to support the deployment of electric vehicles and other carbon emission reduction strategies.	\$ 10,000,000
Autodesk	Access throughout the duration of USDOT grant to <i>Autodesk AEC Collection</i> , 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.	\$ 219,060 *
Amazon Web Services (AWS)	Credits to AWS Cloud services and AWS Professional Services. AWS will also provide solution architecture and best practices guidance to the Recipient.	\$1,000,000
Alphabet's Sidewalk Labs	Consultation and recommendations on best practices for solutions to non-emergency medical transportation needs for expectant mothers.	\$230,000
AT&T	AT&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.	\$1,000,000
Continental	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-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	\$1,000,000

Key Partner	Description of Resources	Estimated Amount
	data; and gamification of driving with incentives for drivers to behave responsibly to improve traffic condition and safety.	
OSU	OSU will provide funding to assist with the implementation of the CEAV project.	\$2,000,000
Greater Columbus Art Council (GCAC)	GCAC will provide funding to assist in the communications and outreach of the USDOT grant projects.	\$1,000,000
INRIX	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.	\$1,424,000
Honda	Honda is proposed to provide 200 Honda associate vehicles to be equipped by Smart Columbus with On-Board Units for the CVE project.	\$2,600,000
Battelle	Battelle is proposed to support the PMO for program management; safety plan development; and system integration of the CVE project.	\$1,000,000
Econolite	Econolite is proposed to support the CVE project with in-kind traffic signal management software.	\$900,000 *
Columbus Partnership	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)	\$15,000,000
Siemens	Siemens is proposed to support the CVE project with in-kind traffic signal equipment, including Roadside Units and management software.	\$385,000
COTA	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.	\$9,000,000
TOTAL		\$49,136,260 *

\* Amount updated subsequent to execution of Award

Source: City of Columbus

### 13.3 ROLES AND RESPONSIBILITIES

Table 25 shows the roles and responsibilities of city staff on partnering.

**Table 25. Roles and Responsibilities for Partnering**

Individual/Group	Responsibilities
CINO	<ul style="list-style-type: none"> <li>Executes awards for Smart Columbus as authorized by Columbus City Council Ordinance 1901-2017<sup>58</sup></li> <li>Provides input/evaluation on partnership strategy</li> </ul>
PgM	<ul style="list-style-type: none"> <li>Approves and provides input/evaluation on partnership strategy</li> <li>Reviews and approves partnership proposals</li> <li>Coordinates partnering with other project aspects (scheduling and performance reporting)</li> <li>Serves as contract administrator for the CINO (Code of Ordinances Section 329.10<sup>59</sup>)</li> </ul>
DPgM	<ul style="list-style-type: none"> <li>Negotiates and develops partnerships</li> <li>Reports on partnership status</li> </ul>
Fiscal/Procurement Officer	<ul style="list-style-type: none"> <li>Provides input/evaluation on partnership strategy</li> </ul>
City PM	<ul style="list-style-type: none"> <li>Provides input/evaluation on partnership strategy and partnership proposals</li> <li>Manages partners during implementation</li> </ul>
Project Leads (Consultant)	<ul style="list-style-type: none"> <li>Provides input/evaluation on partnership proposals</li> </ul>

Source: City of Columbus

### 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

<sup>58</sup> <https://columbus.legistar.com/LegislationDetail.aspx?ID=3102536&GUID=6891877D-7ACA-40FA-8F47-62D81AFF3605&Options=ID|Text|&Search=1901-2017>

<sup>59</sup> [https://library.municode.com/oh/columbus/codes/code\\_of\\_ordinances?nodeId=TIT3FITACO\\_CH329PRGOSEALPR\\_329.10COADEV](https://library.municode.com/oh/columbus/codes/code_of_ordinances?nodeId=TIT3FITACO_CH329PRGOSEALPR_329.10COADEV)



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 Quarterly Progress Report a 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 and Project Team hold introductory discussion with potential partner.
2. The DPgM 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 reviews the proposed changes with the Project Team. The DPgM provides status update to the PgM.
6. The DPgM 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 will consult with the Columbus City Attorney representative assigned to the PMO.
8. The DPgM addresses comments from the Project Team and City Attorney representative and emails the cooperative award draft with comments to the potential partner. The DPgM 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 recommends to the PgM to close the negotiations. If the PgM approves closing the negotiations, the DPgM updates the Vendor Management System and notifies the potential partner. If the PgM disapproves closing the negotiation, the DPgM 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 provides a copy of the final award to the PgM for approval. Upon PgM approval, the DPgM emails the final award to the potential partner in PDF format for signature. The DPgM 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.

12. The DPgM 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. The DPgM updates the Vendor Management System and provides status update to the PgM.
13. The DPgM 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 notifies the PgM, appropriate PM and Project Leads and hands off the partner to the appropriate PM. The DPgM updates the Vendor Management System.
15. If the executed partnership requires expenditure of local match or grant funds, the DPgM then prepares with the Project Team a justification request for bid waiver or sole source following 2 CFR 200.320.
16. The DPgM provides the draft justification request to the PgM for review. The PgM provides review comments back to the DPgM. The DPgM 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 and addresses the comments. Once the justification request is approved by the AO, the DPgM 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 the consultant Project Lead, Systems Engineer(s) from the Project Technical Team and QC Reviewer(s) from the Smart Columbus PMO and their stakeholders. The Project Lead is responsible for reviewing the document to ensure the project design is within the defined scope for the project. The primary role of the Systems Engineer(s) 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. In most cases, especially for highly complex deliverables, the consultant team arranges for multiple systems engineers to participate in this review.

The primary role of the QC Reviewer(s) from the city's PMO and stakeholder team 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 (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 QC tasks. They will certify the QC form for a given submittal.

QA will be monitored by performing quality audits to verify that project quality management activities comply with QMP procedures. The DPgM (Technology) shall be responsible for managing the project audit program. She will oversee regularly scheduled audits. These audits will be supplemented with unscheduled audits when it is suspected that QC problems exist. She may be assisted by quality audit staff from Michael Baker, International and their subcontractor, Battelle (Doug Pape). He will work closely with the DPgM (Technology) to 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 26.

**Table 26. Roles and Responsibilities for Quality Management**

Individual/Group	Responsibilities
Smart Columbus PgM	<ul style="list-style-type: none"> <li>• Review Nonconformance Reports.</li> <li>• Assist in developing a plan for process change to eliminate non-conformance trends.</li> <li>• Ensure deliverables adhere to the project schedule.</li> <li>• Monitor project controls and administration to maintain timely tracking and reporting of project progress.</li> <li>• Authority to stop work that does not meet the standards, specifications, or criteria established for the projects.</li> </ul>
Quality Manager (City)	<ul style="list-style-type: none"> <li>• Conduct deliverable reviews</li> <li>• Ensure that technical reviewer comments are appropriately adjudicated and resolved</li> <li>• Conduct audits to verify that design packages are in conformance with the QMP</li> <li>• Review project initiatives to ensure they are holistic in approach and tightly integrated with the Operating System</li> <li>• Ensure the QMP is followed</li> <li>• Communicate and coordinate with the Smart Columbus team to facilitate decisions and encourage collaboration.</li> <li>• Responsible for the overall implementation and management of the QA process described in the QMP.</li> <li>• Audit to verify that design packages are in conformance with the QMP.</li> </ul>
Quality Auditor (DPgM)	<ul style="list-style-type: none"> <li>• Responsibility for ensuring compliance with the QMP procedures.</li> <li>• Perform periodic audits to verify that design documents have been checked and/or reviewed in accordance with the QMP.</li> </ul>

Individual/Group	Responsibilities
	<ul style="list-style-type: none"> <li>• Prepares an audit report that includes a description of any violation of procedures and a recommended response to correct violations.</li> </ul>
Consultant PM	<ul style="list-style-type: none"> <li>• Ensure conformance with contract documents and client requirements.</li> <li>• Ensure QC processes and activities as described in the QMP are being followed.</li> <li>• Determine, in concert with the QM, the appropriate quality check and review activities to be performed on deliverables.</li> <li>• Oversee implementation of the QMP and resolving related issues.</li> <li>• Ensure appropriate reviewers, resources, schedule and budget for QMP activities are provided.</li> <li>• Authority to stop any work that does not meet the standards, specifications, or criteria established for the Project.</li> </ul>
Quality Management (Consultant)	<ul style="list-style-type: none"> <li>• Ensure that technical reviewer comments are appropriately adjudicated and resolved.</li> <li>• Ensure QMP is followed.</li> <li>• Compile and maintain documentation.</li> </ul>
City of Columbus PM	<ul style="list-style-type: none"> <li>• Ensure conformance with the Award.</li> <li>• Responsible for coordinating city and stakeholder reviews.</li> <li>• Ensure QC processes and activities as described in the QMP are being followed.</li> <li>• Review QA audit findings and ensure that corrective actions are implemented when deficiencies are reported by the QM or others involved in the work.</li> </ul>
Project Lead (Consultant)	<ul style="list-style-type: none"> <li>• Responsible for supervising design within their respective area of expertise in accordance with the contract documents.</li> <li>• Coordinate the design work effort with the design efforts of technical support staff.</li> <li>• Compile and maintain review documents and quality records required by the QMP.</li> </ul>
QC Reviewers (City and Consultant)	<ul style="list-style-type: none"> <li>• Support the Project Leaders throughout the project. Available for discussions with the project team members prior to formal deliverable review points.</li> <li>• 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.</li> <li>• Evaluate and comment on the following: <ul style="list-style-type: none"> <li>○ Do the results support the conclusions?</li> </ul> </li> </ul>

Individual/Group	Responsibilities
	<ul style="list-style-type: none"> <li>○ Have the requirements been satisfied?</li> <li>○ Are the methods/procedures appropriate?</li> <li>○ Are there requirements that were not met?</li> <li>○ Are these appropriately documented?</li> </ul>

Source: City of Columbus

### 14.1.1. Technical Review Responsibilities by Project

Table 27 contains a breakdown of systems engineering, quality control and quality manager review responsibilities for each program deliverable, as well as review responsibilities by project.

**Table 27. Review Responsibilities**

Project/Deliverable	Lead	Reviewers			
		City of Columbus PM	Systems Engineer	QC Reviewer(s)	Quality Manager
<i>Program Deliverables</i>					
PMP	Diane Newton	Mandy Bishop	N/A	Andy Wolpert	Doug Pape
Project Schedule	Diane Newton	Mandy Bishop	N/A	Andy Wolpert	Doug Pape
Quarterly Progress Reports	Ryan Bollo	Mandy Bishop	N/A	N/A	N/A
SEMP	Diane Newton	Mandy Bishop	Bob James	Andy Wolpert	Doug Pape
Demonstration Site Map and Installation Schedule	Diane Newton	Mandy Bishop	Bob James	Andy Wolpert	Jeff Kupko
System Architecture and Standards Plan	Vijay Varadajan	Mandy Bishop	Bob James	Jessica Baker	Doug Pape
Performance Measurement Plan	Vijay Varadajan	Andy Wolpert	Bob James	Ryan Bollo	Jeff Kupko
Data Management Plan	Sherry Kish	Tammy Chellis	Victor Blue	Jeff Siegel	Doug Pape
Data Privacy Plan	Sherry Kish	Tammy Chellis	Victor Blue	Steve Johnson	Doug Pape
Independent Evaluation Support Plan	Vijay Varadajan	Andy Wolpert	Diane Newton	Jeff Kupko	Ryan Bollo



Project/Deliverable	Lead	Reviewers			
		City of Columbus PM	Systems Engineer	QC Reviewer(s)	Quality Manager
Safety Management Plan	Greg Krueger	Jeff Kupko	Diane Newton	Andy Wolpert	Ryan Bollo
Human Use Approval Summary	Victor Blue	Jeff Kupko	Diane Newton	Liz Willock (Advarra)	Andy Wolpert
Communications and Outreach Plan	Marie Keister	Alyssa Chenault	N/A	Andy Wolpert	N/A
Projects					
1. Connected Vehicle Environment	Tom Timcho	Ryan Bollo	Bob James	Scott Shogan	Jessica Baker
2. Smart Columbus Operating System	Eric Flecher	Katie Robinson	Bob James	Mandy Bishop	Kevin Dwinell
3. Common Payment System	Alex Kavanagh	Kevin Dwinell	Bob James	Jeff Siegel	Jeff Kupko
4. Multi-Modal Trip Planning App	Alex Kavanagh	Andy Wolpert	Bob James	Jeff Siegel	Jeff Kupko
5. Smart Mobility Hubs	Matt Graf	Jeff Kupko	Bob James	Andy Wolpert	Andy Wolpert
6. Mobility Assistance for People with Cognitive Disabilities	Alex Kavanagh	Andy Wolpert	Bob James	Jeff Siegel	Jeff Kupko
7. Connected Electric Autonomous Vehicles	Tom Timcho	Jeff Kupko	Bob James	Vijay Varadajan	Andy Wolpert
8. Event Parking Management	Alex Kavanagh	Ryan Bollo	Bob James	Sherry Kish	Amanda Ford
9. Prenatal Trip Assistance	Sherry Kish	Andy Wolpert	Bob James	Jessica Baker	Jeff Kupko

Source: City of Columbus

### 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.

### 14.1.2. Vee Systems Engineering Document Submittal

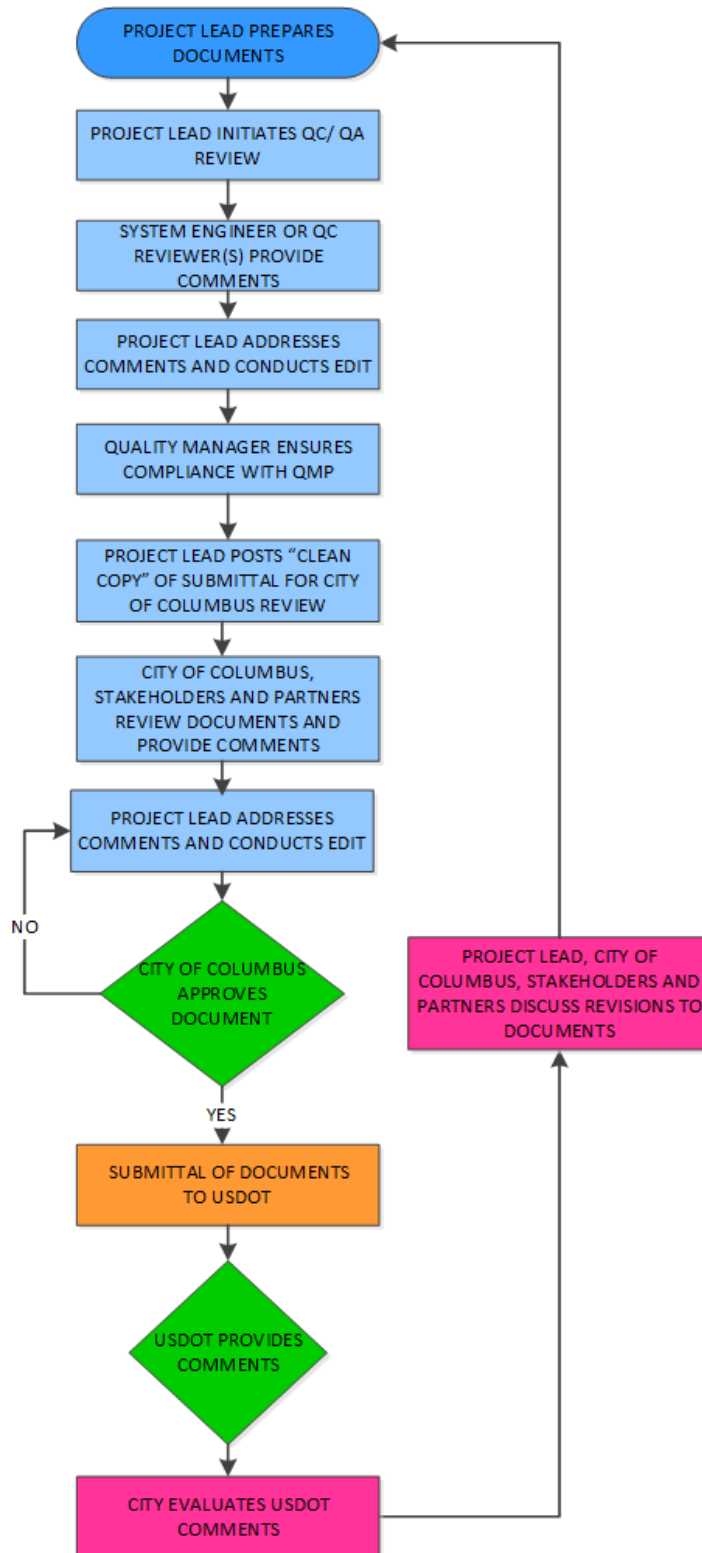
The two primary submittal types are described below. Systems Engineering Documents are defined in the Systems Engineering Management Plan. All submittals shall be made in accordance with the project scope. The bullets below outline the process for submission of draft and final deliverables in the cooperative agreement. Prior to submittal to the USDOT, the City of Columbus, partners, and stakeholders review and provide comments to the Project Lead for incorporation; these comments will be incorporated and verified by the project lead before the draft is provided to the City PM for submission to USDOT and public posting.

- Draft Submittal: provides a formal opportunity for USDOT, partners, stakeholders and the public to review the document to ensure the project has progressed appropriately along the Systems Engineering process and conforms to the scope and requirements.
  - The city must submit the deliverable to USDOT, and concurrently post the draft deliverable on the Columbus Smart City Challenge website, solicit public feedback on the deliverable, and provide a mechanism online for submittal of public comments on the deliverable.
  - USDOT will acknowledge receipt of deliverables. USDOT will review the deliverable and provide one round of high-level USDOT review comments in return.
  - The city must present a public webinar on the deliverable to support the agreement goal of technology and knowledge transfer.
    - The City will coordinate with a third-party provider regarding the webinar hosting logistics; this third-party and the City will promote the webinar through the ITS JPO's outreach mechanisms.
    - The city may group multiple deliverables together for a webinar. Each deliverable does not require a separate stand-alone webinar.
    - The city must conduct outreach to invite the Columbus partners and community to review the deliverable and participate in the public webinar.
    - The city must post on the Smart Columbus website the resulting link to the webinar recording (to be provided by the third-party provider).
- Final Submittal

- The Final Submittal is prepared when all comments from the Draft Submittal have been reviewed and archived; relevant comments must also be addressed and appropriately incorporated.
- The city will post the final document to the Smart Columbus website and send to USDOT.

### **14.1.3. 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 14, with the steps described immediately following the Figure.



Source: City of Columbus, April 2019

Figure 14. Vee Systems Engineering QA/QC Verification Process for Draft Deliverables

1. The Project Lead will initiate the QA/QC review process by providing the draft deliverable to the following reviewers as noted in Table 27:
  - a. Systems Engineer(s)
  - b. QC Reviewer(s)
2. The Systems Engineer and QC Reviewer(s) will provide comments electronically within the document;
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 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 electronic mark-ups of the document, 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 via 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 line responses to the tracked changes copies of the documents, and clean copies of the review plans/documents to the Consultant PgM and Consultant Quality Manager.
10. The Consultant PgM and Consultant Quality Manager will verify the City of Columbus comments have been addressed.
11. The (Consultant) Quality Manager will ensure compliance of technical and management aspects of the QMP. After verification, the (Consultant) Quality Manager will 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.

#### 14.1.4. 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 continuous 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 Jira, 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.

#### **14.1.4.1. GROOMING**

Agile-led projects follow the process identified in the Form SMRT-08, 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.

#### **14.1.4.2. SPRINT PLANNING**

Agile-led projects follow the process identified in Form SMRT-09, 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.

#### **14.1.4.3. SPRINT**

Agile-led projects support a collaborative team environment where each member plays a role in the quality process. The daily stand ups allow 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 to 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 allow the development team to show the Product Owner and Business Owner exactly how the new feature works and allow 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 considered 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 through code review, documentation and automated regression testing, all of which must be completed before the story can be reviewed for acceptance. Stories are accepted by the Product Owner, who ensures the work completed provides the value identified by the story. Completed stories are demonstrated at biweekly Sprint Reviews, where additional feedback and changes desired by stakeholders can become new story cards in the backlog. 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. When a full user-facing feature is completed, a second level of exploratory testing occurs to ensure the different pieces come together to create a fully-functional whole.

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 Github as living files.

#### 14.1.4.4. 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 randomly to verify that project quality management activities comply with QMP procedures. The Quality auditor (DPgM Andy Wolpert) shall be responsible for managing the project audit program. Audits shall occur on a quarterly basis, with one deliverable being selected per quarter. Auditors shall be independent of the activity being audited.

### 14.1.5. 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-02, 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.

### 14.1.6. 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-01, Quality Audit Roster.

### 14.1.7. 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 06, Quality Audit Roster.

### 14.1.8. 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-03, Quality Audit Report Resolved will be prepared to document next steps.

### 14.1.9. 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-05, 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-04, 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-05, 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 28 and located on SharePoint.

**Table 28. Quality Guides and Forms**

Document Number	Document Title
SMRT-01	Quality Audit Roster
SMRT-02	Quality Audit Checklist
SMRT-03	Quality Audit Report Resolved
SMRT-04	Corrective/Preventive Action Request Log
SMRT-05	Corrective/Preventive Action Request Form Resolved



Document Number	Document Title
SMRT-06	Review of Reports Guide
SMRT-07	Review and Checking of Technical Specifications Guide
SMRT-08	Grooming Process
SMRT-09	Definition of Ready
	City of Columbus Division of Design and Construction Checklist – Capital Improvements Projects <sup>60</sup>
	City of Columbus Traffic Signal Design Manual <sup>61</sup>

Source: City of Columbus

<sup>60</sup> <https://www.columbus.gov/publicservice/Design-and-Construction/document-library/CIP-Plan-Checklist>

<sup>61</sup> <https://www.columbus.gov/publicservice/Design-and-Construction/document-library/Traffic-Signal-Design-Manual/>



# 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 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 29 lists the roles and responsibilities for these staff and other individuals who will be involved in project communications.

**Table 29. Roles and Responsibilities for Communications Management**

Individual/Group	Type	Responsibilities
PgM	Internal (primary) External (secondary)	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Support meeting requests and identify locations to host various scheduled meetings other project working groups</li> <li>• Resolve conflicts between team members and facilitate technical delivery of the project.</li> <li>• Ensure USDOT awareness about communication requests being made of the project team</li> <li>• Ensuring USDOT approval of communications on project-related document and deliverables</li> <li>• Use appropriate reporting templates for monthly reporting and program management.</li> <li>• Serves the point of contact for the AO regarding Award requirements, questions and invoicing.</li> <li>• Submits formal changes to the AO for approval.</li> </ul>

Individual/Group	Type	Responsibilities
		<ul style="list-style-type: none"> <li>Escalates any USDOT contract concerns to CINO for consideration.</li> </ul>
Communications PM	External	<ul style="list-style-type: none"> <li>Ensure continued commitments to participate in the SCC project from stakeholders</li> <li>Lead the development of the outreach plan and strategy</li> <li>Lead the development of outreach products such as factsheets, presentations, news releases etc.</li> <li>Coordinate external requests for project information with the project team and USDOT</li> <li>Coordinate conferences and event approval with USDOT</li> <li>Identify presenters on the SCC project at various stakeholder forums identified by the project team</li> <li>Create and execute media strategy and engagement</li> <li>Coordinate conferences and events</li> </ul>
DPgM	External	<ul style="list-style-type: none"> <li>Oversee the development of partnerships benefitting the USDOT and Vulcan grants</li> <li>Coordinate partner awards with the PMO</li> <li>Coordinates legislation related to partnerships</li> <li>Manage vendor engagement and tracking</li> <li>Coordinate policy-related issues and assists with development of policy solutions</li> <li>Oversee development of procedures for legislation and procurement</li> <li>Escalation point for partner and vendor issues to ePMO.</li> </ul>
Communications and Outreach Consultant PM	External	<ul style="list-style-type: none"> <li>Direction and facilitation for stakeholder, local communities</li> <li>Communications and Outreach Crisis Plan development and maintenance</li> <li>Create and manage website content</li> <li>Develop outreach products such as factsheets, news releases, presentations</li> </ul>

Individual/Group	Type	Responsibilities
USDOT AOR	Internal	<ul style="list-style-type: none"> <li>Review requests for communications and information sharing from project team</li> <li>Coordinate with USDOT task lead on any communication that requires their approval</li> <li>Facilitate discussion with USDOT Task G and H leads regarding guidance on potential partnerships, review of Task G and H deliverables</li> </ul>
Working Group Members	Internal and external	<ul style="list-style-type: none"> <li>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.</li> </ul>
Stakeholders	External	<ul style="list-style-type: none"> <li>Provide consultation and engagement as part of the technical and development processes to ensure projects reflect their wants and needs.</li> <li>Act as 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.</li> <li>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</li> </ul>
Subject Matter Expert	Internal and/or external	<ul style="list-style-type: none"> <li>When directed by the PMO, will work with the project teams to offer domain expertise in specified areas to help advance the program and ensure best practices are considered &amp; applied where necessary.</li> </ul>

Source: City of Columbus

## 15.3 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

### 15.1.1. Internal

The PgM will take the lead role in ensuring effective communications on this project. The communications requirements are documented in Table 30.

Table 30. Internal Communications Matrix

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Project Coordination Meeting	Internal city meeting to discuss technical items, meetings, upcoming deliverables	Daily	In-Person	City PMs	Coordination of project activities, meetings and progress	PM
Program Management Office (PMO) Meeting	Internal city meeting to discuss and set program priorities	Bi-Weekly	In-Person	PgM, DPgM, city PMs, Consultant PM	Coordination of program wide activities Updated Decisions, Risks, and Action Items	PgM
Project Management Meetings	Consultant coordination meeting to review progress and set priorities for the upcoming week	Weekly	Conference Call	PgM, DPgMs, city PMs Consultant PMs, Consultant leads	Updated action lists and project risk register	Project Lead (Consultant)
USDOT Coordination Meetings	Bi-weekly meeting with the USDOT and their support staff to discuss progress, upcoming deliverables and action items.	Bi-Weekly	Conference Call	PgM, USDOT AOR, consultant staff as needed.	Discuss action items and project status	PgM

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Project Team Meetings	Meetings to review action register and status	Bi-Weekly	Conference Call	AOR and required personnel as needed & Project Team	Updated Action Register & Minutes	PgM
Schedule Updates	Updates to baseline CPM Schedule	As needed	MS Project	AOR and required personnel as needed, PgM, DPgM, PMs, Consultant PMs	Confirmation of CPM Schedule or Revised CPM Schedule	PgM
Risk Updates	Updates to baseline risk register	Bi-weekly	In-Person/ Conference Call	DPgM, PMs, Consultant PMs	Updated Risk Register	DPgM
Quarterly Progress Meetings	Meeting to review and report progress	Quarterly	In-Person/ Conference Call	AOR and required personnel as needed, PgM, DPgM, PMs, Consultant PMs	Briefing Presentation, Updated CPM Schedule, Action Register, Risk Register and Minutes	AOR / PgM
Technical Review (including Walkthroughs)	Review of any technical document prior to delivery	As Needed at Milestones	Conference Call / Email	PgM, PMs, Consultant PMs, and QA/QC Staff	Approved for distribution document	PMs



Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Performance Measurement Meetings	Review of performance measurement deliverables and inputs/outcomes from each project.	As Needed at Milestones	Conference Call / Email	PgM, PMs, Consultant PMs, USDOT AOR and consultant staff.	Minutes and action items	PMs
Daily Scrums for Agile Projects	Discuss what was worked on yesterday and will be worked on today. Discuss any blockers/issues	Daily	Conference Call	PgM, Scrum Master, Chief Architect, Product Manager, Development Team	Verbal update on status of current sprint activity	Scrum Master
Grooming Meetings for Agile Projects	Prioritize product backlog items. Opportunity for team to ask questions, plan, and identify gaps	Bi-weekly	Conference Call	PgM, Scrum Master, Chief Architect, Product Manager, Development Team	Prepare stories in Ice Box for Backlog	Scrum Master
Retrospectives for Agile Projects & Program Deliverables	What worked, what didn't and how to use what we learned	Every two weeks	Conference Call	PgM, Scrum Master, Chief Architect, Product Manager, Development Team, AOR and required personnel as needed	Minutes	Scrum Master

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Sprint Planning/demonstration meetings for Agile Projects	Backlog management, user story prioritization, demonstration of development	Varies by project: (OS = monthly) (MMTPA/CPS = bi-weekly) (PTA = bi-weekly)	Conference Call	PgM, Scrum Master, Chief Architect, Product Manager, Development Team, AOR and required personnel as needed Team	Approved user stories	Scrum Master

Source: City of Columbus

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 WebEx will be used to enable both formal and informal communications. The Smart Columbus SharePoint site is discussed in Section 5.

#### **15.1.1.1. 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).

#### **15.1.1.2. 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.

### **15.1.2. External**

The Communications PM will take the lead role in facilitating effective and productive external communications on this project. Table 31 provides a summary of the external communications tools. As discussed in the introduction to this section, Table 31 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 31. External Communications Matrix

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
<b>Technical Working Group Meetings</b>	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.	At least twice; then as needed.	In person	Working group roster members	Agenda and meeting minutes	PgM, PMs
<b>Executive Committee</b>	Discussion on the strategic direction, status and upcoming actions for the Smart Columbus.	Quarterly	In person	Smart Columbus DPgM (Partnerships and Policy)  Executive partners, current and potential partners	Agenda and meeting minutes	DPgM
<b>Website and Blog</b>	<ul style="list-style-type: none"> <li>• Smart Columbus goals and overview messaging</li> <li>• Frequently asked questions and a fact sheet</li> <li>• The Smart Columbus video</li> </ul>	Variable	Web	All (internal and external)	Website and blog	Communications PM

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
	<ul style="list-style-type: none"> <li>• A form to submit comments, inquire about business opportunities and be added to the Smart Columbus e-mail list</li> <li>• Overview information about the 9 projects</li> <li>• Overview presentations regarding the USDOT and resources</li> <li>• Press releases</li> <li>• Links to Smart Columbus social media pages</li> <li>• Link to Smart Columbus blog content</li> </ul>					
<b>Communications Toolkit</b>	<ul style="list-style-type: none"> <li>• Brand guidelines and imagery</li> <li>• Presentation and presentation template (also usable for training modules and exhibits)</li> <li>• Fact sheet and talking points</li> <li>• Media relations protocol and boilerplate messages</li> <li>• Blog post template</li> <li>• Materials for use at conferences and trade shows</li> </ul>	N/A	N/A	PMO Team and Executive Partners	Presentation materials Fact sheet Talking Points Media Protocol Web content Newsletter updates	Communications PM, Consultant Communications PM

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
	<ul style="list-style-type: none"> <li>The Smart Columbus video</li> </ul>					
<b>Social Media Toolkit</b>	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.	N/A	N/A	PMO Team and Executive Partners	Blog updates Web content Newsletter updates	Communications PM, Consultant Communications PM
<b>Monthly e-newsletter</b>	Stakeholders can sign up for the newsletter via the Smart Columbus website. It is used to communicate important milestones, opportunities for feedback, and relevant smart city news.	Monthly	Email, on-demand	External: people sign up via the website, direct requests and through attendance at public meetings	Monthly newsletter	Communications PM
<b>Conferences, trade shows</b>	Attendance at planned events with the goal of providing an overview and status of Smart Columbus and the projects, while maintaining consistent messaging. The presentation	As needed	In-person, or web	Public	Exhibits, presentation material, handouts	PgM, Communications PM

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
	can be customized based on the audience and duration of the presentation.					
<b>Webinars</b>	Working with the project managers and technical team to craft a narrative and visual representation of our projects with the aim of sharing our knowledge and lessons learned.	As needed	Web	Public	ITS America webinar	Communications PM, Consultant Communications PM
<b>Vendor Engagement Meetings</b>	A forum for vendors to learn about services and products; ay be invited in to share their product/service expertise in priority order based on service, product or expertise needed; opportunity to partner;	As needed	In person	Vendors	Invite and attendee lists Summary of outcomes	DPgM, Fiscal/Procurement Officer

Source: City of Columbus

## 15.4 COMMUNICATIONS PLATFORM

### 15.1.3. 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, Jira/Confluence and Github 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.

### 15.1.4. 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.

High level contents include:

- Smart Columbus overview:
  - Projects
  - Communities
- Connections:
  - Blog
  - Social Media (Facebook, Twitter, Instagram)
- Newsroom:
  - Smart Columbus outreach materials (fact sheets, presentations, videos)
  - USDOT SCC outreach materials
  - Documents and publications (final deliverables) – likely link to USDOT NTL once documents are published by USDOT.



## 15.5 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 or 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 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
  - All
- Project
  - 1 - SCOS
  - 2 - CVE
  - 3 - MMTPA/CPS
  - 4 - Smart Mobility Hubs
  - 5 - Mobility Assistance
  - 6 - Prenatal Trip Assistance
  - 7 - Event Parking Management
  - 8 - CEAV
  - All
- Phase (V-Model)
  - Concept
  - Close Out
  - Deployment
  - Design
  - O&M
  - Procurement
  - Requirements
  - All Phases
- Phase (Agile)
  - Concept
  - Inception Iterations
  - Conception Iterations
  - Transition (Release)
  - Production (Operate & Support)

- All Phases
- Type
  - Threat
  - Opportunity
- Description
- Trigger

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 points)
- Impact to Cost
  - Very High (5 points)
  - High (4 points)
  - Moderate (3 points)
  - Low (2 points)
  - Very Low (1 points)
- Impact to Schedule
  - Very High (5 points)
  - High (4 points)
  - Moderate (3 points)
  - Low (2 points)
  - Very Low (1 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 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 a bi-weekly meeting 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
  - Active
  - Inactive
  - Retired
  - Closed
- Status Notes as of <date>
  - 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. Acronyms

## ACRONYM LIST

AO	Agreement Officer
AOR	Agreement Officer Representative
AV	Automated Vehicles
AWS	Amazon Web Services
BSM	Basic Safety Message
BRT	Bus Rapid Transit
CAR/PAR	Corrective/Preventive Action Request
CCB	Change Control Board
CDO	Chief Diversity Officer
CEAV	Connected Electric Autonomous Vehicles
CEO	Chief Executive Officer
CI	Configuration Items
CINO	Chief Innovation Officer
CMDB	Configuration Management Database
CMP	Configuration Management Plan
ConOps	Concept of Operations
Comm. Plan	Communications and Outreach Plan
COTA	Central Ohio Transit Authority
CPS	Common Payment System
CPM	Critical Path Method
CRR	Comment Resolution Report
CV	Connected Vehicle
CVE	Connected Vehicle Environment
CVRIA	Connected Vehicles Reference Implementation
DAX	City of Columbus' internal, enterprise-wide financial system
DBE	Disadvantaged Business Enterprise
DCINO	Deputy Chief Innovation Officer
DG	Data Governance
DMP	Data Management Plan

DPgM	Deputy Program Manager
DPP	Data Privacy Plan
DSMIS	Demonstration Site Map and Installation Schedule
DSRC	Dedicated Short Range Communications
EAV	Electric Autonomous Vehicle
EHS	Enhanced Human Services
EPM	Event Parking Management
EVI	Electric Vehicle Infrastructure
FA	Fiscal Assistant
FHWA	Federal Highway Administration
FM	Fiscal Manager
FMLM	First-mile/Last-mile
GCAC	Greater Columbus Art Council
ICD	Interface Control Document
IE	Independent Evaluation
IEEE	Institute of Electrical and Electronics Engineers
IESP	Independent Evaluation Support Plan
IFB	Invitation for Bid
IRB	Institutional Review Board
ITB	Invitation to Bid
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MAI	Management Analyst I
MORPC	Mid-Ohio Regional Planning Commission
MOU	Memorandum of Understanding
MMTPA	Multi-Modal Trip Planning Application
MS	Microsoft
N/A	Not Applicable
NEMT	Non-Emergency Medical Transportation
NHTSA	National Highway Transportation Safety Administration
NTL	National Transportation Library
O&M	Operations and Maintenance
O&MP	Operations and Maintenance Plan

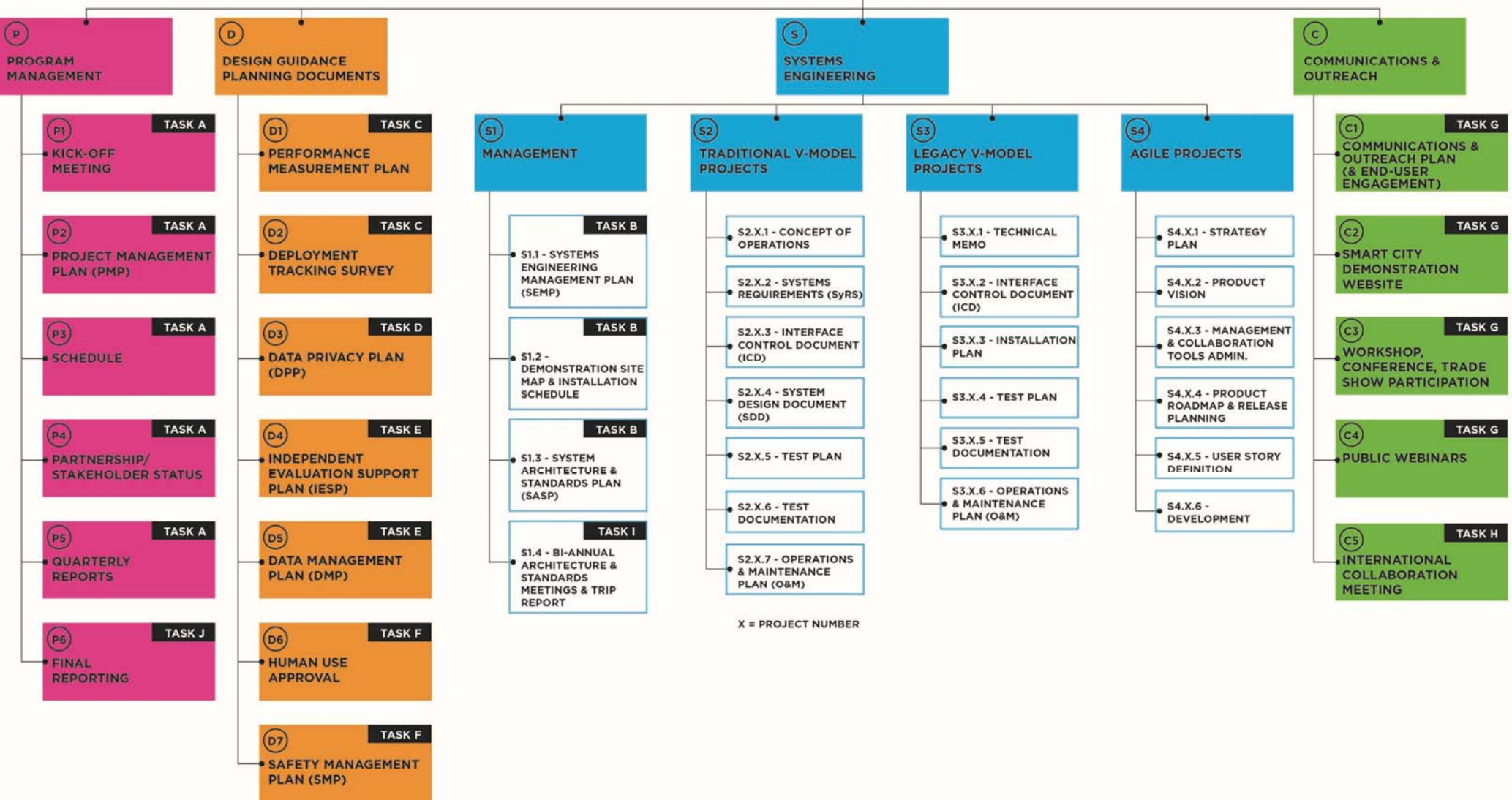


ODC	Other Direct Costs
ODOT	Ohio Department of Transportation
ODPS	Ohio Department of Public Safety
OST	Office of the Secretary of Transportation
OSU	The Ohio State University
PII	Personally Identifiable Information
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMP	Project Management Plan
PgM	Program Manager
PMO	Program Management Office (Smart Columbus program Management Office)
Q&A	Question and Answer
QA	Quality Assurance
QC	Quality Control
QM	Quality Manager
QMP	Quality Management Plan
QPL	Qualified Products List
RDE	Research Data Exchange
RFP	Request for Proposals
ROI	Return on Investment
RSU	Roadside Unit
SASP	System Architecture and Standards Plan
SCC	Smart City Challenge
SCOS	Smart Columbus Operating System
SCS	Monthly Schedule
SDD	System Design Document
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



# Appendix C. DTFH611H00013 Award Document



U.S. Department of Transportation

Cooperative Agreement Award Number DTFH6116H00013

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

<i>Signatures</i>	
City of Columbus	U.S. Department of Transportation Federal Highway Administration
<i>x Jennifer Gallagher</i>	<i>x Arlan E. Finfrock</i>
Printed Name: Jennifer Gallagher	Printed Name: Arlan E. Finfrock
Title: Director of Public Service	Title: Agreement Officer
Date: 8-30-16	Date: 8/30/16

**Award Information**

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### ***Award Information***

Award No.:	DTFH6116H00013
Effective Date:	August 30, 2016
Awarded to:	<p>City of Columbus            90 West Broad Street            Columbus, Ohio 43215-9004</p> <p>DUNS No: 609679548            TIN No.: 316400223</p>
Sponsoring Office/ Federal Agency Name:	<p>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 Tarpgaard, HCFA-32</p>
Total Amount:	<p>Federal Share: \$40,000,000            Recipient Cost Share: <u>\$19,000,000</u>            Total Value: \$59,000,000*</p> <p>*See also Leveraged Partner Resources clause, Section B</p>
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):	# HOIT212116168
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
3. Approved Volume 2 Budget Application dated 07/29/2016 - 24 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<sup>1</sup>. 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

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<sup>1</sup> 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:
  - Status of key procurements if available (do not provide procurement sensitive information but rather only general status information).
  - 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.
  - Progress, achievements, deliverables/milestones, problems, risks.
  - Status of developing and implementing Partnership agreements.
  - 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:
  - Functional Requirements. Including communications, security, and safety requirements.
  - Interface Requirements. Including identification of relevant standards (where appropriate).
  - Data Requirements. Including data-sharing requirements.
  - Performance Requirements. Including system performance targets and performance requirements.
  - 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:
  - Enterprise Architecture. Describes the relationships between organizations required to support the overall system architecture.
  - Functional Architecture. Describes abstract functional elements (processes) and their logical interactions (data flows) that satisfy the system requirements.
  - Physical Architecture. Describes physical objects (systems and devices) and their application objects as well as the high-level interfaces between those physical objects.
  - 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 handling 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, electronic or hardcopy, in their custody from unauthorized 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)<sup>2</sup> 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.<sup>3</sup> Furthermore, NIST provides guidance regarding big data

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<sup>2</sup> 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>

<sup>3</sup> NIST Special Publication 800-53, Appendix J (Security and Privacy Controls for Federal Information Systems and Organizations) can be found at: <http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r4.pdf>



architectures and security requirements in NIST Special Publication 1500-1<sup>4</sup> and NIST Special Publication 1500-4.<sup>5</sup>

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/>

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<sup>4</sup> NIST Big Data Interoperability Framework: Volume 1 Definitions,  
<http://dx.doi.org/10.6028/NIST.SP.1500-1>

<sup>5</sup> 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>.

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](http://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 marketing 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.

<b>Task</b>	<b>Deliverable</b>	<b>Due Date</b>	<b>Section 508 Compliant?</b>
A	Kick-off Meeting – conduct a kickoff meeting at the USDOT or the Recipient’s site.	Within four weeks after award	No
A	Project Management Plan (PMP)	10/24/2016	No
A	Project Schedule	9/26/2016	No
A	Project Schedule Monthly Updates	Monthly	No
A	Partnership/Stakeholder Status Summary (Draft and Final)	9/26/2016	No
A	Quarterly Progress Reports and Briefings – submit progress reports to document technical activities performed. See Quarterly Progress Reports clause below.	Quarterly	No
B	Systems Engineering Management Plan (SEMP)	11/21/2016	Yes

<b>Task</b>	<b>Deliverable</b>	<b>Due Date</b>	<b>Section 508 Compliant?</b>
B	Concept of Operations (ConOps)	2/27/2017	Yes
B	Demonstration Site Map and Installation Schedule	3/31/2017	Yes
B	Systems Requirements Specification (SyRS)	6/12/2017	Yes
B	Interface Control Document (ICD)	7/3/2017	Yes
B	System Design Document (SDD)	9/18/2017	Yes
B	Test Plan (TP)	8/13/2017	Yes
B	System Architecture and Standards Plan	3/24/2017	Yes
B	Other Systems Engineering documents – as identified by the Recipient and agreed to by the USDOT – that provide evidence of following a systems engineering approach	TBD	Yes
C	Performance Measurement Plan	12/21/2016	Yes
C	Response to USDOT Deployment Tracking Surveys (as required)	TBD	No
D	Data Privacy Plan	7/31/2017	Yes
E	Data Management Plan	7/3/2017	Yes
E	Independent Evaluation Support Plan	12/21/2016	Yes
E	Data to support USDOT's Independent Evaluation	TBD	No
E	Data provided to the USDOT's Research Data Exchange (RDE)	TBD	No
F	Safety Management Plan	11/21/2016	Yes

<b>Task</b>	<b>Deliverable</b>	<b>Due Date</b>	<b>Section 508 Compliant?</b>
F	Human Use Approval Summary	2/1/2017	No
G	Communications and Outreach Plan	12/5/2016	Yes
G	A promotional video (6-12 minutes) about the Smart City Demonstration, including two additional updates;	TBD	Yes
G	A Smart City Demonstration website	11/18/2016	Yes
G	Travel and participation in six workshops/conferences/trade shows each year with one of them being international	TBD	No
G	Participation in four public USDOT-organized webinars per year regarding Smart City Challenge Demonstration progress/performance and lessons learned	TBD	No
H	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	TBD	No
I	Attendance at 6 architecture and standards meetings, of which 2 are expected to be held outside of the United States	TBD	No
I	Architecture and Standards Meeting Trip Reports	TBD	No



Task	Deliverable	Due Date	Section 508 Compliant?
J	Smart City Demonstration Interim Reports (annually)	Last Friday of September (annually)	No
J	Smart City Demonstration Final Report	9/23/2020	Yes

**Note:** Section 508 requirements are included in the General Terms and Conditions available online at: <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>

**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.

<b>Estimated Funding Source</b>	<b>Estimated Cost Share Amount</b>	<b>Estimated Cash/In-kind</b>
City of Columbus	\$8,000,000	Cash
State of Ohio (Ohio DOT)	\$7,000,000	In-kind
Franklin County	\$4,000,000	\$1,000,000 cash, \$3,000,000 in-kind
<b>Total</b>	<b>\$19,000,000</b>	

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.

<b>Key Leveraged Partner Resources</b>		
<b>Key Partner</b>	<b>Description of Resources</b>	<b>Estimated Amount</b>
Paul Allen’s Vulcan, Inc.	Funding to support the deployment of electric vehicles and other carbon emission reduction strategies.	\$ 10,000,000
Mobileye	Installation of Mobileye’s Shield +TM technology on transit buses.	\$ 1,950,000
Autodesk	A year-long subscription to <i>Infraworks</i> , an information modeling platform that uses 3-D visualizations and real-world data to plan major engineering projects as well as on-site training.	\$ 34,520

<b>Key Leveraged Partner Resources</b>		
<b>Key Partner</b>	<b>Description of Resources</b>	<b>Estimated Amount</b>
Amazon Web Services (AWS)	Credits to AWS Cloud services and AWS Professional Services. AWS will also provide solution architecture and best practices guidance to the Recipient.	\$1,000,000
NXP	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.	\$2,500,000
Alphabet's Sidewalk Labs	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.	\$230,000
AT&T	AT&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.	\$1,000,000

<b>Key Leveraged Partner Resources</b>		
<b>Key Partner</b>	<b>Description of Resources</b>	<b>Estimated Amount</b>
DC Solar	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.	\$1,500,000
Continental	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.	\$1,000,000
Experience Columbus	Included in Event Parking (Downtown)	\$100,000

<b>Key Leveraged Partner Resources</b>		
<b>Key Partner</b>	<b>Description of Resources</b>	<b>Estimated Amount</b>
Ohio State University	Included in EAV (Commercial)/Program Management	\$2,000,000
Greater Columbus Art Council	Included in Communications and Outreach	\$1,000,000
HERE, Inc.	Included in Information Data Exchange (Enabling Technology)	\$1,000,000
INRIX	Included in Information Data Exchange (Enabling Technology)	\$1,424,000
Mass Factory (App&Town)	Included in Enhanced Human Services (Enabling Technology)	\$40,000
SPARC	Included in CCTN Vehicles (Enabling Technology)	\$388,200
Peloton	Included in Truck Platooning (Logistic)	\$165,000
Honda	Included in CCTN Vehicles (Enabling Technology)	\$2,600,000
Battelle	Included in Program Management	\$1,000,000
Econolite	Included in CCTN (Enabling Technology)	\$280,000
Columbus Partnership	Included in Testing of Autonomous Vehicles (Commercial)	\$5,000,000
Columbus Partnership	Sustainment Cash Available as needed for USDOT and/or electrification deployments	\$10,000,000
TOTAL		\$44,211,720

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.

<b>Key Leveraged Electrification Partner Resources</b>		
<b>Key Partner</b>	<b>Description of Resources</b>	<b>Estimated Amount</b>
City of Columbus	Deploying EV and EV charging infrastructure.	\$ 2,500,000
American Electric Power	Decarbonization of power supply and deployment of electric vehicles and other carbon emission reduction strategies.	\$ 29,100,000
The Ohio State University	Deploying EV and EV charging infrastructure, and University investment in mobility and smart grid related research.	\$ 13,000,000
Columbus Partnership	Deploying EV and EV charging infrastructure, and investment in mobility and smart grid related research.	\$ 7,500,000
Mid-Ohio Regional Planning Commission	Installation of EV charging infrastructure	\$ 600,000
FleetCarma	Installation of advanced telematics devices to track and optimize fleet fuel efficiency strategies.	\$ 300,000
<b>TOTAL</b>		<b>\$ 53,000,000</b>



## **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:

<i>Type*</i>	<i>Indirect Rate</i>	<i>Estimated Rate (%)</i>	<i>Base</i>
Prov.	Fringe	18.95%	City Direct Labor
Prov.	Insurance Rate	Varies by employee from 13.81% - 46.76%	City Direct Labor except Student Interns

\*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:

Name	Title/Position
Aparna Dial	Program Manager
Randy Bowman	Deputy Program Manager

**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:

Name
NONE

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](mailto:Sarah.Tarpgaard@dot.gov)

Submit an **electronic copy** to the AOR at the following address:

[Kate.Hartman@dot.gov](mailto:Kate.Hartman@dot.gov)

Submit an electronic copy to the ITS JPO at the following address:

[ITSPrompts@dot.gov](mailto:ITSPrompts@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.

<u>Calendar quarters are defined as:</u>	<u>Reports due on or before:</u>
1 <sup>st</sup> : January – March	April 30 <sup>th</sup>
2 <sup>nd</sup> : April – June	July 30 <sup>th</sup>
3 <sup>rd</sup> : July – September	October 30 <sup>th</sup>
4 <sup>th</sup> : October – December	January 30 <sup>th</sup>

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
- b. SF-425A, Federal Financial Report Attachment (if applicable).

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.

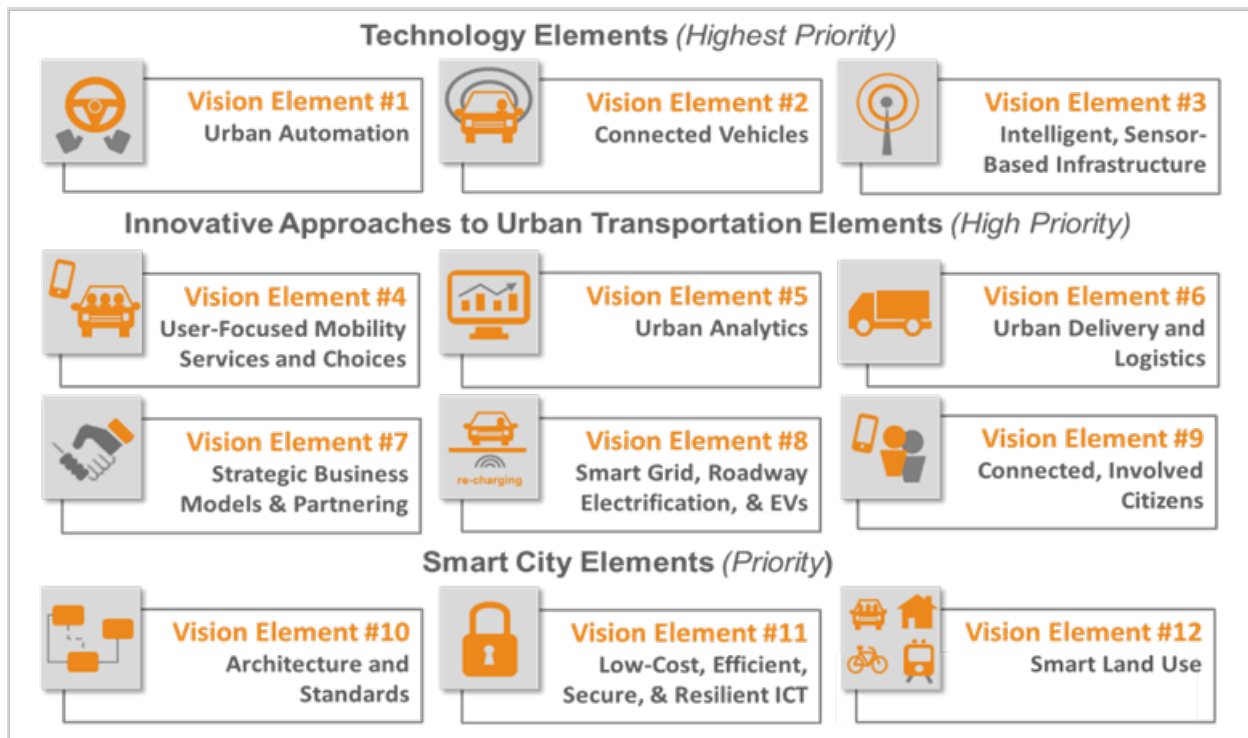
See the Statement of Work, Task A, for progress report content requirements.

## **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**

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/>) and the USDOT's Strategic Plan 2014-2018 (<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>). 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 DSRC<sup>1</sup>. (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

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<sup>1</sup> 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](http://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

### Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1	<b>1</b>	<b>Project Milestones</b>	<b>1169 days</b>	<b>96%</b>	<b>Thu 8/18/16</b>	<b>Wed 3/31/21</b>																									
2	1.1	CoC Task 1 Notice to Proceed (NTP)	0 days	100%	Thu 8/18/16	Thu 8/18/16	88,157,170,15																								
3	1.2	USDOT Cooperative Agreement NTP	0 days	100%	Tue 8/30/16	Tue 8/30/16	11																								
4	1.3	CoC Task 2 NTP	0 days	100%	Mon 10/3/16	Mon 10/3/16	572,683,923,9																								
5	1.4	Independent Evaluator NTP	0 days	100%	Wed 9/14/16	Wed 9/14/16																									
6	1.5	USDOT/City Reset Meeting	1 day	100%	Thu 9/7/17	Thu 9/7/17	2047																								
7	1.6	USDOT Authorization to Resume Phase I - Systems Engineering Activities	22 days	100%	Wed 12/20/17	Thu 1/18/18	945FS+1 day,:																								
8	1.7	Project End	1 day	0%	Wed 3/31/21	Wed 3/31/21																									
9	<b>2</b>	<b>Program Management</b>	<b>1205 days?</b>	<b>82%</b>	<b>Thu 8/18/16</b>	<b>Thu 5/20/21</b>																									
10	<b>2.1</b>	<b>USDOT Kick Off Meeting</b>	<b>19 days</b>	<b>100%</b>	<b>Thu 8/18/16</b>	<b>Tue 9/13/16</b>																									
13	<b>2.2</b>	<b>Project Management Plan (PMP)</b>	<b>1004 days</b>	<b>90%</b>	<b>Thu 8/18/16</b>	<b>Thu 7/30/20</b>																									
14	<b>2.2.1</b>	<b>PMP Original</b>	<b>118 days</b>	<b>100%</b>	<b>Thu 8/18/16</b>	<b>Mon 1/30/17</b>																									
37	<b>2.2.2</b>	<b>PMP Version 2.0</b>	<b>63 days</b>	<b>100%</b>	<b>Mon 9/11/17</b>	<b>Wed 12/6/17</b>																									
72	<b>2.2.3</b>	<b>Quarterly PMP Update (as necessary)</b>	<b>895 days</b>	<b>58%</b>	<b>Wed 1/18/17</b>	<b>Thu 7/30/20</b>																									
73	2.2.3.1	Quarterly PMP Update (as necessary) 1	9 days	100%	Wed 1/18/17	Mon 1/30/17																									
74	2.2.3.2	Quarterly PMP Update 2 (DEPRECATED)	10 days	100%	Tue 10/17/17	Mon 10/30/17																									
75	2.2.3.3	Quarterly PMP Update 3 (as necessary)	20 days	100%	Tue 1/16/18	Mon 2/12/18																									
76	2.2.3.4	Quarterly PMP Update (as necessary) 6	10 days	100%	Tue 4/17/18	Mon 4/30/18																									
77	2.2.3.5	Quarterly PMP Update (as necessary) 7	10 days	100%	Tue 7/17/18	Mon 7/30/18																									
78	2.2.3.6	Quarterly PMP Update (as necessary) 8	10 days	100%	Wed 10/17/18	Tue 10/30/18																									
79	2.2.3.7	Quarterly PMP Update (as necessary) 9	10 days	100%	Wed 1/16/19	Wed 1/30/19																									
80	2.2.3.8	Quarterly PMP Update (as necessary) 10	10 days	10%	Wed 4/17/19	Tue 4/30/19																									
81	2.2.3.9	Quarterly PMP Update (as necessary) 11	10 days	0%	Wed 7/17/19	Tue 7/30/19																									
82	2.2.3.10	Quarterly PMP Update (as necessary) 12	10 days	0%	Thu 10/17/19	Wed 10/30/19																									
83	2.2.3.11	Quarterly PMP Update (as necessary) 13	10 days	0%	Thu 1/16/20	Thu 1/30/20																									
84	2.2.3.12	Quarterly PMP Update (as necessary) 14	10 days	0%	Fri 4/17/20	Thu 4/30/20																									
85	2.2.3.13	Quarterly PMP Update (as necessary) 15	10 days	0%	Fri 7/17/20	Thu 7/30/20																									

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021					
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
86	<b>2.3</b>	<b>Schedule</b>	<b>1196 days</b>	<b>71%</b>	<b>Thu 8/18/16</b>	<b>Fri 5/7/21</b>																									
87	<b>2.3.1</b>	<b>Detailed SmartColumbus Schedule (SCS)</b>	<b>412 days</b>	<b>100%</b>	<b>Thu 8/18/16</b>	<b>Wed 3/21/18</b>																									
98	<b>2.3.2</b>	<b>SCS Monthly Updates</b>	<b>1058 days</b>	<b>73%</b>	<b>Thu 10/27/16</b>	<b>Thu 12/31/20</b>																									
99	2.3.2.1	SCS Monthly Updates 1	3 days	100%	Thu 10/27/16	Mon 10/31/16																									
100	2.3.2.2	SCS Monthly Updates 2	3 days	100%	Mon 11/28/16	Wed 11/30/16																									
101	2.3.2.3	SCS Monthly Updates 3	3 days	100%	Tue 1/3/17	Thu 1/5/17																									
102	2.3.2.4	SCS Monthly Updates 4	3 days	100%	Fri 1/27/17	Tue 1/31/17																									
103	2.3.2.5	SCS Monthly Updates 5	7 days	100%	Fri 2/17/17	Tue 2/28/17																									
104	2.3.2.6	SCS Monthly Updates 6	7 days	100%	Thu 3/23/17	Fri 3/31/17																									
105	2.3.2.7	SCS Monthly Updates 7	7 days	100%	Thu 4/20/17	Fri 4/28/17																									
106	2.3.2.8	SCS Monthly Updates 8	7 days	100%	Mon 5/22/17	Wed 5/31/17																									
107	2.3.2.9	SCS Monthly Updates 9	7 days	100%	Thu 6/22/17	Fri 6/30/17																									
108	2.3.2.10	SCS Monthly Updates 10	7 days	100%	Fri 7/21/17	Mon 7/31/17																									
109	2.3.2.11	SCS Monthly Updates 11	7 days	100%	Wed 8/23/17	Thu 8/31/17																									
110	2.3.2.12	SCS Monthly Updates 12 (DEPRECATED)	7 days	100%	Thu 9/21/17	Fri 9/29/17																									
111	2.3.2.13	SCS Monthly Updates 13	7 days	100%	Mon 10/23/17	Tue 10/31/17																									
112	2.3.2.14	SCS Monthly Updates 14	7 days	100%	Mon 11/20/17	Thu 11/30/17																									
113	2.3.2.15	SCS Monthly Updates 15	7 days	100%	Thu 12/7/17	Fri 12/15/17																									
114	2.3.2.16	SCS Monthly Updates 16	7 days	100%	Tue 1/23/18	Wed 1/31/18																									
115	2.3.2.17	SCS Monthly Updates 17 (Lockdown Schedule Submission)	7 days	100%	Wed 2/14/18	Fri 2/23/18																									
116	2.3.2.18	SCS Quarterly Updates 18	7 days	100%	Thu 6/21/18	Fri 6/29/18																									
117	2.3.2.19	SCS Quarterly Updates 19	7 days	100%	Thu 9/20/18	Fri 9/28/18																									
118	2.3.2.20	SCS Quarterly Updates 20	7 days	100%	Thu 12/20/18	Mon 12/31/18																									
119	2.3.2.21	SCS Quarterly Updates 21	7 days	100%	Thu 3/21/19	Fri 3/29/19																									
120	2.3.2.22	SCS Quarterly Updates 22	7 days	0%	Thu 6/20/19	Fri 6/28/19																									
121	2.3.2.23	SCS Quarterly Updates 23	7 days	0%	Fri 9/20/19	Mon 9/30/19																									
122	2.3.2.24	SCS Quarterly Updates 24	7 days	0%	Fri 12/20/19	Tue 12/31/19																									

### Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021				
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
123	2.3.2.25	SCS Quarterly Updates 25	7 days	0%	Mon 3/23/20	Tue 3/31/20																									
124	2.3.2.26	SCS Quarterly Updates 26	7 days	0%	Mon 6/22/20	Tue 6/30/20																									
125	2.3.2.27	SCS Quarterly Updates 27	7 days	0%	Tue 9/22/20	Wed 9/30/20																									
126	2.3.2.28	SCS Quarterly Updates 28	7 days	0%	Tue 12/22/20	Thu 12/31/20																									
127	<b>2.3.3</b>	<b>SCS Monthly Submittal (Task A)</b>	<b>1144 days</b>	<b>36%</b>	<b>Mon 10/31/16</b>	<b>Fri 5/7/21</b>					◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆																				
128	2.3.3.1	SCS Monthly Submittal (Task A) 1	0 days	100%	Mon 10/31/16	Mon 10/31/16		◆																							
129	2.3.3.2	SCS Monthly Submittal (Task A) 2	0 days	100%	Wed 11/30/16	Wed 11/30/16		◆																							
130	2.3.3.3	SCS Monthly Submittal (Task A) 3	0 days	100%	Thu 1/5/17	Thu 1/5/17		◆																							
131	2.3.3.4	SCS Monthly Submittal (Task A) 4	0 days	100%	Mon 1/30/17	Mon 1/30/17		◆																							
132	2.3.3.5	SCS Monthly Submittal (Task A) 5	0 days	100%	Tue 2/28/17	Tue 2/28/17		◆																							
133	2.3.3.6	SCS Monthly Submittal (Task A) 6	0 days	100%	Fri 3/31/17	Fri 3/31/17		◆																							
134	2.3.3.7	SCS Monthly Submittal (Task A) 7	0 days	100%	Fri 4/28/17	Fri 4/28/17		◆																							
135	2.3.3.8	SCS Monthly Submittal (Task A) 8	0 days	100%	Wed 5/31/17	Wed 5/31/17		◆																							
136	2.3.3.9	SCS Monthly Submittal (Task A) 9	0 days	100%	Fri 6/30/17	Fri 6/30/17		◆																							
137	2.3.3.10	SCS Monthly Submittal (Task A) 10	0 days	100%	Mon 7/31/17	Mon 7/31/17		◆																							
138	2.3.3.11	SCS Monthly Submittal (Task A) 11 (DEPRECATED)	0 days	100%	Wed 8/30/17	Wed 8/30/17		◆																							
139	2.3.3.12	SCS Monthly Submittal (Task A) 12	0 days	100%	Fri 10/6/17	Fri 10/6/17		◆																							
140	2.3.3.13	SCS Monthly Submittal (Task A) 13	0 days	100%	Tue 10/31/17	Tue 10/31/17		◆																							
141	2.3.3.14	SCS Monthly Submittal (Task A) 14	0 days	100%	Thu 11/30/17	Thu 11/30/17		◆																							
142	2.3.3.15	SCS Monthly Submittal (Task A) 15	0 days	100%	Fri 12/29/17	Fri 12/29/17		◆																							
143	2.3.3.16	SCS Monthly Submittal (Task A) 16	0 days	100%	Wed 1/31/18	Wed 1/31/18		◆																							
144	2.3.3.17	SCS Monthly Submittal (Task A) 17 (Lockdown Schedule Submission	0 days	100%	Fri 2/23/18	Fri 2/23/18		◆																							
145	2.3.3.18	SCS Quarterly Submittal to USDOT 18	7 days	100%	Thu 6/21/18	Fri 6/29/18																									
146	2.3.3.19	SCS Quarterly Submittal to USDOT 19	7 days	100%	Thu 9/20/18	Fri 9/28/18																									
147	2.3.3.20	SCS Quarterly Submittal to USDOT 20	7 days	100%	Thu 12/20/18	Mon 12/31/18																									
148	2.3.3.21	SCS Quarterly Submittal to USDOT 21	7 days	100%	Thu 3/21/19	Fri 3/29/19																									
149	2.3.3.22	SCS Quarterly Submittal to USDOT 22	7 days	0%	Fri 7/19/19	Tue 7/30/19																									





**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021												
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4								
199	<b>2.5.2</b>	<b>Submit Quarterly Progress Report (Task A)</b>	<b>1073 days</b>	<b>0%</b>	<b>Mon 1/30/17</b>	<b>Thu 4/29/21</b>				◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇													
200	2.5.2.1	Submit Quarterly Progress Report (Task A) 1	0 days	100%	Mon 1/30/17	Mon 1/30/17				◆	1/30																											
201	2.5.2.2	Submit Quarterly Progress Report (Task A) 2	0 days	100%	Fri 4/28/17	Fri 4/28/17					◆	4/28																										
202	2.5.2.3	Submit Quarterly Progress Report (Task A) 3	0 days	100%	Sun 7/30/17	Sun 7/30/17						◆	7/30																									
203	2.5.2.4	Submit Quarterly Progress Report (Task A) 4	0 days	100%	Mon 10/30/17	Mon 10/30/17							◆	10/30																								
204	2.5.2.5	Submit Quarterly Progress Report (Task A) 5	0 days	100%	Tue 1/30/18	Tue 1/30/18								◆	1/30																							
205	2.5.2.6	Submit Quarterly Progress Report (Task A) 6	0 days	100%	Mon 4/30/18	Mon 4/30/18									◆	4/30																						
206	2.5.2.7	Submit Quarterly Progress Report (Task A) 7	0 days	100%	Mon 7/30/18	Mon 7/30/18										◆	7/30																					
207	2.5.2.8	Submit Quarterly Progress Report (Task A) 8	0 days	100%	Tue 10/30/18	Tue 10/30/18											◆	10/30																				
208	2.5.2.9	Submit Quarterly Progress Report (Task A) 9	0 days	100%	Wed 1/30/19	Wed 1/30/19												◆	1/30																			
209	2.5.2.10	Submit Quarterly Progress Report (Task A) 10	0 days	0%	Tue 4/30/19	Tue 4/30/19	148FF												◆	4/30																		
210	2.5.2.11	Submit Quarterly Progress Report (Task A) 11	0 days	0%	Tue 7/30/19	Tue 7/30/19	149FF													◆	7/30																	
211	2.5.2.12	Submit Quarterly Progress Report (Task A) 12	0 days	0%	Wed 10/30/19	Wed 10/30/19	150FF														◆	10/30																
212	2.5.2.13	Submit Quarterly Progress Report (Task A) 13	0 days	0%	Thu 1/30/20	Thu 1/30/20	151FF															◆	1/30															
213	2.5.2.14	Submit Quarterly Progress Report (Task A) 14	0 days	0%	Thu 4/30/20	Thu 4/30/20	152FF																◆	4/30														
214	2.5.2.15	Submit Quarterly Progress Report (Task A) 15	0 days	0%	Thu 7/30/20	Thu 7/30/20	153FF																	◆	7/30													
215	2.5.2.16	Submit Quarterly Progress Report (Task A) 16	0 days	0%	Fri 10/30/20	Fri 10/30/20	234FS+5 days																			◆	10/30											
216	2.5.2.17	Submit Quarterly Progress Report (Task A) 17	0 days	0%	Tue 2/2/21	Tue 2/2/21	235FS+5 days																					◆	2/2									
217	2.5.2.18	Submit Quarterly Progress Report (Task A) 18	0 days	0%	Thu 4/29/21	Thu 4/29/21	236FS+5 days																						◆	4/29								
218	<b>2.5.3</b>	<b>Quarterly Project Briefing (Task A)</b>	<b>1072 days?</b>	<b>50%</b>	<b>Wed 2/8/17</b>	<b>Fri 5/7/21</b>	<b>154FF</b>																															
219	2.5.3.1	Quarterly Project Briefing (Task A) 1	1 day	100%	Wed 2/8/17	Wed 2/8/17	155FF																															
220	2.5.3.2	Quarterly Project Briefing (Task A) 2	1 day	100%	Wed 5/10/17	Wed 5/10/17																																
221	2.5.3.3	Quarterly Project Briefing (Task A) 3	1 day	100%	Thu 9/7/17	Thu 9/7/17																																
222	2.5.3.4	Quarterly Project Briefing (Task A) 4	1 day	100%	Wed 11/8/17	Wed 11/8/17																																
223	2.5.3.5	Quarterly Project Briefing (Task A) 5	1 day	100%	Wed 3/7/18	Wed 3/7/18																																
224	2.5.3.6	Quarterly Project Briefing (Task A) 6	1 day	100%	Wed 5/9/18	Wed 5/9/18																																
225	2.5.3.7	Quarterly Project Briefing (Task A) 7	1 day	100%	Wed 8/8/18	Wed 8/8/18																																

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
226	2.5.3.8	Quarterly Project Briefing (Task A) 8	1 day	100%	Wed 11/14/18	Wed 11/14/18																							
227	2.5.3.9	Quarterly Project Briefing (Task A) 9	1 day	100%	Wed 2/13/19	Wed 2/13/19																							
228	2.5.3.10	Quarterly Project Briefing (Task A) 10	1 day	0%	Wed 5/8/19	Wed 5/8/19																							
229	2.5.3.11	Quarterly Project Briefing (Task A) 11	1 day	0%	Wed 8/14/19	Wed 8/14/19																							
230	2.5.3.12	Quarterly Project Briefing (Task A) 12	1 day	0%	Wed 11/13/19	Wed 11/13/19																							
231	2.5.3.13	Quarterly Project Briefing (Task A) 13	1 day	0%	Wed 2/12/20	Wed 2/12/20																							
232	2.5.3.14	Quarterly Project Briefing (Task A) 14	1 day	0%	Wed 5/13/20	Wed 5/13/20																							
233	2.5.3.15	Quarterly Project Briefing (Task A) 15	1 day	0%	Wed 8/12/20	Wed 8/12/20	8																						
234	2.5.3.16	Quarterly Project Briefing (Task A) 16	1 day?	0%	Mon 11/9/20	Mon 11/9/20																							
235	2.5.3.17	Quarterly Project Briefing (Task A) 17	1 day?	0%	Wed 2/10/21	Wed 2/10/21																							
236	2.5.3.18	Quarterly Project Briefing (Task A) 18	1 day?	0%	Fri 5/7/21	Fri 5/7/21																							
237	<b>2.6</b>	<b>Interim and Final Reporting</b>	<b>944 days</b>	<b>43%</b>	<b>Fri 8/18/17</b>	<b>Thu 5/20/21</b>																							
238	<b>2.6.1</b>	<b>Year 1 Report</b>	<b>31 days</b>	<b>100%</b>	<b>Fri 8/18/17</b>	<b>Fri 9/29/17</b>																							
245	<b>2.6.2</b>	<b>Final Report Submittal (Task J) - TBD</b>	<b>28 days</b>	<b>0%</b>	<b>Thu 4/1/21</b>	<b>Mon 5/10/21</b>																							
246	2.6.2.1	Develop Draft	15 days	0%	Thu 4/1/21	Wed 4/21/21	247																						
247	2.6.2.2	Prepare Draft Final Report	10 days	0%	Thu 4/22/21	Wed 5/5/21	248,251																						
248	2.6.2.3	QAQC Final Report	3 days	0%	Thu 5/6/21	Mon 5/10/21	249																						
249	2.6.2.4	Submit Final Report	0 days	0%	Mon 5/10/21	Mon 5/10/21																							
250	<b>2.6.3</b>	<b>Close Out Meeting</b>	<b>11 days</b>	<b>0%</b>	<b>Thu 5/6/21</b>	<b>Thu 5/20/21</b>																							
251	2.6.3.1	Close Out Meeting Preparation	10 days	0%	Thu 5/6/21	Wed 5/19/21	252																						
252	2.6.3.2	Project Close Out Meeting	1 day	0%	Thu 5/20/21	Thu 5/20/21																							
253	<b>2.7</b>	<b>Program Execution</b>	<b>1082 days</b>	<b>96%</b>	<b>Sat 9/10/16</b>	<b>Thu 12/17/20</b>																							
254	<b>2.7.1</b>	<b>Human Resources Management</b>	<b>205 days</b>	<b>100%</b>	<b>Mon 9/11/17</b>	<b>Thu 6/28/18</b>																							
255	<b>2.7.1.1</b>	<b>Urgent Needs</b>	<b>53 days</b>	<b>100%</b>	<b>Mon 9/11/17</b>	<b>Wed 11/22/17</b>																							
261	<b>2.7.1.2</b>	<b>Long Range Planning</b>	<b>150 days</b>	<b>100%</b>	<b>Mon 11/27/17</b>	<b>Thu 6/28/18</b>																							
264	<b>2.7.2</b>	<b>Cost Management</b>	<b>993 days</b>	<b>99%</b>	<b>Sat 9/10/16</b>	<b>Mon 8/10/20</b>																							
319	<b>2.7.3</b>	<b>Technical Working Groups (TWGs)</b>	<b>1080 days</b>	<b>87%</b>	<b>Wed 9/14/16</b>	<b>Thu 12/17/20</b>																							













**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
510	3.5.2.10	Update DMP based on updated OS architecture	30 days	0%	Tue 6/4/19	Mon 7/15/19	511																							
511	3.5.2.11	CoC Review	10 days	0%	Tue 7/16/19	Mon 7/29/19	512																							
512	3.5.2.12	Update DMP	10 days	0%	Tue 7/30/19	Mon 8/12/19	513																							
513	3.5.2.13	QA/QC	5 days	0%	Tue 8/13/19	Mon 8/19/19	514																							
514	3.5.2.14	CoC Final Review	0 days	0%	Mon 8/19/19	Mon 8/19/19	515																							
515	3.5.2.15	Submit Revised Final DMP	0 days	0%	Mon 8/19/19	Mon 8/19/19																								
516	<b>3.6</b>	<b>Human Use Approval</b>	<b>179 days?</b>	<b>0%</b>	<b>Fri 12/27/19</b>	<b>Thu 9/10/20</b>																								
517	<b>3.6.1</b>	<b>Human Use Approval Summary</b>	<b>179 days?</b>	<b>0%</b>	<b>Fri 12/27/19</b>	<b>Thu 9/10/20</b>																								
518	3.6.1.1	Prepare Initial Human Use Approval Summary	20 days	0%	Fri 12/27/19	Thu 1/23/20	519																							
519	3.6.1.2	CoC Review	5 days	0%	Fri 1/24/20	Thu 1/30/20	520																							
520	3.6.1.3	Update Summary	5 days	0%	Fri 1/31/20	Thu 2/6/20	521																							
521	3.6.1.4	QA/QC	1 day	0%	Fri 2/7/20	Fri 2/7/20	522																							
522	3.6.1.5	Submit Draft Human Use Approval Request to USDOT	0 days	0%	Fri 2/7/20	Fri 2/7/20	523																							
523	3.6.1.6	USDOT Review Draft Human Use Approval Request	10 days	0%	Mon 2/10/20	Mon 2/24/20	524																							
524	3.6.1.7	Receive USDOT Comments on Draft Human Use Approval Summary	0 days	0%	Mon 2/24/20	Mon 2/24/20	527,525,526																							
525	3.6.1.8	Public Comment Period for Human Use Approval Summary	10 days	0%	Tue 2/25/20	Mon 3/9/20																								
526	3.6.1.9	Webinar for Human Use Approval Summary	1 day	0%	Tue 2/25/20	Tue 2/25/20																								
527	3.6.1.10	Prepare Final Human Use Approval Summary	3 days	0%	Tue 2/25/20	Thu 2/27/20	528																							
528	3.6.1.11	CoC Review	5 days	0%	Fri 2/28/20	Thu 3/5/20	529																							
529	3.6.1.12	Update Summary	5 days	0%	Fri 3/6/20	Thu 3/12/20	530,531																							
530	3.6.1.13	QA/QC	1 day?	0%	Fri 3/13/20	Fri 3/13/20	532																							
531	3.6.1.14	CoC Final Review	1 day?	0%	Fri 3/13/20	Fri 3/13/20																								
532	3.6.1.15	Submit Final Human Use Approval to USDOT	0 days	0%	Fri 3/13/20	Fri 3/13/20	534FS+60 day																							
533	<b>3.6.1.16</b>	<b>Prepare Quarterly Human Use Approval Summary Update</b>	<b>66 days</b>	<b>0%</b>	<b>Tue 6/9/20</b>	<b>Thu 9/10/20</b>																								
534	3.6.1.16.1	Prepare Quarterly Human Use Approval Summary Update 3	3 days	0%	Tue 6/9/20	Thu 6/11/20	535FS+60 day																							
535	3.6.1.16.2	Prepare Quarterly Human Use Approval Summary Update 4	3 days	0%	Tue 9/8/20	Thu 9/10/20	538																							
536	<b>3.6.1.17</b>	<b>Submit Quarterly Human Use Approval Summary (Task F)</b>	<b>63 days</b>	<b>0%</b>	<b>Thu 6/11/20</b>	<b>Thu 9/10/20</b>																								



**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021					
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
571	<b>4.1.1</b>	<b>Draft SEMP</b>	<b>36 days</b>	<b>100%</b>	<b>Mon 10/3/16</b>	<b>Mon 11/21/16</b>				☐																					
578	<b>4.1.2</b>	<b>Final SEMP</b>	<b>76 days</b>	<b>100%</b>	<b>Wed 12/7/16</b>	<b>Thu 3/23/17</b>				☐																					
593	<b>4.1.3</b>	<b>508 Compliant Documentation</b>	<b>36 days</b>	<b>100%</b>	<b>Fri 3/24/17</b>	<b>Fri 5/12/17</b>					☐																				
596	<b>4.1.4</b>	<b>SEMP Version 2.0</b>	<b>80 days</b>	<b>100%</b>	<b>Tue 10/10/17</b>	<b>Wed 1/31/18</b>						☐																			
620	<b>4.1.5</b>	<b>508 Compliant Documentation Version 2.0</b>	<b>20 days</b>	<b>100%</b>	<b>Thu 2/1/18</b>	<b>Thu 3/1/18</b>							☐																		
623	<b>4.2</b>	<b>Demonstration Site Map and Installation Schedule</b>	<b>189 days?</b>	<b>25%</b>	<b>Tue 3/19/19</b>	<b>Tue 12/17/19</b>														☐											
624	<b>4.2.1</b>	<b>Draft Demonstration Site Map and Installation Schedule</b>	<b>55 days?</b>	<b>41%</b>	<b>Tue 3/19/19</b>	<b>Tue 6/4/19</b>														☐											
625	4.2.1.1	Prepare Initial Demonstration Demonstration Site Map and Installation Schedule	15 days	100%	Tue 3/19/19	Mon 4/8/19	626FF													☐											
626	4.2.1.2	CoC Review	5 days	100%	Tue 4/2/19	Mon 4/8/19	627													☐											
627	4.2.1.3	Update Demonstration Site Map and Installation Schedule	3 days	100%	Tue 4/9/19	Thu 4/11/19	630,628													☐											
628	4.2.1.4	QA/QC	1 day?	100%	Fri 4/12/19	Fri 4/12/19	629													☐											
629	4.2.1.5	CoC Final Review	1 day?	100%	Mon 4/15/19	Mon 4/15/19														☐											
630	4.2.1.6	Submit Initial Site Map	0 days	100%	Mon 4/15/19	Mon 4/15/19	631													☐											
631	4.2.1.7	USDOT Review Initial Site Map	10 days	0%	Tue 4/16/19	Mon 4/29/19	632													☐											
632	4.2.1.8	Receive USDOT Comments on Draft Site Map and Schedule	0 days	0%	Mon 4/29/19	Mon 4/29/19	633													☐											
633	4.2.1.9	Prepare Demonstration Site Map and Installation Schedule Comment Resolution Report	10 days	0%	Tue 4/30/19	Mon 5/13/19	634													☐											
634	4.2.1.10	Update Demonstration Site Map and Installation Schedule	10 days	0%	Tue 5/14/19	Mon 5/27/19	635													☐											
635	4.2.1.11	CoC Review	5 days	0%	Tue 5/28/19	Mon 6/3/19	636													☐											
636	4.2.1.12	QA/QC	1 day?	0%	Tue 6/4/19	Tue 6/4/19	637													☐											
637	4.2.1.13	Submit Updated Site Map	0 days	0%	Tue 6/4/19	Tue 6/4/19	639FS+20 day													☐											
638	<b>4.2.2</b>	<b>Final Demonstration Site Map and Installation Schedule</b>	<b>114 days?</b>	<b>0%</b>	<b>Wed 7/3/19</b>	<b>Tue 12/17/19</b>														☐											
639	4.2.2.1	Public Comment Period for Site Map and Installation Schedule	10 days	0%	Wed 7/3/19	Tue 7/16/19	640FS+20 day													☐											
640	4.2.2.2	Webinar for Site Map and Installation Schedule	1 day	0%	Wed 8/14/19	Wed 8/14/19	641													☐											
641	4.2.2.3	Prepare Demonstration Site Map and Installation Schedule Comment Resolution Report	10 days	0%	Thu 8/15/19	Wed 8/28/19														☐											

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021											
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4								
642	4.2.2.4	Prepare Final Demonstration Site Map and Installation Schedule	10 days	0%	Wed 11/20/19	Tue 12/3/19	643																															
643	4.2.2.5	CoC Review	3 days	0%	Wed 12/4/19	Fri 12/6/19	644																															
644	4.2.2.6	Update Demonstration Site Map and Installation Schedule	5 days	0%	Mon 12/9/19	Fri 12/13/19	645																															
645	4.2.2.7	QA/QC	1 day?	0%	Mon 12/16/19	Mon 12/16/19	646																															
646	4.2.2.8	CoC Final Review	1 day?	0%	Tue 12/17/19	Tue 12/17/19	647																															
647	4.2.2.9	Submit Final Demonstration Site Map and Installation Schedule	0 days	0%	Tue 12/17/19	Tue 12/17/19																																
648	<b>4.3</b>	<b>System Architecture and Standards Plan (SASP)</b>	<b>129 days?</b>	<b>60%</b>	<b>Thu 12/20/18</b>	<b>Tue 6/25/19</b>																																
649	<b>4.3.1</b>	<b>Draft SASP</b>	<b>39 days?</b>	<b>100%</b>	<b>Thu 12/20/18</b>	<b>Fri 2/15/19</b>																																
650	4.3.1.1	Develop Draft SASP	15 days	100%	Thu 12/20/18	Wed 1/9/19	651																															
651	4.3.1.2	CoC Review	5 days	100%	Thu 1/10/19	Wed 1/16/19	652																															
652	4.3.1.3	Update SASP	8 days	100%	Thu 1/17/19	Mon 1/28/19	653																															
653	4.3.1.4	QA/QC	1 day	100%	Tue 1/29/19	Tue 1/29/19	654																															
654	4.3.1.5	CoC Final Review	1 day?	100%	Wed 1/30/19	Wed 1/30/19	655																															
655	4.3.1.6	Submit Draft SASP	2 days	100%	Wed 1/23/19	Fri 2/1/19	656																															
656	4.3.1.7	USDOT Review Draft SASP	10 days	100%	Mon 2/4/19	Fri 2/15/19	658																															
657	<b>4.3.2</b>	<b>Final SASP</b>	<b>90 days?</b>	<b>41%</b>	<b>Fri 2/15/19</b>	<b>Tue 6/25/19</b>																																
658	4.3.2.1	Receive USDOT Comments on Draft SASP - N/A	0 days	0%	Fri 2/15/19	Fri 2/15/19	659,660																															
659	4.3.2.2	Prepare Final SASP	10 days	100%	Mon 2/18/19	Fri 3/1/19	661																															
660	4.3.2.3	Prepare SASP Comment Resolution Report - N/A	10 days	0%	Mon 2/18/19	Fri 3/1/19																																
661	4.3.2.4	CoC Review	4 days	100%	Mon 3/4/19	Thu 3/7/19	662																															
662	4.3.2.5	Update SASP	3 days	100%	Mon 3/11/19	Wed 3/13/19	665,666,663																															
663	4.3.2.6	QA/QC	2 days	100%	Thu 3/14/19	Fri 3/15/19	664FF																															
664	4.3.2.7	CoC Final Review	1 day?	100%	Fri 3/15/19	Fri 3/15/19																																
665	4.3.2.8	Submit Final SASP	0 days	100%	Fri 3/15/19	Fri 3/15/19	667																															
666	4.3.2.9	Submit Comment Resolution Report for SASP - N/A	0 days	0%	Wed 3/13/19	Wed 3/13/19																																
667	4.3.2.10	Receive USDOT Comments on Final SASP	16 days	100%	Mon 3/18/19	Mon 4/8/19	668																															
668	4.3.2.11	Update SASP per USDOT comments	20 days	0%	Tue 4/9/19	Mon 5/6/19	669FS+5 days																															

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021				
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
669	4.3.2.12	Public Comment Period for SASP	10 days	0%	Tue 5/14/19	Mon 5/27/19	670FS+10 day																								
670	4.3.2.13	Webinar for SASP	1 day	0%	Tue 6/11/19	Tue 6/11/19	671																								
671	4.3.2.14	Update Final SASP per public comment	10 days	0%	Wed 6/12/19	Tue 6/25/19																									
672	<b>4.4</b>	<b>System of System Framework</b>	<b>29 days</b>	<b>100%</b>	<b>Mon 12/4/17</b>	<b>Fri 1/12/18</b>																									
673	<b>4.4.1</b>	<b>Draft SoS Framework</b>	<b>29 days</b>	<b>100%</b>	<b>Mon 12/4/17</b>	<b>Fri 1/12/18</b>																									
680	<b>5</b>	<b>Projects</b>	<b>1169 days?</b>	<b>39%</b>	<b>Thu 8/18/16</b>	<b>Wed 3/31/21</b>		[Gantt bar from Thu 8/18/16 to Wed 3/31/21]																							
681	<b>5.1</b>	<b>SmartColumbus Operating System (SCOS)</b>	<b>1120 days</b>	<b>40%</b>	<b>Mon 9/26/16</b>	<b>Mon 3/1/21</b>		[Gantt bar from Mon 9/26/16 to Mon 3/1/21]																							
682	<b>5.1.1</b>	<b>SCOS Strategy Plan</b>	<b>54 days</b>	<b>100%</b>	<b>Mon 9/26/16</b>	<b>Thu 12/8/16</b>		[Gantt bar from Mon 9/26/16 to Thu 12/8/16]																							
689	<b>5.1.2</b>	<b>SCOS Architecture and Governance Story Workshop</b>	<b>168 days</b>	<b>100%</b>	<b>Tue 1/10/17</b>	<b>Thu 8/31/17</b>		[Gantt bar from Tue 1/10/17 to Thu 8/31/17]																							
699	<b>5.1.3</b>	<b>SCOS Architecture and Governance Development</b>	<b>61 days</b>	<b>100%</b>	<b>Thu 1/19/17</b>	<b>Thu 4/13/17</b>		[Gantt bar from Thu 1/19/17 to Thu 4/13/17]																							
720	<b>5.1.4</b>	<b>SCOS Platform Framework Story Workshop</b>	<b>3 days</b>	<b>100%</b>	<b>Fri 3/24/17</b>	<b>Tue 3/28/17</b>		[Gantt bar from Fri 3/24/17 to Tue 3/28/17]																							
723	<b>5.1.5</b>	<b>SCOS Development</b>	<b>989 days</b>	<b>36%</b>	<b>Tue 3/28/17</b>	<b>Mon 3/1/21</b>		[Gantt bar from Tue 3/28/17 to Mon 3/1/21]																							
724	<b>5.1.5.1</b>	<b>SCOS Phase I Sprints (Open Data Portal, DevOps, Real-Time Data Streaming)</b>	<b>322 days</b>	<b>100%</b>	<b>Tue 3/28/17</b>	<b>Tue 6/26/18</b>		[Gantt bar from Tue 3/28/17 to Tue 6/26/18]																							
886	<b>5.1.5.2</b>	<b>SCOS Phase II Sprints (Core Big Data Architecture)</b>	<b>592 days</b>	<b>36%</b>	<b>Wed 6/27/18</b>	<b>Thu 10/1/20</b>		[Gantt bar from Wed 6/27/18 to Thu 10/1/20]																							
887	5.1.5.2.1	SCOS Phase II Sprints (Core Big Data Architecture)	129 days	100%	Wed 6/27/18	Mon 12/24/18	888SS,910	[Gantt bar from Wed 6/27/18 to Mon 12/24/18]																							
888	5.1.5.2.2	MVP - Release 3	0 days	100%	Tue 7/3/18	Tue 7/3/18	889	[Milestone on Tue 7/3/18]																							
889	5.1.5.2.3	MVP - Release 4	0 days	100%	Tue 8/7/18	Tue 8/7/18	890	[Milestone on Tue 8/7/18]																							
890	5.1.5.2.4	MVP - Release 5	0 days	100%	Tue 9/4/18	Tue 9/4/18	893FS+5 days	[Milestone on Tue 9/4/18]																							
891	5.1.5.2.5	Visualization Tool 1.0 (Online Data Scientist Notebook)	66 days	100%	Wed 6/27/18	Fri 9/28/18		[Gantt bar from Wed 6/27/18 to Fri 9/28/18]																							
892	5.1.5.2.6	Key Performance Indicator (KPI) Support	66 days	100%	Wed 6/27/18	Fri 9/28/18		[Gantt bar from Wed 6/27/18 to Fri 9/28/18]																							
893	5.1.5.2.7	Data Platform 2.0 - Launch	96 days	96%	Tue 12/4/18	Mon 4/22/19	894FF,895,45	[Gantt bar from Tue 12/4/18 to Mon 4/22/19]																							
894	5.1.5.2.8	MVP Centralized Account Management (IDAM)	76 days	74%	Thu 1/3/19	Mon 4/22/19		[Gantt bar from Thu 1/3/19 to Mon 4/22/19]																							
895	5.1.5.2.9	MMTPA Data Integration	0 days	100%	Tue 12/18/18	Tue 12/18/18	896	[Milestone on Tue 12/18/18]																							
896	5.1.5.2.10	Open Source Release 1	126 days	0%	Tue 12/18/18	Tue 6/18/19	898,899	[Gantt bar from Tue 12/18/18 to Tue 6/18/19]																							
897	5.1.5.2.11	Application Hosting	0 days	0%	Fri 8/2/19	Fri 8/2/19		[Milestone on Fri 8/2/19]																							
898	5.1.5.2.12	MVP Data Ingestion User Interface (UI)	32 days	0%	Wed 6/19/19	Fri 8/2/19		[Gantt bar from Wed 6/19/19 to Fri 8/2/19]																							

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021								
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
899	5.1.5.2.13	Data Discovery & Use User Interface (UI)	32 days	0%	Wed 6/19/19	Fri 8/2/19	897,900FS+4C																											
900	5.1.5.2.14	Visualization Tool 2.0	252 days	0%	Tue 10/1/19	Thu 10/1/20																												
901	5.1.5.2.15	Open Source Release 2	252 days	0%	Tue 10/1/19	Thu 10/1/20																												
902	<b>5.1.5.3</b>	<b>SCOS Phase III Sprints (Projects Data Exchange)</b>	<b>388 days</b>	<b>6%</b>	<b>Wed 12/19/18</b>	<b>Tue 7/7/20</b>																												
903	5.1.5.3.1	CEAV Data Integration (Vendor #1)	20 days	100%	Wed 12/19/18	Thu 1/17/19																												
904	5.1.5.3.2	MAPCD Data Integration	20 days	50%	Tue 4/2/19	Mon 4/29/19	480																											
905	5.1.5.3.3	PTA Data Integration	20 days	0%	Fri 5/3/19	Fri 5/31/19	481																											
906	5.1.5.3.4	MMPA (Final) Data Integration	20 days	0%	Fri 8/2/19	Thu 8/29/19	482																											
907	5.1.5.3.5	CEAV Data Integration (Vendor #2-3)	20 days	0%	Tue 10/22/19	Tue 11/19/19	483																											
908	5.1.5.3.6	MMPA with CPS Data Integration	20 days	0%	Mon 12/9/19	Tue 1/7/20	484																											
909	5.1.5.3.7	SMH Data Integration	20 days	0%	Fri 1/24/20	Fri 2/21/20	485																											
910	5.1.5.3.8	SCOS Phase III Sprints (Projects Data Exchange)	304 days	0%	Wed 12/26/18	Fri 3/13/20	914,915,917																											
911	5.1.5.3.9	EPM Data Integration	20 days	0%	Wed 2/26/20	Tue 3/24/20	486																											
912	5.1.5.3.10	CVE Data Integration	20 days	0%	Tue 6/9/20	Tue 7/7/20	487																											
913	<b>5.1.5.4</b>	<b>SCOS Phase IV: Operations and Maintenance</b>	<b>240 days</b>	<b>0%</b>	<b>Mon 3/16/20</b>	<b>Mon 3/1/21</b>																												
914	5.1.5.4.1	Establish Operational Plan	240 days	0%	Mon 3/16/20	Mon 3/1/21																												
915	5.1.5.4.2	Productization	240 days	0%	Mon 3/16/20	Mon 3/1/21																												
916	<b>5.1.5.4.3</b>	<b>Transition</b>	<b>182 days</b>	<b>0%</b>	<b>Mon 3/16/20</b>	<b>Thu 12/3/20</b>																												
917	5.1.5.4.3.1	Identify Transition Stakeholders	5 days	0%	Mon 3/16/20	Fri 3/20/20	918																											
918	5.1.5.4.3.2	Transition Period	132 days	0%	Mon 3/23/20	Fri 9/25/20	919																											
919	5.1.5.4.3.3	Deliver Technical Docs for Transition Activities	45 days	0%	Mon 9/28/20	Thu 12/3/20																												
920	<b>5.2</b>	<b>Connected Vehicle Environment (CVE)</b>	<b>1137 days?</b>	<b>35%</b>	<b>Mon 10/3/16</b>	<b>Wed 3/31/21</b>																												
921	<b>5.2.1</b>	<b>Phase I - Systems Engineering</b>	<b>990.5 days?</b>	<b>69%</b>	<b>Mon 10/3/16</b>	<b>Wed 8/26/20</b>																												
922	<b>5.2.1.1</b>	<b>CVE Strategy Plan</b>	<b>120 days</b>	<b>100%</b>	<b>Mon 10/3/16</b>	<b>Fri 3/17/17</b>																												
929	<b>5.2.1.2</b>	<b>CVE Concept of Operations (ConOps)</b>	<b>713 days?</b>	<b>89%</b>	<b>Tue 2/7/17</b>	<b>Wed 11/27/19</b>																												
930	<b>5.2.1.2.1</b>	<b>Draft CVE ConOps</b>	<b>119 days</b>	<b>100%</b>	<b>Tue 2/7/17</b>	<b>Fri 7/21/17</b>																												
939	<b>5.2.1.2.2</b>	<b>CVE ConOps Walkthrough</b>	<b>2 days</b>	<b>100%</b>	<b>Wed 8/9/17</b>	<b>Fri 8/11/17</b>																												







**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1040	5.2.1.6.1.4	QA/QC	1 day?	0%	Fri 8/30/19	Fri 8/30/19																								
1041	5.2.1.6.1.5	CoC Final Review	1 day	0%	Fri 8/30/19	Fri 8/30/19	1042																							
1042	5.2.1.6.1.6	Submit Draft CVE Test Plan to USDOT	1 day	0%	Tue 9/3/19	Tue 9/3/19	1043																							
1043	5.2.1.6.1.7	USDOT Review Draft CVE Test Plan	10 days	0%	Wed 9/4/19	Tue 9/17/19	1045																							
1044	<b>5.2.1.6.2</b>	<b>Final CVE Test Plan</b>	<b>127 days?</b>	<b>0%</b>	<b>Tue 9/17/19</b>	<b>Tue 3/24/20</b>																								
1045	5.2.1.6.2.1	Receive USDOT Comments on Draft CVE Test Plan	0 days	0%	Tue 9/17/19	Tue 9/17/19	1046,1047																							
1046	5.2.1.6.2.2	Update CVE Test Plan	10 days	0%	Wed 9/18/19	Tue 10/1/19	1049																							
1047	5.2.1.6.2.3	Public Comment Period for CVE Test Plan	10 days	0%	Wed 9/18/19	Tue 10/1/19	1049																							
1048	5.2.1.6.2.4	Webinar for CVE Test Plan and Results	1 day	0%	Tue 3/24/20	Tue 3/24/20																								
1049	5.2.1.6.2.5	CoC Review	5 days	0%	Wed 10/2/19	Tue 10/8/19	1050																							
1050	5.2.1.6.2.6	Address CoC Comments Test Plan	5 days	0%	Wed 10/9/19	Wed 10/16/19	1052,1051																							
1051	5.2.1.6.2.7	QA/QC	1 day?	0%	Thu 10/17/19	Thu 10/17/19																								
1052	5.2.1.6.2.8	CoC Final Review	1 day	0%	Thu 10/17/19	Thu 10/17/19	1053																							
1053	5.2.1.6.2.9	Submit Final CVE Test Plan to USDOT	1 day	0%	Fri 10/18/19	Fri 10/18/19	1233FS+10 da																							
1054	<b>5.2.2</b>	<b>Phase II - Develop, Procure, Deploy</b>	<b>755 days</b>	<b>23%</b>	<b>Mon 3/26/18</b>	<b>Wed 3/31/21</b>																								
1055	<b>5.2.2.1</b>	<b>Installation Development</b>	<b>182 days</b>	<b>98%</b>	<b>Mon 6/25/18</b>	<b>Tue 3/19/19</b>																								
1056	5.2.2.1.1	Stage 1/2	104 days	100%	Mon 6/25/18	Wed 11/21/18																								
1071	5.2.2.1.2	Stage 3 - Installation Plans	78 days	93%	Mon 11/26/18	Tue 3/19/19																								
1085	<b>5.2.2.2</b>	<b>RSU Integration and Installation Procurements</b>	<b>349 days</b>	<b>36%</b>	<b>Mon 3/26/18</b>	<b>Tue 8/13/19</b>																								
1086	5.2.2.2.1	Procure RSU Installation Contractor	93 days	0%	Wed 4/3/19	Tue 8/13/19																								
1087	5.2.2.2.1.1	Prepare advertisement documents	9 days	0%	Wed 4/3/19	Mon 4/15/19	1088																							
1088	5.2.2.2.1.2	USDOT Review - N/A	5 days	0%	Tue 4/16/19	Mon 4/22/19	1089																							
1089	5.2.2.2.1.3	Ad to performance series	1 day	0%	Tue 4/23/19	Tue 4/23/19	1091,1090SS+																							
1090	5.2.2.2.1.4	Pre-bid meeting	1 day	0%	Thu 5/2/19	Thu 5/2/19																								
1091	5.2.2.2.1.5	Advertisement	15 days	0%	Wed 4/24/19	Tue 5/14/19	1092																							
1092	5.2.2.2.1.6	Addendum(s) issued if required, minimum 72 hours prior to bid opening	5 days	0%	Wed 5/15/19	Tue 5/21/19	1093																							

Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1093	5.2.2.2.1.7	Bid opening (recorded by Auditor per Columbus City Code 329	1 day	0%	Wed 5/22/19	Wed 5/22/19	1094																								
1094	5.2.2.2.1.8	Select responsive and responsible contractor	2 days	0%	Thu 5/23/19	Fri 5/24/19	1095																								
1095	5.2.2.2.1.9	Prepare recommendation memo and other forms for signature	2 days	0%	Tue 5/28/19	Wed 5/29/19	1096																								
1096	5.2.2.2.1.10	Recommend contractor to CINO	2 days	0%	Thu 5/30/19	Fri 5/31/19	1097																								
1097	5.2.2.2.1.11	Receive letter of contractor approval from CINO	1 day	0%	Mon 6/3/19	Mon 6/3/19	1100,1098																								
1098	5.2.2.2.1.12	USDOT Review	5 days	0%	Wed 5/29/19	Tue 6/4/19																									
1099	<b>5.2.2.2.1.13</b>	<b>Legislation Process</b>	<b>29 days</b>	<b>0%</b>	<b>Tue 6/4/19</b>	<b>Mon 7/15/19</b>																									
1100	5.2.2.2.1.13.1	Prepare legislation and submit to Fiscal (2 working days day	2 days	0%	Tue 6/4/19	Wed 6/5/19	1101																								
1101	5.2.2.2.1.13.2	Fiscal modifies and processes legislation (6 working days)	6 days	0%	Thu 6/6/19	Thu 6/13/19	1102																								
1102	5.2.2.2.1.13.3	To Administrator (2 working days)	2 days	0%	Fri 6/14/19	Mon 6/17/19	1103																								
1103	5.2.2.2.1.13.4	To CINO (4 working days)	3 days	0%	Tue 6/18/19	Thu 6/20/19	1104																								
1104	5.2.2.2.1.13.5	To Finance (7 working days)	3 days	0%	Fri 6/21/19	Tue 6/25/19	1105																								
1105	5.2.2.2.1.13.6	To Equal Business Opportunity (4 working days)	2 days	0%	Wed 6/26/19	Thu 6/27/19	1106																								
1106	5.2.2.2.1.13.7	To Auditor (2 working days)	2 days	0%	Fri 6/28/19	Mon 7/1/19	1107																								
1107	5.2.2.2.1.13.8	To City Attorney (2 working days)	2 days	0%	Tue 7/2/19	Wed 7/3/19	1108																								
1108	5.2.2.2.1.13.9	To City Clerk (6 working days min.)	5 days	0%	Fri 7/5/19	Thu 7/11/19	1109																								
1109	5.2.2.2.1.13.10	Council passes legislation*	1 day	0%	Fri 7/12/19	Fri 7/12/19	1110																								
1110	5.2.2.2.1.13.11	Mayor Signs (2 working days)	1 day	0%	Mon 7/15/19	Mon 7/15/19	1112																								
1111	<b>5.2.2.2.1.14</b>	<b>Contract Process</b>	<b>21 days</b>	<b>0%</b>	<b>Tue 7/16/19</b>	<b>Tue 8/13/19</b>																									
1112	5.2.2.2.1.14.1	Prepare contract documents	4 days	0%	Tue 7/16/19	Fri 7/19/19	1113																								
1113	5.2.2.2.1.14.2	Fiscal enters Performance information	5 days	0%	Mon 7/22/19	Fri 7/26/19	1114																								
1114	5.2.2.2.1.14.3	Sent to Consultant and returned to City	5 days	0%	Mon 7/29/19	Fri 8/2/19	1115																								
1115	5.2.2.2.1.14.4	To CINO	2 days	0%	Mon 8/5/19	Tue 8/6/19	1116																								
1116	5.2.2.2.1.14.5	To City Attorney	2 days	0%	Wed 8/7/19	Thu 8/8/19	1117																								
1117	5.2.2.2.1.14.6	To Auditor	2 days	0%	Fri 8/9/19	Mon 8/12/19	1118																								
1118	5.2.2.2.1.14.7	Notice to proceed issued	1 day	0%	Tue 8/13/19	Tue 8/13/19	1193,1194																								
1119	<b>5.2.2.2.2</b>	<b>Procure RSU Integrator (and Equipment)</b>	<b>338 days</b>	<b>57%</b>	<b>Mon 3/26/18</b>	<b>Mon 7/29/19</b>																									

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021							
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
1120	<b>5.2.2.2.2.1</b>	<b>Consultant Selection Process (QBS) (Professional Services)</b>	<b>280 days</b>	<b>87%</b>	<b>Mon 3/26/18</b>	<b>Mon 5/6/19</b>																													
1121	5.2.2.2.2.1.1	Prepare project LOI / RFQ / RFP	23 days	100%	Mon 12/3/18	Fri 1/4/19	1122																												
1122	5.2.2.2.2.1.2	USDOT Review of Request for Subcontractor Approval	5 days	100%	Mon 1/7/19	Fri 1/11/19	1123FS+10 da																												
1123	5.2.2.2.2.1.3	Advertise LOI / RFQ / RFP in Performance Series	15 days	100%	Tue 1/29/19	Tue 2/19/19	1124																												
1124	5.2.2.2.2.1.4	Receive Technical Proposals	0 days	100%	Tue 2/19/19	Tue 2/19/19	1125																												
1125	5.2.2.2.2.1.5	Request highest ranking firm to define project scope of serv	10 days	100%	Wed 2/20/19	Tue 3/5/19	1126,1128FS+																												
1126	5.2.2.2.2.1.6	CINO Approval	5 days	100%	Wed 3/6/19	Tue 3/12/19	1127																												
1127	5.2.2.2.2.1.7	Negotiate project final scope of services	5 days	100%	Wed 3/13/19	Tue 3/19/19	1130																												
1128	5.2.2.2.2.1.8	Vendor Interviews	2 days	100%	Wed 3/20/19	Thu 3/21/19																													
1129	5.2.2.2.2.1.9	Prepare request for subcontract approval (to USDOT)	15 days	75%	Mon 3/26/18	Fri 4/13/18																													
1130	5.2.2.2.2.1.10	Establish contract terms	10 days	100%	Wed 3/20/19	Tue 4/2/19	1131																												
1131	5.2.2.2.2.1.11	City Attorney reviews (if required)	0 days	100%	Tue 4/2/19	Tue 4/2/19	1132																												
1132	5.2.2.2.2.1.12	Request fee proposal	13 days	100%	Wed 4/3/19	Fri 4/19/19	1133																												
1133	5.2.2.2.2.1.13	Negotiate fees	10 days	0%	Mon 4/22/19	Fri 5/3/19	1134,1136																												
1134	5.2.2.2.2.1.14	Notify CINO	1 day	0%	Mon 5/6/19	Mon 5/6/19																													
1135	<b>5.2.2.2.2.2</b>	<b>Legislation Process</b>	<b>27 days</b>	<b>0%</b>	<b>Mon 5/6/19</b>	<b>Wed 6/12/19</b>																													
1136	5.2.2.2.2.2.1	Prepare legislation and submit to Fiscal (2 working days day	2 days	0%	Mon 5/6/19	Tue 5/7/19	1137																												
1137	5.2.2.2.2.2.2	Fiscal modifies and processes legislation (6 working days)	5 days	0%	Wed 5/8/19	Tue 5/14/19	1138																												
1138	5.2.2.2.2.2.3	To Administrator (2 working days)	3 days	0%	Wed 5/15/19	Fri 5/17/19	1139																												
1139	5.2.2.2.2.2.4	To CINO (4 working days)	3 days	0%	Mon 5/20/19	Wed 5/22/19	1140																												
1140	5.2.2.2.2.2.5	To Finance (7 working days)	3 days	0%	Thu 5/23/19	Tue 5/28/19	1141																												
1141	5.2.2.2.2.2.6	To Equal Business Opportunity (4 working days)	2 days	0%	Wed 5/29/19	Thu 5/30/19	1142																												
1142	5.2.2.2.2.2.7	To Auditor (2 working days)	1 day	0%	Fri 5/31/19	Fri 5/31/19	1143																												
1143	5.2.2.2.2.2.8	To City Attorney (2 working days)	1 day	0%	Mon 6/3/19	Mon 6/3/19	1144																												
1144	5.2.2.2.2.2.9	To City Clerk (6 working days min.)	5 days	0%	Tue 6/4/19	Mon 6/10/19	1145																												
1145	5.2.2.2.2.2.10	Council passes legislation*	1 day	0%	Tue 6/11/19	Tue 6/11/19	1146																												
1146	5.2.2.2.2.2.11	Mayor Signs (2 working days)	1 day	0%	Wed 6/12/19	Wed 6/12/19	1148																												

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1147	<b>5.2.2.2.2.3</b>	<b>Contract Process</b>	<b>32 days</b>	<b>0%</b>	<b>Thu 6/13/19</b>	<b>Mon 7/29/19</b>																								
1148	5.2.2.2.2.3.1	Prepare contract documents	4 days	0%	Thu 6/13/19	Tue 6/18/19	1149																							
1149	5.2.2.2.2.3.2	Fiscal enters Performance information	8 days	0%	Wed 6/19/19	Fri 6/28/19	1150																							
1150	5.2.2.2.2.3.3	Sent to Consultant and returned to City	7 days	0%	Mon 7/1/19	Wed 7/10/19	1151																							
1151	5.2.2.2.2.3.4	To CINO	5 days	0%	Thu 7/11/19	Wed 7/17/19	1152																							
1152	5.2.2.2.2.3.5	To City Attorney	5 days	0%	Thu 7/18/19	Wed 7/24/19	1153																							
1153	5.2.2.2.2.3.6	To Auditor	2 days	0%	Thu 7/25/19	Fri 7/26/19	1154																							
1154	5.2.2.2.2.3.7	Notice to proceed issued	1 day	0%	Mon 7/29/19	Mon 7/29/19	1198,1196,10																							
1155	<b>5.2.2.3</b>	<b>OBU Integrator Procurement (equipment + installation)</b>	<b>339 days</b>	<b>54%</b>	<b>Mon 3/26/18</b>	<b>Tue 7/30/19</b>																								
1156	<b>5.2.2.3.1</b>	<b>Consultant Selection Process (QBS) (Professional Services)</b>	<b>286 days</b>	<b>84%</b>	<b>Mon 3/26/18</b>	<b>Tue 5/14/19</b>																								
1157	5.2.2.3.1.1	Prepare project LOI / RFQ / RFP	23 days	100%	Mon 12/3/18	Fri 1/4/19	1158																							
1158	5.2.2.3.1.2	USDOT Review of Request for Subcontractor Approval	5 days	100%	Mon 1/7/19	Fri 1/11/19	1159FS+10 da																							
1159	5.2.2.3.1.3	Advertise LOI / RFQ / RFP in Performance Series	15 days	100%	Tue 1/29/19	Tue 2/19/19	1160																							
1160	5.2.2.3.1.4	Receive Technical Proposals	0 days	100%	Tue 2/19/19	Tue 2/19/19	1161																							
1161	5.2.2.3.1.5	Request highest ranking firm to define project scope of service	10 days	100%	Wed 2/20/19	Tue 3/5/19	1162FS+10 da																							
1162	5.2.2.3.1.6	Vendor Interviews	2 days	100%	Wed 3/20/19	Thu 3/21/19	1163																							
1163	5.2.2.3.1.7	CINO Approval	2 days	100%	Fri 3/22/19	Mon 3/25/19	1164																							
1164	5.2.2.3.1.8	Negotiate project final scope of services	5 days	100%	Tue 3/26/19	Mon 4/1/19	1166																							
1165	5.2.2.3.1.9	Prepare request for subcontract approval (to USDOT)	15 days	100%	Mon 3/26/18	Fri 4/13/18	1163																							
1166	5.2.2.3.1.10	Establish contract terms	5 days	75%	Tue 4/2/19	Mon 4/8/19	1167																							
1167	5.2.2.3.1.11	City Attorney reviews (if required)	0 days	0%	Mon 4/8/19	Mon 4/8/19	1168																							
1168	5.2.2.3.1.12	Request fee proposal	10 days	100%	Tue 4/9/19	Mon 4/22/19	1169																							
1169	5.2.2.3.1.13	Negotiate fees	10 days	0%	Tue 4/23/19	Mon 5/6/19	1170,1173																							
1170	5.2.2.3.1.14	Notify CINO	1 day	0%	Tue 5/7/19	Tue 5/7/19	1171																							
1171	5.2.2.3.1.15	USDOT Review	5 days	0%	Wed 5/8/19	Tue 5/14/19																								
1172	<b>5.2.2.3.2</b>	<b>Legislation Process</b>	<b>27 days</b>	<b>0%</b>	<b>Tue 5/7/19</b>	<b>Thu 6/13/19</b>																								
1173	5.2.2.3.2.1	Prepare legislation and submit to Fiscal (2 working days days)	2 days	0%	Tue 5/7/19	Wed 5/8/19	1174																							

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1174	5.2.2.3.2.2	Fiscal modifies and processes legislation (6 working days)	5 days	0%	Thu 5/9/19	Wed 5/15/19	1175																							
1175	5.2.2.3.2.3	To Administrator (2 working days)	3 days	0%	Thu 5/16/19	Mon 5/20/19	1176																							
1176	5.2.2.3.2.4	To CINO (4 working days)	3 days	0%	Tue 5/21/19	Thu 5/23/19	1177																							
1177	5.2.2.3.2.5	To Finance (7 working days)	3 days	0%	Fri 5/24/19	Wed 5/29/19	1178																							
1178	5.2.2.3.2.6	To Equal Business Opportunity (4 working days)	2 days	0%	Thu 5/30/19	Fri 5/31/19	1179																							
1179	5.2.2.3.2.7	To Auditor (2 working days)	1 day	0%	Mon 6/3/19	Mon 6/3/19	1180																							
1180	5.2.2.3.2.8	To City Attorney (2 working days)	1 day	0%	Tue 6/4/19	Tue 6/4/19	1181																							
1181	5.2.2.3.2.9	To City Clerk (6 working days min.)	5 days	0%	Wed 6/5/19	Tue 6/11/19	1182																							
1182	5.2.2.3.2.10	Council passes legislation*	1 day	0%	Wed 6/12/19	Wed 6/12/19	1183																							
1183	5.2.2.3.2.11	Mayor Signs (2 working days)	1 day	0%	Thu 6/13/19	Thu 6/13/19	1185																							
1184	<b>5.2.2.3.3</b>	<b>Contract Process</b>	<b>32 days</b>	<b>0%</b>	<b>Fri 6/14/19</b>	<b>Tue 7/30/19</b>																								
1185	5.2.2.3.3.1	Prepare contract documents	4 days	0%	Fri 6/14/19	Wed 6/19/19	1186																							
1186	5.2.2.3.3.2	Fiscal enters Performance information	8 days	0%	Thu 6/20/19	Mon 7/1/19	1187																							
1187	5.2.2.3.3.3	Sent to Consultant and returned to City	7 days	0%	Tue 7/2/19	Thu 7/11/19	1188																							
1188	5.2.2.3.3.4	To CINO	5 days	0%	Fri 7/12/19	Thu 7/18/19	1189																							
1189	5.2.2.3.3.5	To City Attorney	5 days	0%	Fri 7/19/19	Thu 7/25/19	1190																							
1190	5.2.2.3.3.6	To Auditor	2 days	0%	Fri 7/26/19	Mon 7/29/19	1191																							
1191	5.2.2.3.3.7	Notice to proceed issued	1 day	0%	Tue 7/30/19	Tue 7/30/19	1198,1196,12																							
1192	<b>5.2.2.4</b>	<b>RSU Installation</b>	<b>120 days</b>	<b>0%</b>	<b>Wed 8/14/19</b>	<b>Fri 2/7/20</b>																								
1193	5.2.2.4.1	Install Field Equipment (Cable, mounting equipment, switches and RSUs)	120 days	0%	Wed 8/14/19	Fri 2/7/20	1223																							
1194	5.2.2.4.2	Install Fiber and Splicing	120 days	0%	Wed 8/14/19	Fri 2/7/20	1223																							
1195	<b>5.2.2.5</b>	<b>OBU Installation</b>	<b>290 days</b>	<b>0%</b>	<b>Wed 7/31/19</b>	<b>Thu 9/24/20</b>																								
1196	5.2.2.5.1	Application Development for OBUs (Light Vehicles)	150 days	0%	Wed 7/31/19	Mon 3/9/20	1197SS,1200S																							
1197	5.2.2.5.2	Application Development for OBUs (Transit Vehicles)	150 days	0%	Wed 7/31/19	Mon 3/9/20																								
1198	5.2.2.5.3	IRB Management	1 day	0%	Mon 11/25/19	Mon 11/25/19																								
1199	<b>5.2.2.5.4</b>	<b>Recruit Participants</b>	<b>290 days</b>	<b>0%</b>	<b>Wed 7/31/19</b>	<b>Thu 9/24/20</b>																								





**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021									
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
1253	5.3.1	<b>Phase I - Systems Engineering</b>	<b>230 days</b>	<b>100%</b>	<b>Mon 1/22/18</b>	<b>Wed 12/19/18</b>																													
1254	5.3.1.1	<b>MMTPA/CPS Concept of Operations (ConOps)</b>	<b>159 days</b>	<b>100%</b>	<b>Mon 1/22/18</b>	<b>Wed 9/5/18</b>																													
1255	5.3.1.1.1	<b>Draft MMTPA/CPS ConOps</b>	<b>94 days</b>	<b>100%</b>	<b>Mon 1/22/18</b>	<b>Mon 6/4/18</b>																													
1263	5.3.1.1.2	<b>Final MMTPA/CPS ConOps</b>	<b>65 days</b>	<b>100%</b>	<b>Tue 6/5/18</b>	<b>Wed 9/5/18</b>																													
1271	5.3.1.2	<b>CPS ONLY System Requirements Specification (SyRS)</b>	<b>90 days</b>	<b>100%</b>	<b>Thu 8/9/18</b>	<b>Wed 12/19/18</b>																													
1272	5.3.1.2.1	<b>Draft CPS ONLY SyRS</b>	<b>61 days</b>	<b>100%</b>	<b>Thu 8/9/18</b>	<b>Mon 11/5/18</b>																													
1279	5.3.1.2.2	<b>Final CPS ONLY SyRS</b>	<b>29 days</b>	<b>100%</b>	<b>Tue 11/6/18</b>	<b>Wed 12/19/18</b>																													
1287	5.3.2	<b>Phase II - Develop, Procure, Deploy</b>	<b>678 days?</b>	<b>31%</b>	<b>Tue 5/8/18</b>	<b>Mon 1/25/21</b>																													
1288	5.3.2.1	<b>MMTPA Procurement</b>	<b>152 days</b>	<b>100%</b>	<b>Tue 5/8/18</b>	<b>Fri 12/14/18</b>																													
1289	5.3.2.1.1	<b>Preparation for RFP/Agile Artifacts</b>	<b>50 days</b>	<b>100%</b>	<b>Tue 5/8/18</b>	<b>Wed 7/18/18</b>																													
1294	5.3.2.1.2	<b>RFP and Vendor Selection</b>	<b>152 days</b>	<b>100%</b>	<b>Tue 5/8/18</b>	<b>Fri 12/14/18</b>																													
1311	5.3.2.2	<b>CPS Procurement</b>	<b>113 days</b>	<b>100%</b>	<b>Fri 10/5/18</b>	<b>Fri 3/22/19</b>																													
1312	5.3.2.2.1	<b>Preparation for RFP/Agile Artifacts</b>	<b>30 days</b>	<b>100%</b>	<b>Fri 10/5/18</b>	<b>Mon 11/19/18</b>																													
1317	5.3.2.2.2	<b>RFP and Vendor Selection</b>	<b>113 days</b>	<b>100%</b>	<b>Fri 10/5/18</b>	<b>Fri 3/22/19</b>																													
1337	5.3.2.3	<b>Agreement with TSPs</b>	<b>262 days</b>	<b>35%</b>	<b>Mon 12/17/18</b>	<b>Fri 1/3/20</b>																													
1338	5.3.2.3.1	Finalize Agreement with Transportation Service Providers	262 days	35%	Mon 12/17/18	Fri 1/3/20	1387																												
1339	5.3.2.4	<b>IRB Process</b>	<b>246 days</b>	<b>53%</b>	<b>Mon 12/17/18</b>	<b>Tue 12/10/19</b>																													
1340	5.3.2.4.1	Engage IRB	20 days	100%	Mon 12/17/18	Tue 1/15/19	1341																												
1341	5.3.2.4.2	Develop Participant Recruitment Plan	20 days	35%	Wed 1/16/19	Wed 2/13/19	1342																												
1342	5.3.2.4.3	Develop and Submit Human Use Approval Request for IRB	20 days	100%	Thu 2/14/19	Thu 3/14/19	1343																												
1343	5.3.2.4.4	IRB Review and Provide Findings (Initial)	45 days	100%	Fri 3/15/19	Thu 5/16/19																													
1344	5.3.2.4.5	Update and Submit IRB Application	30 days	35%	Mon 3/25/19	Fri 5/3/19	1345																												
1345	5.3.2.4.6	IRB Review and Provide Findings (Revised)	20 days	0%	Mon 5/6/19	Mon 6/3/19	1346																												
1346	5.3.2.4.7	Training Program - MMTPA	20 days	0%	Tue 7/9/19	Mon 8/5/19	1347,1386																												
1347	5.3.2.4.8	Training Program - MMTPA/CPS	20 days	0%	Fri 11/8/19	Tue 12/10/19	1387,518																												
1348	5.3.2.5	<b>Product Delivery</b>	<b>226 days</b>	<b>31%</b>	<b>Fri 12/14/18</b>	<b>Thu 11/7/19</b>																													
1349	5.3.2.5.1	<b>MMTPA Agile Development</b>	<b>140 days</b>	<b>54%</b>	<b>Fri 12/14/18</b>	<b>Mon 7/8/19</b>																													





**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021							
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1377	5.3.2.6.2.6.3	Address Comments From CoC Review	4 days	0%	Wed 1/15/20	Tue 1/21/20	1378,1379																											
1378	5.3.2.6.2.6.4	QA/QC Draft Test Report	1 day	0%	Wed 1/22/20	Wed 1/22/20																												
1379	5.3.2.6.2.6.5	CoC Final Review	1 day	0%	Wed 1/22/20	Wed 1/22/20	1380																											
1380	5.3.2.6.2.6.6	Submit Draft Test Report	0 days	0%	Wed 1/22/20	Wed 1/22/20	1381																											
1381	5.3.2.6.2.6.7	USDOT Review Draft Test Report	10 days	0%	Thu 1/23/20	Wed 2/5/20	1382																											
1382	5.3.2.6.2.6.8	Receive DOT Comments Draft Test Report	0 days	0%	Wed 2/5/20	Wed 2/5/20	1383																											
1383	5.3.2.6.2.6.9	Update Test Report	3 days	0%	Thu 2/6/20	Mon 2/10/20	1384FS+10 da																											
1384	5.3.2.6.2.6.10	MMTPA/CPS Webinar: Test Results + Presentation of Combined MVP + Lessons Learned	1 day?	0%	Wed 2/26/20	Wed 2/26/20																												
1385	5.3.2.7	Demonstration Period	348 days	0%	Thu 8/29/19	Mon 1/25/21																												
1386	5.3.2.7.1	Go Live (MMTPA Only)	0 days	0%	Thu 8/29/19	Thu 8/29/19	906FF																											
1387	5.3.2.7.2	Go Live (MMTPA and CPS)	0 days	0%	Tue 1/7/20	Tue 1/7/20	1388,1389,13																											
1388	5.3.2.7.3	Performance and System Monitoring	262 days	0%	Wed 1/8/20	Mon 1/25/21	246																											
1389	5.3.2.7.4	Data Collection	262 days	0%	Wed 1/8/20	Mon 1/25/21																												
1390	5.3.2.7.5	Quarterly Update 1 (Application)	66 days	0%	Wed 1/8/20	Fri 4/10/20	1391																											
1391	5.3.2.7.6	Quarterly Update 2 (Application)	66 days	0%	Mon 4/13/20	Wed 7/15/20	1392																											
1392	5.3.2.7.7	Quarterly Update 3 (Application)	66 days	0%	Thu 7/16/20	Mon 10/19/20																												
1393	5.4	Smart Mobility Hubs (SMH)	1134 days?	35%	Thu 8/18/16	Tue 2/9/21																												
1394	5.4.1	Phase I - Systems Engineering	970 days?	75%	Thu 8/18/16	Thu 6/11/20																												
1395	5.4.1.1	SMH Strategy Plan	167 days	100%	Thu 8/18/16	Fri 4/7/17																												
1400	5.4.1.2	SMH Concept of Operations (ConOps)	373 days?	81%	Fri 1/19/18	Mon 7/15/19																												
1401	5.4.1.2.1	Draft SMH ConOps	122 days	100%	Fri 1/19/18	Thu 7/12/18																												
1409	5.4.1.2.2	Final SMH ConOps	12 days	100%	Thu 7/12/18	Mon 7/30/18																												
1416	5.4.1.2.3	ConOps Refresh	32 days?	0%	Thu 5/30/19	Mon 7/15/19																												
1417	5.4.1.2.3.1	Update SMH ConOps per SDD Changes	20 days	0%	Thu 5/30/19	Wed 6/26/19	1418																											
1418	5.4.1.2.3.2	CoC Review	5 days	0%	Thu 6/27/19	Wed 7/3/19	1419																											
1419	5.4.1.2.3.3	Address CoC Comments SMH ConOps	5 days	0%	Fri 7/5/19	Thu 7/11/19	1420																											



### Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021					
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
1472	5.4.1.5.2.3	CoC Review	5 days	0%	Tue 5/14/19	Mon 5/20/19	1473																										
1473	5.4.1.5.2.4	Update for City Comments	4 days	0%	Tue 5/21/19	Fri 5/24/19	1474																										
1474	5.4.1.5.2.5	QA/QC	1 day	0%	Tue 5/28/19	Tue 5/28/19	1475																										
1475	5.4.1.5.2.6	CoC Final Review	1 day	0%	Wed 5/29/19	Wed 5/29/19	1476																										
1476	5.4.1.5.2.7	Submit Final SMH SDD (and post for public comment)	0 days	0%	Wed 5/29/19	Wed 5/29/19	642FS+10 day																										
1477	5.4.1.5.2.8	SMH ICD and SDD Webinar (post document 10 days prior)	1 day?	0%	Thu 6/13/19	Thu 6/13/19	1478																										
1478	5.4.1.5.2.9	Update SMH SDD as needed (for public comment)	10 days	0%	Fri 6/14/19	Thu 6/27/19																											
1479	<b>5.4.1.5.3</b>	<b>Final As-Built SMH SDD</b>	<b>49 days</b>	<b>0%</b>	<b>Fri 4/3/20</b>	<b>Thu 6/11/20</b>																											
1480	5.4.1.5.3.1	Prepare Final SMH SDD	30 days	0%	Fri 4/3/20	Thu 5/14/20	1481																										
1481	5.4.1.5.3.2	COC Review of Final SMH SDD	5 days	0%	Fri 5/15/20	Thu 5/21/20	1482																										
1482	5.4.1.5.3.3	Address CoC Comments SDD	10 days	0%	Fri 5/22/20	Fri 6/5/20	1483																										
1483	5.4.1.5.3.4	QA/QC	2 days	0%	Mon 6/8/20	Tue 6/9/20	1484																										
1484	5.4.1.5.3.5	CoC Final Review	1 day	0%	Wed 6/10/20	Wed 6/10/20	1485																										
1485	5.4.1.5.3.6	Submit Final SMH SDD to USDOT	1 day	0%	Thu 6/11/20	Thu 6/11/20																											
1486	<b>5.4.1.6</b>	<b>SMH Test Plan (TP)</b>	<b>106 days</b>	<b>0%</b>	<b>Tue 4/16/19</b>	<b>Fri 9/13/19</b>																											
1487	<b>5.4.1.6.1</b>	<b>Draft SMH Test Plan</b>	<b>51 days</b>	<b>0%</b>	<b>Tue 4/16/19</b>	<b>Wed 6/26/19</b>																											
1488	5.4.1.6.1.1	Prepare Draft SMH Test Plan	30 days	0%	Tue 4/16/19	Tue 5/28/19	1489																										
1489	5.4.1.6.1.2	COC Review of SMH Test Plan	5 days	0%	Wed 5/29/19	Tue 6/4/19	1490																										
1490	5.4.1.6.1.3	Address CoC Comments SMH Test Plan	5 days	0%	Wed 6/5/19	Tue 6/11/19	1491																										
1491	5.4.1.6.1.4	CoC Final Review	1 day	0%	Wed 6/12/19	Wed 6/12/19	1492																										
1492	5.4.1.6.1.5	Submit Draft SMH Test Plan (Task B)	0 days	0%	Wed 6/12/19	Wed 6/12/19	1493																										
1493	5.4.1.6.1.6	USDOT Review Draft SMH Test Plan	10 days	0%	Thu 6/13/19	Wed 6/26/19	1495																										
1494	<b>5.4.1.6.2</b>	<b>Final SMH Test Plan</b>	<b>55 days</b>	<b>0%</b>	<b>Wed 6/26/19</b>	<b>Fri 9/13/19</b>																											
1495	5.4.1.6.2.1	Receive USDOT Comments on Draft SMH Test Plan	0 days	0%	Wed 6/26/19	Wed 6/26/19	1496																										
1496	5.4.1.6.2.2	Update SMH Test Plan	10 days	0%	Fri 8/16/19	Thu 8/29/19	1497																										
1497	5.4.1.6.2.3	CoC Review	5 days	0%	Fri 8/30/19	Fri 9/6/19	1498																										
1498	5.4.1.6.2.4	Update Test Plan	4 days	0%	Mon 9/9/19	Thu 9/12/19	1500,1499																										

Smart City Schedule		Smart Columbus Project - All Activities																																			
Cooperative Agreement No. DTFH6116H00013																																					
ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021									
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4							
1499	5.4.1.6.2.5	QA/QC	1 day	0%	Fri 9/13/19	Fri 9/13/19																															
1500	5.4.1.6.2.6	CoC Final Review	1 day	0%	Fri 9/13/19	Fri 9/13/19	1501																														
1501	5.4.1.6.2.7	Submit Final SMH Test Plan	0 days	0%	Fri 9/13/19	Fri 9/13/19	1582FS+10 da																														
1502	<b>5.4.2</b>	<b>Phase II - Develop, Procure, Deploy</b>	<b>621 days?</b>	<b>15%</b>	<b>Tue 8/14/18</b>	<b>Tue 2/9/21</b>																															
1503	<b>5.4.2.1</b>	<b>Design</b>	<b>151 days</b>	<b>100%</b>	<b>Tue 8/14/18</b>	<b>Mon 3/25/19</b>																															
1504	<b>5.4.2.1.1</b>	<b>Stage 1</b>	<b>96 days</b>	<b>100%</b>	<b>Tue 8/14/18</b>	<b>Thu 1/3/19</b>																															
1505	5.4.2.1.1.1	Finalize HUB locations	10 days	100%	Tue 8/14/18	Mon 8/27/18	1506FS+20 da																														
1506	5.4.2.1.1.2	Survey	30 days	100%	Wed 9/26/18	Wed 11/7/18																															
1507	5.4.2.1.1.3	Utility coordination	50 days	100%	Wed 9/12/18	Mon 11/26/18	1510																														
1508	5.4.2.1.1.4	Site plans	37 days	100%	Tue 8/28/18	Fri 10/19/18	1509																														
1509	5.4.2.1.1.5	Network communication plans	10 days	100%	Thu 10/11/18	Thu 11/1/18	1511																														
1510	5.4.2.1.1.6	Power service plans	10 days	100%	Tue 11/27/18	Mon 12/10/18	1511																														
1511	5.4.2.1.1.7	Stage 1 submittal	1 day	100%	Tue 12/11/18	Tue 12/11/18	1512																														
1512	5.4.2.1.1.8	Stage 1 review	15 days	100%	Wed 12/12/18	Thu 1/3/19	1514,1524																														
1513	<b>5.4.2.1.2</b>	<b>Stage 3</b>	<b>35 days</b>	<b>100%</b>	<b>Fri 1/4/19</b>	<b>Mon 2/25/19</b>																															
1514	5.4.2.1.2.1	Address stage 1 review comments	10 days	100%	Fri 1/4/19	Thu 1/17/19	1515,1517																														
1515	5.4.2.1.2.2	Finalize HUB services	10 days	100%	Fri 1/18/19	Fri 2/1/19	1516																														
1516	5.4.2.1.2.3	Network communication plans	15 days	100%	Mon 2/4/19	Mon 2/25/19																															
1517	5.4.2.1.3	Develop plan quantities	5 days	100%	Fri 1/18/19	Fri 1/25/19	1518																														
1518	5.4.2.1.4	Engineer's Estimate	5 days	100%	Mon 1/28/19	Fri 2/1/19	1519																														
1519	5.4.2.1.5	Submit Final Plans (P,S, & E)	10 days	100%	Mon 2/4/19	Fri 2/15/19	1520,1522,14																														
1520	5.4.2.1.6	City Review	15 days	100%	Tue 2/19/19	Mon 3/11/19	1521																														
1521	5.4.2.1.7	USDOT Review	10 days	100%	Tue 3/12/19	Mon 3/25/19																															
1522	5.4.2.1.8	Signatures	20 days	100%	Tue 2/19/19	Mon 3/18/19	1524																														
1523	<b>5.4.2.2</b>	<b>Installation Procurement</b>	<b>106 days</b>	<b>7%</b>	<b>Tue 3/19/19</b>	<b>Thu 8/15/19</b>																															
1524	5.4.2.2.1	Develop procurement criteria (Site Construction)	15 days	30%	Tue 3/19/19	Mon 4/8/19	1525																														
1525	5.4.2.2.2	Prepare contract documents	1 day	30%	Tue 4/9/19	Tue 4/9/19	1526																														



**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1553	<b>5.4.2.4</b>	<b>Draft O&amp;M Manual</b>	<b>54 days</b>	<b>0%</b>	<b>Wed 10/30/19</b>	<b>Tue 1/21/20</b>																								
1554	5.4.2.4.1	Develop Draft O&M Manual	20 days	0%	Wed 10/30/19	Mon 12/2/19																								
1555	5.4.2.4.2	QA/QC Draft O&M Manual	5 days	0%	Mon 12/2/19	Mon 12/9/19	1554SF																							
1556	5.4.2.4.3	CoC Review Draft O&M Manual	5 days	0%	Mon 12/9/19	Mon 12/16/19	1555SF																							
1557	5.4.2.4.4	Address Comments From CoC Review	5 days	0%	Mon 12/16/19	Mon 12/23/19	1556SF																							
1558	5.4.2.4.5	CoC Final Review	1 day	0%	Mon 12/23/19	Tue 12/24/19	1557SF																							
1559	5.4.2.4.6	Submit Draft O&M Manual	0 days	0%	Tue 12/24/19	Tue 12/24/19	1558SF																							
1560	5.4.2.4.7	USDOT Review Draft O&M Manual	10 days	0%	Tue 12/24/19	Thu 1/9/20	1559SF																							
1561	5.4.2.4.8	Receive DOT Comments Draft O&M Manual	0 days	0%	Thu 1/9/20	Thu 1/9/20	1560SF																							
1562	5.4.2.4.9	Update Final Draft O&M Manual	8 days	0%	Thu 1/9/20	Tue 1/21/20	1561SF																							
1563	<b>5.4.2.5</b>	<b>IRB Process</b>	<b>155 days</b>	<b>0%</b>	<b>Thu 5/30/19</b>	<b>Mon 1/13/20</b>																								
1564	5.4.2.5.1	Engage IRB	20 days	0%	Thu 5/30/19	Wed 6/26/19	1565																							
1565	5.4.2.5.2	Survey Development for IRB	20 days	0%	Thu 6/27/19	Thu 7/25/19	1566																							
1566	5.4.2.5.3	Develop and Submit Human Use Approval Request for IRB	20 days	0%	Fri 7/26/19	Thu 8/22/19	1567																							
1567	5.4.2.5.4	IRB Review and Provide Findings (Initial)	45 days	0%	Fri 8/23/19	Mon 10/28/19	1568,518																							
1568	5.4.2.5.5	Update and Submit IRB Application (If needed)	30 days	0%	Tue 10/29/19	Thu 12/12/19	1569																							
1569	5.4.2.5.6	IRB Review and Provide Findings (Revised)	20 days	0%	Fri 12/13/19	Mon 1/13/20	1581																							
1570	<b>5.4.2.6</b>	<b>Post-Installation</b>	<b>250 days</b>	<b>0%</b>	<b>Tue 12/3/19</b>	<b>Tue 12/1/20</b>																								
1571	<b>5.4.2.6.1</b>	<b>Verification</b>	<b>15 days</b>	<b>0%</b>	<b>Tue 12/3/19</b>	<b>Mon 12/23/19</b>																								
1572	5.4.2.6.1.1	Component Verification	10 days	0%	Tue 12/3/19	Mon 12/16/19	1574SS,1579S																							
1573	5.4.2.6.1.2	System Verification	5 days	0%	Tue 12/17/19	Mon 12/23/19	1581																							
1574	5.4.2.6.2	City completes as-built drawing mark-ups	30 days	0%	Tue 12/3/19	Wed 1/15/20	1575																							
1575	5.4.2.6.3	Consultant makes as-built revisions	37 days	0%	Thu 1/16/20	Tue 3/10/20	1576																							
1576	5.4.2.6.4	City reviews revisions	30 days	0%	Wed 3/11/20	Tue 4/21/20	1577																							
1577	5.4.2.6.5	Consultant makes final revisions	12 days	0%	Wed 4/22/20	Thu 5/7/20	1578																							
1578	5.4.2.6.6	Evaluation of Consultant	10 days	0%	Fri 5/8/20	Thu 5/21/20																								
1579	5.4.2.6.7	Warranty work check-out (within one year of completion)	250 days	0%	Tue 12/3/19	Tue 12/1/20																								

### Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1580	<b>5.4.2.7</b>	<b>Testing</b>	<b>59 days?</b>	<b>0%</b>	<b>Tue 1/14/20</b>	<b>Tue 4/7/20</b>																								
1581	5.4.2.7.1	Prepare for Acceptance Testing (Schedule, Eqpt, Artifacts)	5 days	0%	Tue 1/14/20	Tue 1/21/20	1582																							
1582	5.4.2.7.2	Conduct Acceptance Testing	6 days	0%	Wed 1/22/20	Wed 1/29/20	1583																							
1583	5.4.2.7.3	Review Results with Contractor	1 day	0%	Thu 1/30/20	Thu 1/30/20	1584																							
1584	5.4.2.7.4	Contractor Revisions based on Test Results	7 days	0%	Fri 1/31/20	Mon 2/10/20	1585																							
1585	5.4.2.7.5	Perform Regression Testing Until Acceptance	7 days	0%	Tue 2/11/20	Thu 2/20/20	1586FF,1588																							
1586	5.4.2.7.6	Prepare and Submit Test Report	10 days	0%	Thu 2/6/20	Thu 2/20/20	1599																							
1587	<b>5.4.2.7.7</b>	<b>Prepare and Submit MMTPA/CPS Test Report</b>	<b>33 days?</b>	<b>0%</b>	<b>Fri 2/21/20</b>	<b>Tue 4/7/20</b>																								
1588	5.4.2.7.7.1	Develop Draft Report	10 days	0%	Fri 2/21/20	Thu 3/5/20	1589																							
1589	5.4.2.7.7.2	CoC Review Draft Test Report	5 days	0%	Fri 3/6/20	Thu 3/12/20	1590																							
1590	5.4.2.7.7.3	Address Comments From CoC Review	4 days	0%	Fri 3/13/20	Wed 3/18/20	1591,1592																							
1591	5.4.2.7.7.4	QA/QC Draft Test Report	1 day	0%	Thu 3/19/20	Thu 3/19/20																								
1592	5.4.2.7.7.5	CoC Final Review	1 day	0%	Thu 3/19/20	Thu 3/19/20	1593																							
1593	5.4.2.7.7.6	Submit Draft Test Report	0 days	0%	Thu 3/19/20	Thu 3/19/20	1594,1597FS+																							
1594	5.4.2.7.7.7	USDOT Review Draft Test Report	10 days	0%	Fri 3/20/20	Thu 4/2/20	1595																							
1595	5.4.2.7.7.8	Receive DOT Comments Draft Test Report	0 days	0%	Thu 4/2/20	Thu 4/2/20	1596,1480																							
1596	5.4.2.7.7.9	Update Test Report	3 days	0%	Fri 4/3/20	Tue 4/7/20																								
1597	5.4.2.7.7.10	Webinar for Test Plan and Results	1 day?	0%	Fri 3/27/20	Fri 3/27/20																								
1598	<b>5.4.2.8</b>	<b>Demonstration Period</b>	<b>243 days</b>	<b>0%</b>	<b>Fri 2/21/20</b>	<b>Tue 2/9/21</b>																								
1599	5.4.2.8.1	Go Live	1 day	0%	Fri 2/21/20	Fri 2/21/20	1562FF-22 da																							
1600	5.4.2.8.2	Performance and System Monitoring	242 days	0%	Mon 2/24/20	Tue 2/9/21	246,1602FF																							
1601	5.4.2.8.3	Data Collection	242 days	0%	Mon 2/24/20	Tue 2/9/21	1602FF																							
1602	5.4.2.8.4	O&M Plan Final Update	20 days	0%	Tue 1/12/21	Tue 2/9/21																								
1603	5.4.2.8.5	Quarterly Update 1 (Application)	66 days	0%	Mon 2/24/20	Tue 5/26/20	1604																							
1604	5.4.2.8.6	Quarterly Update 2 (Application)	66 days	0%	Wed 5/27/20	Thu 8/27/20																								
1605	<b>5.5</b>	<b>Mobility Assistance (MAPCD)</b>	<b>951 days</b>	<b>63%</b>	<b>Thu 8/18/16</b>	<b>Thu 5/14/20</b>																								
1606	<b>5.5.1</b>	<b>Phase I - Systems Engineering</b>	<b>710 days</b>	<b>98%</b>	<b>Thu 8/18/16</b>	<b>Wed 5/29/19</b>																								



Smart City Schedule		Smart Columbus Project - All Activities																											
Cooperative Agreement No. DTFH6116H00013																													
ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1607	5.5.1.1	MA Strategy Plan	224 days	100%	Thu 8/18/16	Wed 6/28/17		█																					
1612	5.5.1.2	MA Trade Study	238 days	100%	Mon 5/1/17	Mon 4/2/18				█																			
1632	5.5.1.3	MA Interface Control Document (ICD)	91 days	100%	Tue 4/3/18	Thu 8/9/18								█															
1633	5.5.1.3.1	Draft Mobility Assistance Interfaces	60 days	100%	Tue 4/3/18	Tue 6/26/18								█															
1640	5.5.1.3.2	Final Mobility Assistance Interfaces	31 days	100%	Tue 6/26/18	Thu 8/9/18								█															
1648	5.5.1.4	MA Test Plan (TP)	177 days	89%	Wed 9/12/18	Wed 5/29/19								█															
1649	5.5.1.4.1	Draft Mobility Assistance Test Plan	61 days	100%	Wed 9/12/18	Tue 12/11/18								█															
1650	5.5.1.4.1.1	Prepare Draft Mobility Assistance Test Plan	40 days	100%	Wed 9/12/18	Wed 11/7/18	1651							█															
1651	5.5.1.4.1.2	COC Review of Mobility Assistance Test Plan	5 days	100%	Thu 11/8/18	Thu 11/15/18	1652							█															
1652	5.5.1.4.1.3	Address CoC Comments	5 days	100%	Fri 11/16/18	Mon 11/26/18	1653							█															
1653	5.5.1.4.1.4	CoC Final Review	1 day	100%	Tue 11/27/18	Tue 11/27/18	1654							█															
1654	5.5.1.4.1.5	Submit Draft Mobility Assistance Test Plan (Task B)	0 days	100%	Tue 11/27/18	Tue 11/27/18	1655							█															
1655	5.5.1.4.1.6	USDOT Review Draft Mobility Assistance Test Plan	10 days	100%	Wed 11/28/18	Tue 12/11/18	1657							█															
1656	5.5.1.4.2	Final Mobility Assistance Test Plan	116 days	70%	Tue 12/11/18	Wed 5/29/19								█															
1657	5.5.1.4.2.1	Receive USDOT Comments on Draft Mobility Assistance Test Pl	0 days	100%	Tue 12/11/18	Tue 12/11/18	1658							█															
1658	5.5.1.4.2.2	Update Mobility Assistance Test Plan	15 days	100%	Wed 12/12/18	Thu 1/3/19	1659							█															
1659	5.5.1.4.2.3	CoC Review	5 days	100%	Fri 1/4/19	Thu 1/10/19	1660							█															
1660	5.5.1.4.2.4	Update Test Plan	5 days	100%	Fri 1/11/19	Thu 1/17/19	1661							█															
1661	5.5.1.4.2.5	CoC Final Review	1 day	100%	Fri 1/18/19	Fri 1/18/19	1662							█															
1662	5.5.1.4.2.6	Submit Final Mobility Assistance Test Plan	0 days	100%	Fri 1/18/19	Fri 1/18/19	1694FS+10 da							█															
1663	5.5.1.4.2.7	Public Comment Period for MAPCD Test Plan	10 days	0%	Wed 5/15/19	Wed 5/29/19	1664SS+5 day							█															
1664	5.5.1.4.2.8	Webinar for MAPCD Test Plan and results	1 day	0%	Wed 5/22/19	Wed 5/22/19								█															
1665	5.5.2	Phase II - Develop, Procure, Deploy	541 days	42%	Tue 3/20/18	Thu 5/14/20								█															
1666	5.5.2.1	Contract	70 days	100%	Tue 3/20/18	Tue 6/26/18								█															
1667	5.5.2.1.1	Finalize Contract with Mobility Assistance Partner	70 days	100%	Tue 3/20/18	Tue 6/26/18								█															
1668	5.5.2.2	Draft O&M Manual	118 days	0%	Thu 3/28/19	Thu 9/12/19								█															
1669	5.5.2.2.1	Develop Draft O&M Manual	80 days	0%	Thu 3/28/19	Fri 7/19/19	1670							█															

Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021									
								Q2	Q3	Q4	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4						
1670	5.5.2.2.2	CoC Review Draft O&M Manual	5 days	0%	Mon 7/22/19	Fri 7/26/19	1671																														
1671	5.5.2.2.3	Address Comments From CoC Review	10 days	0%	Mon 7/29/19	Fri 8/9/19	1672																														
1672	5.5.2.2.4	QA/QC Draft O&M Manual	4 days	0%	Mon 8/12/19	Thu 8/15/19	1673																														
1673	5.5.2.2.5	CoC Final Review	1 day	0%	Fri 8/16/19	Fri 8/16/19	1674																														
1674	5.5.2.2.6	Submit Draft O&M Manual	0 days	0%	Fri 8/16/19	Fri 8/16/19	1675																														
1675	5.5.2.2.7	USDOT Review Draft O&M Manual	10 days	0%	Mon 8/19/19	Fri 8/30/19	1676																														
1676	5.5.2.2.8	Receive DOT Comments Draft O&M Manual	0 days	0%	Fri 8/30/19	Fri 8/30/19	1677																														
1677	5.5.2.2.9	Update Final Draft O&M Manual	8 days	0%	Tue 9/3/19	Thu 9/12/19																															
1678	<b>5.5.2.3</b>	<b>IRB Process</b>	<b>143 days</b>	<b>100%</b>	<b>Fri 7/27/18</b>	<b>Mon 2/25/19</b>																															
1679	5.5.2.3.1	Engage IRB - OSU	5 days	100%	Fri 7/27/18	Thu 8/2/18	1680																														
1680	5.5.2.3.2	Develop Participant Recruitment Plan	59 days	100%	Fri 8/3/18	Fri 10/26/18	1681																														
1681	5.5.2.3.3	Develop and Submit Human Use Approval Request for IRB	10 days	100%	Fri 8/31/18	Fri 11/2/18	1682																														
1682	5.5.2.3.4	IRB Review and Provide Findings (Initial)	10 days	100%	Mon 11/5/18	Mon 11/19/18	1683FS+26 da																														
1683	5.5.2.3.5	Update and Submit IRB Application (If needed)	28 days	100%	Mon 12/31/18	Fri 2/8/19	1684																														
1684	5.5.2.3.6	IRB Review and Provide Findings (Revised)	10 days	100%	Mon 2/11/19	Mon 2/25/19	518																														
1685	<b>5.5.2.4</b>	<b>Product Delivery</b>	<b>269 days</b>	<b>75%</b>	<b>Tue 4/3/18</b>	<b>Mon 4/29/19</b>																															
1686	5.5.2.4.1	Refinements and Updates to Mobility App based on Smart Columbus Needs	60 days	100%	Tue 4/3/18	Tue 6/26/18	1691FF																														
1687	5.5.2.4.2	Recruitment of Test Participants	78 days	50%	Tue 10/23/18	Fri 4/26/19	1688																														
1688	5.5.2.4.3	COTA, OSU, Franklin County Board of Developmental Disabilities preparation for deployment	40 days	100%	Fri 12/21/18	Wed 2/20/19	1689																														
1689	5.5.2.4.4	Training Program	23 days	50%	Thu 3/28/19	Mon 4/29/19	1704																														
1690	<b>5.5.2.5</b>	<b>Testing</b>	<b>226 days</b>	<b>95%</b>	<b>Wed 5/30/18</b>	<b>Wed 4/24/19</b>																															
1691	5.5.2.5.1	Prepare for Acceptance Testing (Schedule, Eqpt, Artifacts)	20 days	100%	Wed 5/30/18	Tue 6/26/18	1694,1692																														
1692	5.5.2.5.2	OSU Conduct Testing	40 days	100%	Wed 6/27/18	Wed 8/22/18	1693																														
1693	5.5.2.5.3	AbleLink Incorporate Findings from OSU Testing	66 days	100%	Thu 8/23/18	Thu 11/29/18	1688																														
1694	5.5.2.5.4	Conduct Acceptance Testing	10 days	100%	Tue 2/5/19	Tue 2/19/19	1695,1687																														





**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
1769	5.6.4.1.1.4	Vendor/RFP #2	80 days	0%	Wed 6/5/19	Thu 9/26/19	1791FF-5 day:																								
1770	5.6.4.1.1.5	Safety Management Plan Inputs	1 day	0%	Fri 9/27/19	Fri 9/27/19	557																								
1771	5.6.4.1.1.6	Operational Demonstrations	4 days	0%	Fri 9/27/19	Wed 10/2/19																									
1772	<b>5.6.4.1.2</b>	<b>Infrastructure - RFP #1</b>	<b>40 days</b>	<b>100%</b>	<b>Tue 10/30/18</b>	<b>Fri 12/28/18</b>																									
1773	5.6.4.1.2.1	Infrastructure enhancements	20 days	100%	Tue 10/30/18	Thu 11/29/18	1774																								
1774	5.6.4.1.2.2	RSU installation	20 days	100%	Fri 11/30/18	Fri 12/28/18																									
1775	<b>5.6.4.1.3</b>	<b>Infrastructure - RFP #2</b>	<b>40 days</b>	<b>0%</b>	<b>Fri 9/27/19</b>	<b>Mon 11/25/19</b>																									
1776	5.6.4.1.3.1	Infrastructure enhancements	20 days	0%	Fri 9/27/19	Fri 10/25/19	1777																								
1777	5.6.4.1.3.2	RSU installation	20 days	0%	Mon 10/28/19	Mon 11/25/19																									
1778	<b>5.6.4.2</b>	<b>Deployment</b>	<b>333 days</b>	<b>33%</b>	<b>Tue 10/9/18</b>	<b>Mon 2/10/20</b>																									
1779	<b>5.6.4.2.1</b>	<b>IRB Process (Vendor #2)</b>	<b>90 days</b>	<b>0%</b>	<b>Fri 9/27/19</b>	<b>Mon 2/10/20</b>																									
1780	5.6.4.2.1.1	Engage IRB	10 days	0%	Fri 9/27/19	Thu 10/10/19	1781																								
1781	5.6.4.2.1.2	Develop Participant Recruitment Plan	20 days	0%	Fri 10/11/19	Fri 11/8/19	1782																								
1782	5.6.4.2.1.3	Develop and Submit Human Use Approval Request for IRB	20 days	0%	Tue 11/12/19	Wed 12/11/19	1783																								
1783	5.6.4.2.1.4	IRB Review and Provide Findings (Initial)	10 days	0%	Thu 12/12/19	Thu 12/26/19	1784,518																								
1784	5.6.4.2.1.5	Update and Submit IRB Application	20 days	0%	Fri 12/27/19	Mon 1/27/20	1785																								
1785	5.6.4.2.1.6	IRB Review and Provide Findings (Revised)	10 days	0%	Tue 1/28/20	Mon 2/10/20																									
1786	<b>5.6.4.2.2</b>	<b>Verification</b>	<b>243 days</b>	<b>68%</b>	<b>Tue 10/9/18</b>	<b>Thu 9/26/19</b>																									
1787	<b>5.6.4.2.2.1</b>	<b>Vendor #1</b>	<b>15 days</b>	<b>100%</b>	<b>Tue 10/9/18</b>	<b>Mon 10/29/18</b>																									
1788	5.6.4.2.2.1.1	Component Verification	10 days	100%	Tue 10/9/18	Mon 10/22/18																									
1789	5.6.4.2.2.1.2	System Verification	5 days	100%	Tue 10/23/18	Mon 10/29/18	1795																								
1790	<b>5.6.4.2.2.2</b>	<b>Vendor #2</b>	<b>7 days</b>	<b>0%</b>	<b>Wed 9/18/19</b>	<b>Thu 9/26/19</b>																									
1791	5.6.4.2.2.2.1	Tabletop exercise	2 days	0%	Wed 9/18/19	Thu 9/19/19																									
1792	5.6.4.2.2.2.2	Factory acceptance testing (component verification)	5 days	0%	Fri 9/20/19	Thu 9/26/19	1802FF																								
1793	<b>5.6.4.2.3</b>	<b>Testing</b>	<b>264 days</b>	<b>56%</b>	<b>Tue 10/30/18</b>	<b>Tue 11/19/19</b>																									
1794	<b>5.6.4.2.3.1</b>	<b>Vendor #1</b>	<b>53 days</b>	<b>100%</b>	<b>Tue 10/30/18</b>	<b>Thu 1/17/19</b>																									
1795	5.6.4.2.3.1.1	Test Plan (Schedule, Eqpt, Artifacts)	17 days	100%	Tue 10/30/18	Mon 11/26/18	1796																								

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021									
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4							
1796	5.6.4.2.3.1.2	Conduct Acceptance Testing	10 days	100%	Tue 11/27/18	Mon 12/10/18	1797																														
1797	5.6.4.2.3.1.3	Review Results with Contractor	1 day	100%	Tue 12/11/18	Tue 12/11/18	1798																														
1798	5.6.4.2.3.1.4	Contractor Revisions based on Test Results	10 days	100%	Wed 12/12/18	Wed 12/26/18	1799																														
1799	5.6.4.2.3.1.5	Perform Regression Testing Until Acceptance	5 days	100%	Thu 12/27/18	Thu 1/3/19	1800																														
1800	5.6.4.2.3.1.6	Prepare and Submit Test Report (Test Logs)	10 days	100%	Fri 1/4/19	Thu 1/17/19	1809FF																														
1801	<b>5.6.4.2.3.2</b>	<b>Vendor #2</b>	<b>41 days</b>	<b>0%</b>	<b>Fri 9/20/19</b>	<b>Tue 11/19/19</b>																															
1802	5.6.4.2.3.2.1	Test Plan (Schedule, Eqpt, Artifacts)	5 days	0%	Fri 9/20/19	Thu 9/26/19	1803																														
1803	5.6.4.2.3.2.2	Conduct On-Site Acceptance Testing	10 days	0%	Fri 9/27/19	Thu 10/10/19	1804																														
1804	5.6.4.2.3.2.3	Review Results with Contractor	1 day	0%	Fri 10/11/19	Fri 10/11/19	1805																														
1805	5.6.4.2.3.2.4	Contractor Revisions based on Test Results	10 days	0%	Tue 10/15/19	Mon 10/28/19	1806																														
1806	5.6.4.2.3.2.5	Perform Regression Testing Until Acceptance	5 days	0%	Tue 10/29/19	Mon 11/4/19	1807																														
1807	5.6.4.2.3.2.6	Prepare and Submit Test Report (Test Logs)	10 days	0%	Tue 11/5/19	Tue 11/19/19	1810FF																														
1808	<b>5.6.4.3</b>	<b>Demonstration Period</b>	<b>463 days?</b>	<b>16%</b>	<b>Thu 1/17/19</b>	<b>Fri 11/20/20</b>																															
1809	5.6.4.3.1	Go Live (Vendor #1)	0 days	100%	Thu 1/17/19	Thu 1/17/19	1814,1816,90																														
1810	5.6.4.3.2	Go Live (Vendor #2)	0 days	0%	Tue 11/19/19	Tue 11/19/19	1815,1817,90																														
1811	5.6.4.3.3	Integration to Operating System (Vendor #1)	20 days	100%	Fri 1/18/19	Fri 2/15/19																															
1812	5.6.4.3.4	Integration to Operating System (Vendor #2)	20 days	0%	Wed 11/20/19	Thu 12/19/19																															
1813	5.6.4.3.5	Webinar: Presentation of Linden Deployment	1 day?	0%	Fri 12/13/19	Fri 12/13/19																															
1814	5.6.4.3.6	Performance and System Monitoring (Vendor #1)	240 days	30%	Fri 1/18/19	Fri 1/3/20																															
1815	5.6.4.3.7	Performance and System Monitoring (Vendor #2)	252 days	0%	Wed 11/20/19	Fri 11/20/20																															
1816	5.6.4.3.8	Data Collection (Vendor #1)	240 days	30%	Fri 1/18/19	Fri 1/3/20	1820FF																														
1817	5.6.4.3.9	Data Collection (Vendor #2)	252 days	0%	Wed 11/20/19	Fri 11/20/20	1820FF,1822F																														
1818	<b>5.6.4.4</b>	<b>Documentation</b>	<b>89 days?</b>	<b>0%</b>	<b>Thu 9/24/20</b>	<b>Thu 2/4/21</b>																															
1819	<b>5.6.4.4.1</b>	<b>Draft Demonstration Summary</b>	<b>89 days?</b>	<b>0%</b>	<b>Thu 9/24/20</b>	<b>Thu 2/4/21</b>																															
1820	5.6.4.4.1.1	Lessons Learned	30 days	0%	Thu 10/8/20	Fri 11/20/20																															
1821	<b>5.6.4.4.1.2</b>	<b>Deployment Playbook</b>	<b>47 days?</b>	<b>0%</b>	<b>Thu 9/24/20</b>	<b>Thu 12/3/20</b>																															
1822	5.6.4.4.1.2.1	User acceptance	20 days	0%	Thu 9/24/20	Thu 10/22/20	1823,1824																														

Smart City Schedule		Smart Columbus Project - All Activities																																					
Cooperative Agreement No. DTFH6116H00013																																							
ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016		2017				2018				2019				2020				2021													
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4									
1823	5.6.4.4.1.2.2	Interoperability	15 days	0%	Fri 10/23/20	Fri 11/13/20	1825																																
1824	5.6.4.4.1.2.3	Safety	10 days	0%	Fri 10/23/20	Thu 11/5/20																																	
1825	5.6.4.4.1.2.4	CoC Review	5 days	0%	Mon 11/16/20	Fri 11/20/20	1826																																
1826	5.6.4.4.1.2.5	Update Playbook	5 days	0%	Mon 11/23/20	Tue 12/1/20	1827,1828																																
1827	5.6.4.4.1.2.6	QA/QC	1 day?	0%	Wed 12/2/20	Wed 12/2/20																																	
1828	5.6.4.4.1.2.7	CoC Final Review	1 day?	0%	Wed 12/2/20	Wed 12/2/20	1829																																
1829	5.6.4.4.1.2.8	Submit Draft Lessons Learned and Deployment Playbook	1 day?	0%	Thu 12/3/20	Thu 12/3/20	1830																																
1830	5.6.4.4.1.3	USDOT Review of Lessons Learned and Deployment Playbook	10 days	0%	Fri 12/4/20	Thu 12/17/20	1831,1832																																
1831	<b>5.6.4.4.1.4</b>	<b>Final Lessons Learned and Deployment Playbook</b>	<b>32 days?</b>	<b>0%</b>	<b>Fri 12/18/20</b>	<b>Thu 2/4/21</b>																																	
1832	5.6.4.4.1.4.1	USDOT Comments	1 day?	0%	Fri 12/18/20	Fri 12/18/20	1833																																
1833	5.6.4.4.1.4.2	Update Playbook	20 days	0%	Mon 12/21/20	Wed 1/20/21	1834																																
1834	5.6.4.4.1.4.3	CoC Review	5 days	0%	Thu 1/21/21	Wed 1/27/21	1835																																
1835	5.6.4.4.1.4.4	QA/QC	5 days	0%	Thu 1/28/21	Wed 2/3/21	1836FF																																
1836	5.6.4.4.1.4.5	CoC Final Review	1 day?	0%	Wed 2/3/21	Wed 2/3/21	1837																																
1837	5.6.4.4.1.4.6	Submit Draft Lessons Learned and Deployment Playbook	1 day?	0%	Thu 2/4/21	Thu 2/4/21																																	
1838	<b>5.7</b>	<b>Event Parking Management (EPM)</b>	<b>1163 days?</b>	<b>40%</b>	<b>Thu 8/18/16</b>	<b>Tue 3/23/21</b>																																	
1839	<b>5.7.1</b>	<b>Phase I - Systems Engineering</b>	<b>887 days?</b>	<b>70%</b>	<b>Thu 8/18/16</b>	<b>Thu 2/13/20</b>																																	
1840	<b>5.7.1.1</b>	<b>EPM Strategy Plan</b>	<b>167 days</b>	<b>100%</b>	<b>Thu 8/18/16</b>	<b>Fri 4/7/17</b>																																	
1845	<b>5.7.1.2</b>	<b>EPM Concept of Operations (ConOps)</b>	<b>796 days</b>	<b>90%</b>	<b>Fri 12/2/16</b>	<b>Thu 1/23/20</b>																																	
1846	<b>5.7.1.2.1</b>	<b>Draft Event Parking Management ConOps</b>	<b>166 days</b>	<b>100%</b>	<b>Fri 12/2/16</b>	<b>Fri 7/21/17</b>																																	
1852	<b>5.7.1.2.2</b>	<b>Event Parking Management ConOps Walkthrough</b>	<b>2 days</b>	<b>100%</b>	<b>Wed 8/9/17</b>	<b>Fri 8/11/17</b>																																	
1857	<b>5.7.1.2.3</b>	<b>Additional End User Engagement</b>	<b>69 days</b>	<b>100%</b>	<b>Mon 1/22/18</b>	<b>Fri 4/27/18</b>																																	
1863	<b>5.7.1.2.4</b>	<b>Final Event Parking Management ConOps</b>	<b>71 days</b>	<b>100%</b>	<b>Tue 4/3/18</b>	<b>Thu 7/12/18</b>																																	
1878	<b>5.7.1.2.5</b>	<b>ConOps Refresh</b>	<b>41 days</b>	<b>0%</b>	<b>Thu 11/21/19</b>	<b>Thu 1/23/20</b>																																	
1879	5.7.1.2.5.1	Update ConOps per SDD Changes	20 days	0%	Thu 11/21/19	Fri 12/20/19	1880																																
1880	5.7.1.2.5.2	CoC Review	5 days	0%	Mon 12/23/19	Mon 12/30/19	1881																																
1881	5.7.1.2.5.3	Address CoC Comments ConOps	5 days	0%	Tue 12/31/19	Tue 1/7/20	1882																																

Smart City Schedule		Smart Columbus Project - All Activities																												
Cooperative Agreement No. DTFH6116H00013																														
ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1882	5.7.1.2.5.4	CoC Final Review	1 day	0%	Wed 1/8/20	Wed 1/8/20	1883																							
1883	5.7.1.2.5.5	Submit Final Revised ConOps	0 days	0%	Wed 1/8/20	Wed 1/8/20	1884																							
1884	5.7.1.2.5.6	USDOT Review Final Revised ConOps	10 days	0%	Thu 1/9/20	Thu 1/23/20	1885																							
1885	5.7.1.2.5.7	Receive DOT Approval on Revised ConOps	0 days	0%	Thu 1/23/20	Thu 1/23/20																								
1886	<b>5.7.1.3</b>	<b>EPM System Requirements Specification (SyRS)</b>	<b>396 days</b>	<b>76%</b>	<b>Fri 7/13/18</b>	<b>Thu 2/13/20</b>																								
1887	<b>5.7.1.3.1</b>	<b>Draft Event Parking Management SyRS</b>	<b>61 days</b>	<b>100%</b>	<b>Fri 7/13/18</b>	<b>Tue 10/9/18</b>																								
1894	<b>5.7.1.3.2</b>	<b>Final Event Parking Management SyRS</b>	<b>42 days</b>	<b>100%</b>	<b>Wed 10/10/18</b>	<b>Tue 12/11/18</b>																								
1895	5.7.1.3.2.1	Update Final Event Parking Management SyRS	31 days	100%	Wed 10/10/18	Mon 11/26/18	1898,1896SS+																							
1896	5.7.1.3.2.2	Public Comment Period for EPM SyRS	10 days	100%	Thu 11/8/18	Mon 11/26/18	1897SS+4 day																							
1897	5.7.1.3.2.3	Webinar for EPM SyRS	1 day	100%	Thu 11/15/18	Thu 11/15/18																								
1898	5.7.1.3.2.4	CoC Review	5 days	100%	Tue 11/27/18	Mon 12/3/18	1899																							
1899	5.7.1.3.2.5	Address coC Comments EPM SyRS	5 days	100%	Tue 12/4/18	Mon 12/10/18	1900																							
1900	5.7.1.3.2.6	CoC Final Review	1 day	100%	Tue 12/11/18	Tue 12/11/18	1901																							
1901	5.7.1.3.2.7	Submit Final Event Parking Management SyRS	0 days	100%	Tue 12/11/18	Tue 12/11/18	650,408FS+10																							
1902	<b>5.7.1.3.3</b>	<b>SyRS Refresh</b>	<b>36 days</b>	<b>0%</b>	<b>Mon 12/23/19</b>	<b>Thu 2/13/20</b>																								
1903	5.7.1.3.3.1	Update SyRS per SDD Changes	15 days	0%	Mon 12/23/19	Tue 1/14/20	1904																							
1904	5.7.1.3.3.2	CoC Review	5 days	0%	Wed 1/15/20	Wed 1/22/20	1905																							
1905	5.7.1.3.3.3	Address CoC Comments SyRS	5 days	0%	Thu 1/23/20	Wed 1/29/20	1906																							
1906	5.7.1.3.3.4	CoC Final Review	1 day	0%	Thu 1/30/20	Thu 1/30/20	1907																							
1907	5.7.1.3.3.5	Submit Final Revised Event Parking Management SyRS	0 days	0%	Thu 1/30/20	Thu 1/30/20	1908																							
1908	5.7.1.3.3.6	USDOT Review Final Revised SyRS	10 days	0%	Fri 1/31/20	Thu 2/13/20	1909																							
1909	5.7.1.3.3.7	Receive DOT Approval on Revised SyRS	0 days	0%	Thu 2/13/20	Thu 2/13/20																								
1910	<b>5.7.1.4</b>	<b>EPM Interface Control Document (ICD)</b>	<b>62 days?</b>	<b>16%</b>	<b>Thu 12/27/18</b>	<b>Wed 3/27/19</b>																								
1911	<b>5.7.1.4.1</b>	<b>Draft Event Parking Management Interfaces</b>	<b>41 days?</b>	<b>24%</b>	<b>Thu 12/27/18</b>	<b>Tue 2/26/19</b>																								
1912	5.7.1.4.1.1	Prepare Draft Event Parking Management Interfaces	20 days	50%	Thu 12/27/18	Fri 1/25/19	1913																							
1913	5.7.1.4.1.2	COC Review of Draft Event Parking Management Interfaces	5 days	0%	Mon 1/28/19	Fri 2/1/19	1914																							
1914	5.7.1.4.1.3	Address CoC Comments Draft EPM Interfaces	5 days	0%	Mon 2/4/19	Fri 2/8/19	1916,1915																							



**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021									
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
1915	5.7.1.4.1.4	QA/QC	1 day?	0%	Mon 2/11/19	Mon 2/11/19																															
1916	5.7.1.4.1.5	CoC Final Review	1 day	0%	Mon 2/11/19	Mon 2/11/19	1917																														
1917	5.7.1.4.1.6	Submit Draft Event Parking Management Interfaces (Task B)	0 days	0%	Mon 2/11/19	Mon 2/11/19	1929,1918																														
1918	5.7.1.4.1.7	USDOT Review Draft Event Parking Management Interfaces	10 days	0%	Tue 2/12/19	Tue 2/26/19	1920																														
1919	<b>5.7.1.4.2</b>	<b>Final Event Parking Management Interfaces</b>	<b>21 days?</b>	<b>0%</b>	<b>Tue 2/26/19</b>	<b>Wed 3/27/19</b>																															
1920	5.7.1.4.2.1	Receive USDOT Comments on Draft Event Parking Management Interfaces	0 days	0%	Tue 2/26/19	Tue 2/26/19	1921																														
1921	5.7.1.4.2.2	Update Event Parking Management Interfaces	10 days	0%	Wed 2/27/19	Tue 3/12/19	1922																														
1922	5.7.1.4.2.3	CoC Review	5 days	0%	Wed 3/13/19	Tue 3/19/19	1923																														
1923	5.7.1.4.2.4	Address CoC Comments EPM Interfaces	5 days	0%	Wed 3/20/19	Tue 3/26/19	1925,1924																														
1924	5.7.1.4.2.5	QA/QC	1 day?	0%	Wed 3/27/19	Wed 3/27/19																															
1925	5.7.1.4.2.6	CoC Final Review	1 day	0%	Wed 3/27/19	Wed 3/27/19	1926																														
1926	5.7.1.4.2.7	Submit Final Event Parking Management Interfaces	0 days	0%	Wed 3/27/19	Wed 3/27/19																															
1927	<b>5.7.1.5</b>	<b>EPM System Design Document (SDD)</b>	<b>186 days?</b>	<b>0%</b>	<b>Tue 2/12/19</b>	<b>Tue 11/5/19</b>																															
1928	<b>5.7.1.5.1</b>	<b>Draft Event Parking Management System Design Document</b>	<b>81 days?</b>	<b>0%</b>	<b>Tue 2/12/19</b>	<b>Thu 6/6/19</b>																															
1929	5.7.1.5.1.1	Prepare Draft Event Parking Management System Design Docu	60 days	0%	Tue 2/12/19	Tue 5/7/19	1930																														
1930	5.7.1.5.1.2	COC Review of Draft SDD Event Parking Management	5 days	0%	Wed 5/8/19	Tue 5/14/19	1931																														
1931	5.7.1.5.1.3	Address CoC Comments Draft EPM SDD	5 days	0%	Wed 5/15/19	Tue 5/21/19	1933,1932																														
1932	5.7.1.5.1.4	QA/QC	1 day?	0%	Wed 5/22/19	Wed 5/22/19																															
1933	5.7.1.5.1.5	CoC Final Review	1 day	0%	Wed 5/22/19	Wed 5/22/19	1934																														
1934	5.7.1.5.1.6	Submit Draft Event Parking Management System Design Document (Task B)	0 days	0%	Wed 5/22/19	Wed 5/22/19	1947,1935																														
1935	5.7.1.5.1.7	USDOT Review Draft Event Parking Management System Design Document	10 days	0%	Thu 5/23/19	Thu 6/6/19	1937																														
1936	<b>5.7.1.5.2</b>	<b>Final Event Parking Management System Design Document</b>	<b>105 days</b>	<b>0%</b>	<b>Thu 6/6/19</b>	<b>Tue 11/5/19</b>																															
1937	5.7.1.5.2.1	Receive USDOT Comments on Draft Event Parking Management System Design Document	0 days	0%	Thu 6/6/19	Thu 6/6/19	1938																														

Smart Columbus Project - All Activities

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1938	5.7.1.5.2.2	Update Final Event Parking Management System Design Docur	20 days	0%	Mon 9/23/19	Mon 10/21/19	1941,1939SS+																							
1939	5.7.1.5.2.3	Public Comment Period for EPM ICD and SDD	10 days	0%	Mon 10/7/19	Mon 10/21/19	1940SS+5 day																							
1940	5.7.1.5.2.4	Webinar for EPM ICD and SDD	1 day	0%	Tue 10/15/19	Tue 10/15/19																								
1941	5.7.1.5.2.5	CoC Review	5 days	0%	Tue 10/22/19	Mon 10/28/19	1942																							
1942	5.7.1.5.2.6	Address CoC Comments EPM System Design Document	5 days	0%	Tue 10/29/19	Mon 11/4/19	1943																							
1943	5.7.1.5.2.7	CoC Final Review	1 day	0%	Tue 11/5/19	Tue 11/5/19	1944																							
1944	5.7.1.5.2.8	Submit Final Event Parking Management System Design Docun	0 days	0%	Tue 11/5/19	Tue 11/5/19	642FS+10 day																							
1945	<b>5.7.1.6</b>	<b>EPM Test Plan (TP)</b>	<b>105 days?</b>	<b>0%</b>	<b>Thu 5/23/19</b>	<b>Tue 10/22/19</b>																								
1946	<b>5.7.1.6.1</b>	<b>Draft Event Parking Management Test Plan</b>	<b>51 days?</b>	<b>0%</b>	<b>Thu 5/23/19</b>	<b>Mon 8/5/19</b>																								
1947	5.7.1.6.1.1	Prepare Draft Event Parking Management Test Plan	30 days	0%	Thu 5/23/19	Fri 7/5/19	1948																							
1948	5.7.1.6.1.2	COC Review of Event Parking Management Test Plan	5 days	0%	Mon 7/8/19	Fri 7/12/19	1949																							
1949	5.7.1.6.1.3	Address CoC Comments Draft EPM Test Plan	5 days	0%	Mon 7/15/19	Fri 7/19/19	1951,1950																							
1950	5.7.1.6.1.4	QA/QC	1 day?	0%	Mon 7/22/19	Mon 7/22/19																								
1951	5.7.1.6.1.5	CoC Final Review	1 day	0%	Mon 7/22/19	Mon 7/22/19	1952																							
1952	5.7.1.6.1.6	Submit Draft Event Parking Management Test Plan (Task B)	0 days	0%	Mon 7/22/19	Mon 7/22/19	1953																							
1953	5.7.1.6.1.7	USDOT Review Draft Event Parking Management Test Plan	10 days	0%	Tue 7/23/19	Mon 8/5/19	1955																							
1954	<b>5.7.1.6.2</b>	<b>Final Event Parking Management Test Plan</b>	<b>54 days?</b>	<b>0%</b>	<b>Mon 8/5/19</b>	<b>Tue 10/22/19</b>																								
1955	5.7.1.6.2.1	Receive USDOT Comments on Draft Event Parking Management Test Plan	0 days	0%	Mon 8/5/19	Mon 8/5/19	1958,1956																							
1956	5.7.1.6.2.2	Public Comment Period for EPM Test Plan	10 days	0%	Tue 8/6/19	Mon 8/19/19	1957SS+5 day																							
1957	5.7.1.6.2.3	Webinar for EPM Test Plan	1 day	0%	Tue 8/13/19	Tue 8/13/19																								
1958	5.7.1.6.2.4	Update Event Parking Management Test Plan	10 days	0%	Mon 9/23/19	Fri 10/4/19	1959																							
1959	5.7.1.6.2.5	CoC Review	5 days	0%	Mon 10/7/19	Fri 10/11/19	1960																							
1960	5.7.1.6.2.6	Address CoC Comments EPM Test Plan	5 days	0%	Tue 10/15/19	Mon 10/21/19	1962,1961																							
1961	5.7.1.6.2.7	QA/QC	1 day?	0%	Tue 10/22/19	Tue 10/22/19																								
1962	5.7.1.6.2.8	CoC Final Review	1 day	0%	Tue 10/22/19	Tue 10/22/19	1963																							
1963	5.7.1.6.2.9	Submit Final Event Parking Management Test Plan	0 days	0%	Tue 10/22/19	Tue 10/22/19	2027FS+10 da																							

**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1964	<b>5.7.2</b>	<b>Phase II - Develop, Procure, Deploy</b>	<b>697 days?</b>	<b>11%</b>	<b>Thu 6/7/18</b>	<b>Tue 3/23/21</b>																								
1965	<b>5.7.2.1</b>	<b>Vendor Selection</b>	<b>227 days</b>	<b>43%</b>	<b>Thu 10/25/18</b>	<b>Fri 9/20/19</b>																								
1966	5.7.2.1.1	Develop Procurement Criteria	30 days	100%	Thu 10/25/18	Mon 12/10/18	1967																							
1967	5.7.2.1.2	CoC Review/Approval	30 days	100%	Thu 11/29/18	Fri 1/11/19	1968																							
1968	5.7.2.1.3	Submitted Vendor Recommendation for USDOT	25 days	100%	Mon 1/14/19	Tue 2/19/19	1969																							
1969	5.7.2.1.4	USDOT Response	10 days	100%	Wed 2/20/19	Tue 3/5/19	1970																							
1970	5.7.2.1.5	Submitted Response to USDOT	5 days	100%	Wed 3/6/19	Tue 3/12/19	1971																							
1971	5.7.2.1.6	Procurement Decision	28 days	0%	Wed 3/13/19	Fri 4/19/19	1972																							
1972	5.7.2.1.7	RFP or Contract Development	20 days	0%	Mon 4/22/19	Fri 5/17/19	1973																							
1973	5.7.2.1.8	Vendor Response	15 days	0%	Mon 5/20/19	Mon 6/10/19	1974																							
1974	5.7.2.1.9	Receive vendor proposals	1 day	0%	Tue 6/11/19	Tue 6/11/19	1975																							
1975	5.7.2.1.10	City review vendor proposals	10 days	0%	Wed 6/12/19	Tue 6/25/19	1976																							
1976	5.7.2.1.11	CoC Evaluation	5 days	0%	Wed 6/26/19	Tue 7/2/19	1977																							
1977	5.7.2.1.12	Select responsive and responsible contractor	5 days	0%	Wed 7/3/19	Wed 7/10/19	1978																							
1978	5.7.2.1.13	Prepare recommendation memo for signature	2 days	0%	Thu 7/11/19	Fri 7/12/19	1979																							
1979	5.7.2.1.14	Recommend vendor to CINO	3 days	0%	Mon 7/15/19	Wed 7/17/19	1980																							
1980	5.7.2.1.15	Receive letter of contractor approval from CINO	1 day	0%	Thu 7/18/19	Thu 7/18/19	1982																							
1981	<b>5.7.2.1.16</b>	<b>Legislation Process</b>	<b>30 days</b>	<b>0%</b>	<b>Fri 7/19/19</b>	<b>Thu 8/29/19</b>																								
1982	5.7.2.1.16.1	Prepare legislation and submit to Fiscal (2 working days)	2 days	0%	Fri 7/19/19	Mon 7/22/19	1983																							
1983	5.7.2.1.16.2	Fiscal modifies and processes legislation (6 working days)	6 days	0%	Tue 7/23/19	Tue 7/30/19	1984																							
1984	5.7.2.1.16.3	To Administrator (2 working days)	2 days	0%	Wed 7/31/19	Thu 8/1/19	1985																							
1985	5.7.2.1.16.4	To CIFO (4 working days)	3 days	0%	Fri 8/2/19	Tue 8/6/19	1986																							
1986	5.7.2.1.16.5	To Finance (7 working days)	3 days	0%	Wed 8/7/19	Fri 8/9/19	1987																							
1987	5.7.2.1.16.6	To Equal Business Opportunity (4 working days)	2 days	0%	Mon 8/12/19	Tue 8/13/19	1988																							
1988	5.7.2.1.16.7	To Auditor (2 working days)	2 days	0%	Wed 8/14/19	Thu 8/15/19	1989																							
1989	5.7.2.1.16.8	To City Attorney (2 working days)	2 days	0%	Fri 8/16/19	Mon 8/19/19	1990																							
1990	5.7.2.1.16.9	To City Clerk (6 working days min.)	6 days	0%	Tue 8/20/19	Tue 8/27/19	1991																							



**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2018	5.7.2.4.4	IRB Review and Provide Findings (Initial)	10 days	0%	Mon 11/25/19	Tue 12/10/19	2019,518																							
2019	5.7.2.4.5	Update and Submit IRB Application (if needed)	30 days	0%	Wed 12/11/19	Fri 1/24/20	2020																							
2020	5.7.2.4.6	IRB Review and Provide Findings (Revised)	10 days	0%	Mon 1/27/20	Fri 2/7/20	2024																							
2021	<b>5.7.2.5</b>	<b>Product Development</b>	<b>124 days</b>	<b>0%</b>	<b>Mon 9/23/19</b>	<b>Tue 3/24/20</b>																								
2022	5.7.2.5.1	Product Delivery	4 mons	0%	Mon 9/23/19	Tue 1/21/20	2023,2015SS																							
2023	5.7.2.5.2	Refinements and Updates to App based on Smart Columbus Need	20 days	0%	Wed 1/22/20	Wed 2/19/20	2026FF																							
2024	5.7.2.5.3	Preparation for Deployment	10 days	0%	Wed 3/11/20	Tue 3/24/20	2040																							
2025	<b>5.7.2.6</b>	<b>Testing</b>	<b>55 days?</b>	<b>0%</b>	<b>Wed 2/5/20</b>	<b>Wed 4/22/20</b>																								
2026	5.7.2.6.1	Prepare for Acceptance Testing (Schedule, Eqpt, Artifacts)	10 days	0%	Wed 2/5/20	Wed 2/19/20	2027																							
2027	5.7.2.6.2	Conduct Acceptance Testing	6 days	0%	Thu 2/20/20	Thu 2/27/20	2028																							
2028	5.7.2.6.3	Review Results with Contractor	1 day	0%	Fri 2/28/20	Fri 2/28/20	2029																							
2029	5.7.2.6.4	Contractor Revisions based on Test Results	7 days	0%	Mon 3/2/20	Tue 3/10/20	2024,2030,20																							
2030	5.7.2.6.5	Perform Regression Testing Until Acceptance	6 days	0%	Wed 3/11/20	Wed 3/18/20																								
2031	<b>5.7.2.6.6</b>	<b>Test Plan and Results</b>	<b>31 days?</b>	<b>0%</b>	<b>Wed 3/11/20</b>	<b>Wed 4/22/20</b>																								
2032	5.7.2.6.6.1	Develop Draft Test Plan and Results	9 days	0%	Wed 3/11/20	Mon 3/23/20	2033																							
2033	5.7.2.6.6.2	CoC Review	3 days	0%	Tue 3/24/20	Thu 3/26/20	2034																							
2034	5.7.2.6.6.3	Update Draft Test Plan and Results	3 days	0%	Fri 3/27/20	Tue 3/31/20	2035,2036																							
2035	5.7.2.6.6.4	QA/QC	1 day?	0%	Wed 4/1/20	Wed 4/1/20																								
2036	5.7.2.6.6.5	Submit Draft Test Plan and Results to USDOT	1 day?	0%	Wed 4/1/20	Wed 4/1/20	2037																							
2037	5.7.2.6.6.6	Receive USDOT Comments on Draft Test Plan and Results	10 days	0%	Thu 4/2/20	Wed 4/15/20	2038																							
2038	5.7.2.6.6.7	Update Draft Test Plan and Results	5 days	0%	Thu 4/16/20	Wed 4/22/20																								
2039	<b>5.7.2.7</b>	<b>Demonstration Period</b>	<b>249 days</b>	<b>0%</b>	<b>Tue 3/24/20</b>	<b>Tue 3/23/21</b>																								
2040	5.7.2.7.1	Go Live	0 days	0%	Tue 3/24/20	Tue 3/24/20	2013FF-22 da																							
2041	5.7.2.7.2	Performance and System Monitoring	249 days	0%	Wed 3/25/20	Tue 3/23/21	246,2043FF																							
2042	5.7.2.7.3	Data Collection	249 days	0%	Wed 3/25/20	Tue 3/23/21	2043FF																							
2043	5.7.2.7.4	O&M Plan Final Update	20 days	0%	Wed 2/24/21	Tue 3/23/21																								
2044	<b>5.8</b>	<b>Prenatal Trip Assistance (PTA)</b>	<b>824 days?</b>	<b>36%</b>	<b>Fri 9/8/17</b>	<b>Fri 12/18/20</b>																								





**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021							
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
2137	6.1.2.10	Prep and Request USDOT Comments Clarifications	12 days	100%	Mon 5/1/17	Tue 5/16/17	2138																											
2138	6.1.2.11	Receive USDOT Clarifications Response	30 days	100%	Wed 5/17/17	Tue 6/27/17	2139																											
2139	6.1.2.12	Resubmit Final Comm Plan to USDOT (v3)	2 days	100%	Thu 6/29/17	Fri 6/30/17	2140																											
2140	6.1.2.13	Receive USDOT Comments (v3)	12 days	100%	Fri 6/30/17	Mon 7/17/17	2141,2157																											
2141	6.1.2.14	Receive Comment Clarifications (v3) via call	5 days	100%	Wed 7/19/17	Tue 7/25/17	2142																											
2142	6.1.2.15	Create Comm Plan (v4)	60 days	100%	Wed 7/26/17	Tue 10/17/17																												
2143	6.1.2.16	Update Communications Plan	40 days	100%	Mon 8/20/18	Tue 10/16/18	2144																											
2144	6.1.2.17	USDOT Review of Draft Communications Plan	10 days	100%	Wed 10/17/18	Tue 10/30/18	2145																											
2145	6.1.2.18	Revise to Final Communications Plan	20 days	100%	Wed 10/31/18	Fri 11/30/18	2146																											
2146	6.1.2.19	USDOT Review of Final Communications Plan	10 days	100%	Mon 12/3/18	Fri 12/14/18	2147																											
2147	6.1.2.20	Quarterly Update #1 of Communications Plan	10 days	100%	Mon 3/18/19	Fri 3/29/19																												
2148	<b>6.1.3</b>	<b>508 Compliant Documentation</b>	<b>119 days</b>	<b>100%</b>	<b>Thu 2/9/17</b>	<b>Tue 7/25/17</b>																												
2158	<b>6.2</b>	<b>Public Relations and Marketing Material Development</b>	<b>451 days</b>	<b>100%</b>	<b>Tue 11/15/16</b>	<b>Tue 8/7/18</b>																												
2159	<b>6.2.1</b>	<b>Communication Toolkit</b>	<b>413 days</b>	<b>100%</b>	<b>Fri 1/6/17</b>	<b>Tue 8/7/18</b>																												
2160	<b>6.2.1.1</b>	<b>Year 1 Toolkit</b>	<b>167 days</b>	<b>100%</b>	<b>Fri 1/6/17</b>	<b>Mon 8/28/17</b>																												
2168	<b>6.2.1.2</b>	<b>Year 2 Toolkit</b>	<b>246 days</b>	<b>100%</b>	<b>Tue 8/29/17</b>	<b>Tue 8/7/18</b>																												
2176	<b>6.2.2</b>	<b>Brand Development</b>	<b>124 days</b>	<b>100%</b>	<b>Tue 11/15/16</b>	<b>Fri 5/5/17</b>	2187SS+11 da																											
2184	<b>6.3</b>	<b>Outreach Products</b>	<b>991 days</b>	<b>61%</b>	<b>Mon 9/19/16</b>	<b>Wed 8/12/20</b>																												
2185	<b>6.3.1</b>	<b>Smart Columbus Website</b>	<b>977 days</b>	<b>61%</b>	<b>Tue 11/15/16</b>	<b>Wed 8/12/20</b>																												
2186	6.3.1.1	Website Strategy	5 days	100%	Tue 11/15/16	Mon 11/21/16																												
2187	6.3.1.2	Website Design	15 days	100%	Fri 12/2/16	Thu 12/22/16	2188																											
2188	6.3.1.3	Website Design Review by City of Columbus (Task G)	5 days	100%	Mon 1/9/17	Fri 1/13/17	2189																											
2189	6.3.1.4	Revise Design per Comments	5 days	100%	Tue 1/17/17	Mon 1/23/17	2190																											
2190	6.3.1.5	Submittal of Final Website Design to City	0 days	100%	Mon 1/23/17	Mon 1/23/17	2191																											
2191	6.3.1.6	City Review of Final Design	3 days	100%	Tue 1/24/17	Thu 1/26/17	2192																											
2192	6.3.1.7	Incorporate Website Design Edits	13 days	100%	Fri 1/27/17	Tue 2/14/17	2193																											
2193	6.3.1.8	City Final Approval	0 days	100%	Tue 2/14/17	Tue 2/14/17	2194FS+21 da																											







**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016			2017				2018				2019				2020				2021			
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2252	6.3.2.1.5	Workshop/Conference/Trade Show Preparation 5	10 days	100%	Mon 5/22/17	Fri 6/2/17																								
2253	6.3.2.1.6	Workshop/Conference/Trade Show Preparation 6	10 days	100%	Mon 7/17/17	Fri 7/28/17																								
2254	6.3.2.1.7	Workshop/Conference/Trade Show Preparation 7	10 days	100%	Mon 9/18/17	Fri 9/29/17																								
2255	6.3.2.1.8	Workshop/Conference/Trade Show Preparation 8	10 days	100%	Mon 11/20/17	Fri 12/1/17																								
2256	6.3.2.1.9	Workshop/Conference/Trade Show Preparation 9	10 days	100%	Mon 1/22/18	Fri 2/2/18																								
2257	6.3.2.1.10	Workshop/Conference/Trade Show Preparation 10	10 days	100%	Mon 3/19/18	Fri 3/30/18																								
2258	6.3.2.1.11	Workshop/Conference/Trade Show Preparation 11	10 days	100%	Mon 5/21/18	Mon 6/4/18																								
2259	6.3.2.1.12	Workshop/Conference/Trade Show Preparation 12	10 days	100%	Mon 7/16/18	Fri 7/27/18																								
2260	6.3.2.1.13	Workshop/Conference/Trade Show Preparation 13	10 days	100%	Mon 9/17/18	Fri 9/28/18																								
2261	6.3.2.1.14	Workshop/Conference/Trade Show Preparation 14	10 days	100%	Mon 11/19/18	Tue 12/4/18																								
2262	6.3.2.1.15	Workshop/Conference/Trade Show Preparation 15	10 days	0%	Tue 1/22/19	Mon 2/4/19																								
2263	6.3.2.1.16	Workshop/Conference/Trade Show Preparation 16	10 days	0%	Mon 3/18/19	Fri 3/29/19																								
2264	6.3.2.1.17	Workshop/Conference/Trade Show Preparation 17	10 days	0%	Mon 5/20/19	Mon 6/3/19																								
2265	6.3.2.1.18	Workshop/Conference/Trade Show Preparation 18	10 days	0%	Mon 7/22/19	Fri 8/2/19																								
2266	6.3.2.1.19	Workshop/Conference/Trade Show Preparation 19	10 days	0%	Mon 9/16/19	Fri 9/27/19																								
2267	6.3.2.1.20	Workshop/Conference/Trade Show Preparation 20	10 days	0%	Mon 11/18/19	Tue 12/3/19																								
2268	6.3.2.1.21	Workshop/Conference/Trade Show Preparation 21	10 days	0%	Tue 1/21/20	Mon 2/3/20																								
2269	6.3.2.1.22	Workshop/Conference/Trade Show Preparation 22	10 days	0%	Mon 3/16/20	Fri 3/27/20																								
2270	6.3.2.1.23	Workshop/Conference/Trade Show Preparation 23	10 days	0%	Mon 5/18/20	Mon 6/1/20																								
2271	6.3.2.1.24	Workshop/Conference/Trade Show Preparation 24	10 days	0%	Mon 7/20/20	Fri 7/31/20																								
2272	<b>6.3.2.2</b>	<b>Workshop/Conference/Trade Show Attendance</b>	<b>977 days</b>	<b>58%</b>	<b>Mon 9/19/16</b>	<b>Thu 7/23/20</b>																								
2273	6.3.2.2.1	Workshop/Conference/Trade Show Attendance 1	4 days	100%	Mon 9/19/16	Thu 9/22/16																								
2274	6.3.2.2.2	Workshop/Conference/Trade Show Attendance 2	4 days	100%	Mon 11/21/16	Thu 11/24/16																								
2275	6.3.2.2.3	Workshop/Conference/Trade Show Attendance 3	4 days	100%	Tue 1/17/17	Fri 1/20/17																								
2276	6.3.2.2.4	Workshop/Conference/Trade Show Attendance 4	4 days	100%	Mon 3/20/17	Thu 3/23/17																								
2277	6.3.2.2.5	Workshop/Conference/Trade Show Attendance 5	4 days	100%	Mon 5/22/17	Thu 5/25/17																								
2278	6.3.2.2.6	Workshop/Conference/Trade Show Attendance 6	4 days	100%	Mon 7/17/17	Thu 7/20/17																								



**Smart Columbus Project - All Activities**

ID	Outline Number	Task Name	Duration	% Complete	Start	Finish	Successors	2016				2017				2018				2019				2020				2021							
								Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
2306	<b>6.3.3.2</b>	<b>Webinar Participation</b>	<b>387 days</b>	<b>100%</b>	<b>Tue 10/11/16</b>	<b>Mon 4/9/18</b>																													
2307	6.3.3.2.1	Webinar Participation 1	1 day	100%	Tue 10/11/16	Tue 10/11/16	2300																												
2308	6.3.3.2.2	Webinar Participation 2	1 day	100%	Tue 1/10/17	Tue 1/10/17	2301																												
2309	6.3.3.2.3	Webinar Participation 3	1 day	100%	Mon 4/10/17	Mon 4/10/17	2302																												
2310	6.3.3.2.4	Webinar Participation 4	1 day	100%	Tue 7/11/17	Tue 7/11/17	2303																												
2311	6.3.3.2.5	Webinar Participation 5	1 day	100%	Mon 10/9/17	Mon 10/9/17	2304																												
2312	6.3.3.2.6	Webinar Participation 6	1 day	100%	Mon 1/8/18	Mon 1/8/18	2305																												
2313	6.3.3.2.7	Webinar Participation 7	1 day	100%	Mon 4/9/18	Mon 4/9/18																													
2314	<b>6.4</b>	<b>International Collaboration</b>	<b>287 days</b>	<b>100%</b>	<b>Wed 2/1/17</b>	<b>Thu 3/8/18</b>																													
2315	<b>6.4.1</b>	<b>Prepare for International Meetings</b>	<b>265 days</b>	<b>100%</b>	<b>Wed 2/1/17</b>	<b>Thu 2/8/18</b>																													
2316	6.4.1.1	Prepare for International Meetings 1	6 days	100%	Wed 2/1/17	Wed 2/8/17	2317,2319																												
2317	6.4.1.2	Prepare for International Meetings 2	6 days	100%	Thu 2/1/18	Thu 2/8/18	2320																												
2318	<b>6.4.2</b>	<b>Attend International Meetings</b>	<b>263 days</b>	<b>100%</b>	<b>Wed 2/15/17</b>	<b>Wed 2/21/18</b>																													
2319	6.4.2.1	Attend International Meetings 1	5 days	100%	Wed 2/15/17	Tue 2/21/17	2322																												
2320	6.4.2.2	Attend International Meetings 2	5 days	100%	Thu 2/15/18	Wed 2/21/18	2323																												
2321	<b>6.4.3</b>	<b>International Meeting Debrief</b>	<b>264 days</b>	<b>100%</b>	<b>Wed 3/1/17</b>	<b>Thu 3/8/18</b>																													
2322	6.4.3.1	International Meeting Debrief 1	6 days	100%	Wed 3/1/17	Wed 3/8/17	2317																												
2323	6.4.3.2	International Meeting Debrief 2	6 days	100%	Thu 3/1/18	Thu 3/8/18																													



# Appendix E. Quality Documentation



Form SMRT-01  
Quality Audit Roster

Audit Number	Opening Meeting Date

Quality Audit Scope Documents	Audit Date	Auditor	Closing Meeting Date

Attendees:

Printed Name	Title	Firm	Phone No.	Email Address	Opening	Closing

Opening Meeting Agenda:	Closing Meeting Agenda:
• Review of Quality Audit Scope and duration	• Review of Quality Audit Scope
• Handling of findings/observations	• Review of commendable efforts
• Approximate date of Closing Meeting	• Review of findings/observations
• Content & expected date of Quality Audit Report	• Expected date of Final Quality Audit Report







**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, **XX** findings resulting in Corrective Action Requests (CAR), and **XX** observations as further detailed within this report.

CAR/PAR Number	Description	Responsible Manager
<b>CARXXX</b>		
<b>CARXXX</b>		

**Commendable Efforts (Good Points):**

**Findings:**

**Finding #1:**

**Responsible Manager:**

**Finding #2:**

**Responsible Manager:**

**Observations:** The following **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:**





Form SMRT-05 Corrective-Preventative Action Request Form Resolved

<b>Issue Date:</b>	<b>Response Due Date:</b>	<b>Tracking #:</b>
<b>Originator:</b>		
<b>Classification:</b> <input type="checkbox"/> <b>Corrective Action</b> <input type="checkbox"/> <b>Preventive Action</b>		
<b>Description of Problem or Potential Problem:</b>		
<b>Responsible Manager:</b>	<b>Date of Response:</b>	
<b>Root Cause:</b>		
<b>Action Plan sufficient to prevent recurrence or occurrence:</b>		
<b>Implementation Date:</b>		
<b>Quality Manager Review and Approval:</b>		
<b>Quality Manager Verification of Implementation/Effectiveness:</b>		
<b>Closed</b> <input type="checkbox"/>	<b>Date:</b>	

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# 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



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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.

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# 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.



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## 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



Form SMRT-08

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## 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



Form SMRT-09

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## 5 References

- ▶ [Agile Alliance](#)
- ▶ [Innolution](#)

# Appendix F. Risk Register

Project Risk Register

	Retired	Active	Total
Low priority: 0-19	17	39	56
Medium priority: 20-29	9	10	19
High priority: 30+	4	2	6
<b>Total</b>	<b>30</b>	<b>51</b>	<b>81</b>

Risk Identification									Qualitative Baseline Assessment					Monitoring & Control		
No.	Name	Risk Group	Category	Project	Phase	Type	Description (Cause, Effect)	Risk Trigger	Engage USDOT	Probability of Occurrence	Impact to Cost	Impact to Schedule	On or near CP?	Rank	Status	Status Notes as of 3/31/19
1	Multi-Modal Trip Planning is limited to a couple services	Technical	Enhanced Human Services	3 - MMTPA/CPS	Design	Threat	If at the time of deployment, COTA and CABS are the only confirmed provider. Will limit user access to services.	Confirmation of MMTPA service providers.	Yes	Moderate	Low	Low	No	12	Active	ADW   We have two providers for Release 1. We will continue discussions to onboard additional providers.
2	Limited FMLM providers engaged	Technical	Enhanced Human Services	4 - Smart Mobility Hubs	Design	Threat	If at the time of deployment, we have not confirmed FMLM service providers we will not improve existing conditions.	Submittal of demonstration site map and installation schedule	Yes	Moderate	Low	Low	No	12	Active	ADW   Yellow Cab, Zipcar, CoGo, and Lyft are very interested to provide services at Mobility Hubs.
3	Cannot Recruit 3000 Aftermarket Safety Device (ASD) Participants	Technical	Enabling Technologies	2 - CVE	Requirements	Threat	At conclusion of installation, less than 3000 units have been installed. Reduces amount of data collected and extends schedule	Number of signed up interested participants by the time installation begins	Yes	Very Low	Low	Moderate	No	5	Retired	RJB   1500-1800 total participants are needed with simplified scope. No longer applicable. Additional outreach will need to be coordinated with Communications Team for Q3 of 2018.
4	Media driven scope creep	Organizational	Outreach	All	All Phases	Threat	Media mis-interprets or misrepresents the message/real scope of the project. Creates expectation to include more scope in the project.	Media event	Yes	High	Low	Low	No	16	Active	ANC   Coordination of all media events will be through the Communications Team to the media and thru partners to the media.
5	Media driven negative perception of project	Organizational	Outreach	All	All Phases	Threat	Media mis-interprets or misrepresents the scope of the project. Creates negative response and lack of participation/support by the users/public.	Media event	Yes	Moderate	Moderate	Moderate	No	18	Active	ANC   Coordination of all media events will be through the Communications Team to the media and thru partners to the media.
6	RFID Parking Permit "system" cannot be integrated into CoC System	Technical	Downtown	11-Enhanced Permit Parking	Design	Threat	During development of requirements workshop, we identify the system is incompatible. Parking improvements/benefits not realized.	During the system requirements development phase	Yes	Moderate	Moderate	Moderate	Yes	18	Retired	RJB   Project removed from program.
7	Parking permit technology	Technical	Downtown	11-Enhanced Permit Parking	Concept	Threat	City preference identified in ConOps approach versus technology solution specified in the application (RFID).	Technology decision during SE process	Yes	High	Moderate	Moderate	No	24	Retired	RJB   Project removed from program.
8	Delivery zone availability application development	Usability	Downtown	10-Delivery Zone Availability	Deployment	Threat	Development of end user application not in the scope, but identified as a user need	Deployment phase	Yes	High	High	Moderate	Yes	28	Retired	RJB   INRIX is providing the application, risk is retired. Project removed from program.
9	City not able to use designated partner	Technical	All	All	Deployment	Threat	City is unable to accept partner offerings.	Decision on partner agreement	Yes	High	High	Moderate	Yes	28	Retired	MKB   City not able to use NXP. Budget increased. Risk retired.
10	Wi-Fi coverage not sufficient to improve access to educational/employment resources	Technical	Enabling Technologies	2-Smart Street Lighting	Design	Threat	During field testing, system does not meet service expectations. Access to educational/employments services not realized	SDD	Yes	High	Moderate	Low	No	20	Retired	RJB   Not a performance measure, risk is retired. Project removed from program.
11	Development required for OBUs & RSUs to meet requirements.	Technical	Enabling Technologies	All	Procurement	Threat	Off-the-shelf OBUs & RSUs do not meet requirements. Delay deployment/change in scope.	During vendor pre-qual/assessment process	Yes	Moderate	Moderate	High	Yes	21	Active	RJB   Coordination with the CV Pilots and outreach to OBU / RSU manufacturers need to stay active throughout the life of the project.
12	CV product does not meet technical specifications.	Technical	Enabling Technologies	All	Deployment	Threat	Off-the-shelf application does not meet specifications. Delay deployment/change in scope.	During lab testing	Yes	Moderate	Low	High	Yes	18	Active	RJB   Low risk due to simplified scope. Coordination with the CV Pilots and outreach to OBU / RSU manufacturers need to stay active throughout the life of the project.
13	Development required for off-the-shelf applications to meet requirements.	Technical	All	All	Procurement	Threat	Off-the-shelf applications do not meet requirements. Delay deployment/change in scope.	During the RFQs / Procurement process	Yes	High	High	High	Yes	32	Active	MKB   1) Understand the must have requirements for each solution and convey the same clearly in RFI/RFP 2) Understand what is not off the shelf by starting procurement with an RFI to determine effort for customization work. 3) Manage software development using Agile approach to ensure 'fail fast', thin slice delivery to enable quick pivots if needed for optimized delivery.

Project Risk Register

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14	USDOT funding priorities	Schedule	All	All	Concept	Threat	After Administration change, funding is interrupted/ cancelled. If interrupted - delay in schedule/stop work order.	Policy change in USDOT.	Yes	Low	Moderate	Low	No	10	Retired	MKB   Funding is not interrupted.
15	Unforeseen procurement process duration with City	Schedule	All	All	Procurement	Threat	Unable to shorten typical procurement process. Delayed schedule.	During the RFQs / Procurement process	Yes	Moderate	Low	High	Yes	18	Active	MKB   We know the city procurement cycle is 80 days. Plan for this in the project and be out in front of the process as much as possible - getting as much pre-work done as possible to reduce cycle time. Run parallel efforts wherever possible for efficiency.
16	Unforeseen procurement process duration with partners	Schedule	All	All	Procurement	Threat	Unexpected change in partner delivery date. Delayed schedule.	When installation is scheduled to begin	Yes	High	Low	High	Yes	24	Retired	MKB   Procurement factored into schedule.
17	Timeframe to install on AEP Assets	Schedule	Enabling Technologies	2 - CVE	Deployment	Threat	County in-kind project could impact AEP poles. Will know by March.	During design phase	Yes	Low	Moderate	High	Yes	14	Active	RJB   Work with county to identify poles with excessive integration.
18	Equipment attachment point on poles not high enough and limits coverage	Technical	Enabling Technologies	2 - CVE	Deployment	Threat	Existing infrastructure cannot support additional equipment at the required height. Delayed schedule/increase cost	During deployment phase	Yes	Low	Low	High	No	12	Retired	RJB   Field meetings occurred for development of the Installation Plans to identify locations and height.
19	Lack of "Mobility Assistance" resources	Technical	Enhanced Human Services	5 - Mobility Assistance	Deployment	Threat	Limited ability to fully test the Mobility Assistance application and application does not provide benefit to people with Cognitive Disabilities.	During field testing	Yes	High	Low	Low	No	16	Retired	ADW   Two applications have been tested with OSU faculty and COTA staff. Risk is mitigated.
20	Sensitive PII becomes compromised	Technical	OS	1 - OS	Deployment	Threat	Data privacy safeguard policies are circumvented and personally identifiable information (PII) is compromised	During deployment phase	Yes	Low	Low	Low	Yes	8	Active	ADW   Smart Columbus has adopted the policy that the OS will not receive PII.
21	Legislation for the deployment of the planned autonomous shuttles	Legislative	Emerging Technologies	8 - CEAV	Deployment	Threat	Legislation will likely be required for the deployment of AV on City streets	Appropriate legislation not in place prior to deployment commencing	Yes	High	High	High	Yes	32	Retired	ADW   Governor's office issued an executive order allowing AV testing.
22	Significantly more stakeholders to coordinate with than anticipated	Schedule	All	All	Concept	Threat	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.	Concept of Operation development	Yes	High	Moderate	Moderate	Yes	24	Retired	MKB   Risk not realized
23	Legislation for truck platooning on public streets	Legislative	Emerging Technologies	9 - Truck Platooning	Deployment	Threat	Legislation may be desired for truck platooning on highways (see note).	Deployment phase	yes	Moderate	Low	High	Yes	18	Retired	ADW   The truck platooning project removed from the portfolio.
24	Partners: SPARC, local partner in the City's grant application, delayed their ground breaking development	Schedule	Emerging Technologies	8 - CEAV	Deployment	Threat	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.	During deployment phase	Yes	High	Moderate	Low	No	20	Retired	MKB   The SPARC facility will not be available in time for us to use it for testing. The city is in conversations with TRC to determine if testing can occur there.
25	COTA Mobility Assistance Call Center Support Liability	Organizational	Enhanced Human Services	5 - Mobility Assistance	Concept	Threat	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.	Upon COTA legal team making a decision.	Yes	High	Low	Low	No	16	Retired	ADW   Support center is not supported by COTA, caregiver approach is provided by both applications. Risk is retired.
26	Projects not deployed in time to collect 12 months of performance data.	Schedule	All	All	Deployment	Threat	Project delays result in projects not be operational for 12 months during the 4-year grant period.	Schedule indicates projects will not be completed by the end of the grant's 3rd year.	Yes	Moderate	Low	High	Yes	18	Retired	MKB   Grant period may be extended, so risk retired.
27	Delayed agreement with TRC to test vehicles	Schedule	Emerging Technologies	8 - CEAV	Deployment	Threat	With SPARC unavailable, we need to establish an agreement with TRC to test vehicles.	During deployment phase	Yes	Moderate	Moderate	High	No	21	Retired	MKB   Talks with TRC are ongoing. Risk downgraded.
28	Delayed definition of partner scope	Schedule	All	All	Procurement	Threat	Unexpected/ late change in partner scope definition/ contribution. Increased costs and delayed schedule.	Notification of scope of change	Yes	Low	Moderate	Low	Yes	10	Retired	MKB   Risk not realized

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29	Common Payment System has limited partners	Technical	Enhanced Human Services	3 - MMTPA/CPS	Design	Threat	May not be able to integrate with several back office pay distribution systems.	Negotiations with mobility providers	Yes	High	Moderate	Moderate	Yes	24	Active	ADW   Conversations with TSPs continue. The city has included language in mobility provider permits that requires integration with the CPS (Bird, Lime). TNCs remain the largest risk.
30	CV Interoperability	Technical	Enabling Technologies	2 - CVE	Procurement	Threat	CV vendor provides proprietary solution that is not interoperable with other vendor's products based on the latest standards	Deployment phase	Yes	Low	Moderate	Moderate	Yes	12	Active	RJB   Following ODOT guidance/standards for interoperability.
31	DSRC Onboard Equipment (OBE)	Cost	Enabling Technologies	2 - CVE	Requirements	Threat	Technology readiness of the applications	Procurement selection	Yes	Low	Moderate	Moderate	Yes	12	Active	RJB   OBU vendor has been recommended and feedback from the proposal indicates that the technology readiness of the applications is higher than initially anticipated.
32	Adding DSRC RSUs to the planned management tool	Technical	Enabling Technologies	2 - CVE	Deployment	Threat	DSRC Roadside Units (RSUs) may not easily be added to the planned RSU Management tool.	Procurement	Yes	Low	Low	Low	No	8	Active	RJB   Recommended vendor outlined a tool to integrate with the existing signal monitoring software.
33	Need for multiple OBE vendors	Technical	Enabling Technologies	2 - CVE	Requirements	Threat	Multiple OBE Vendors may be necessary to support multiple vehicle types planned for SmartColumbus deployment.	Results of requirements work	Yes	Moderate	Low	Low	No	12	Active	RJB   Recommended vendor has one OBU and multiple HMIs.
34	Technology can't support proposed CEAV routes in mixed traffic environment.	Usability	Emerging Technologies	8 - CEAV	Procurement	Threat	Technology is not advanced enough for vendors to commit to supporting the proposed CEAV routes in the Linden area.	Route evaluation	Yes	Low	Moderate	High	Yes	14	Active	ADW   Recommended vendor did not identify any issues with the proposed routes.
35	Vendor unable to integrate CV into navigation system	Technical	Emerging Technologies	8 - CEAV	Procurement	Threat	Vendor is unable/unwilling to integrate CV technology into the vehicle's navigation services.	Deployment phase	Yes	Low	Low	Low	No	8	Active	RJB   Recommended vendor did not identify any issues.
36	Additional snow removal required along CEAV routes	Cost	Emerging Technologies	8 - CEAV	O&M	Threat	More frequent/aggressive snow removal by local maintenance crews needed once CEAV is deployed for it to operate properly.	Deployment phase	Yes	Moderate	Low	Low	No	12	Active	ADW   Local maintenance personnel increase frequency and/or revise method for snow removal to avoid impacting operations of CEAV by creating previously unknown obstacle (snow pile) along the route.
37	Operation and Maintenance of CEAV	Contractual	Emerging Technologies	8 - CEAV	O&M	Threat	Need to develop plan for O&M during pilot project with ODOT, OSU, Partnership, and COTA.	Requirements and specifications phase	Yes	Low	Low	Low	No	8	Active	ADW   The recommended vendor will provide storage and charging facilities.
38	Finalize outreach information for COTA, Columbus (Public Safety and Public Service), and other key stakeholders	Organizational	Enabling Technologies	2 - CVE	Concept	Threat	Stakeholders are in agreement with applications and deployment.	Deployment phase	Yes	Moderate	Moderate	Low	No	15	Active	RJB   Will be finalized once vendors are onboarded and testing begins.
39	Developing business/cost model to sustain the MMTPA after the life of the grant	Cost	Enhanced Human Services	3 - MMTPA/CPS	Concept	Threat	COTA has agreed (in principle) to own the MMTPA after the grant.	Deployment phase	Yes	Low	Low	Low	No	8	Active	ADW   MMTPA has low ongoing costs after the grant, which are low (based on vendor proposal). Costs are reasonable for COTA. Scheduling a meeting to discuss COTA's agreed upon ownership of MMTPA and CPS.
40	Unknown time and resources needed to reach agreements and integrate with TSP and existing systems	Cost	Enhanced Human Services	3 - MMTPA/CPS	Concept	Threat	Project costs - unknown time and resources needed to reach agreements and integrate with TSPs and existing systems.	RFP	Yes	Moderate	High	High	No	24	Active	ADW   Developing agreements and beginning negotiations to allow for adequate time. Have agreements with Yellow Cab and EmpowerBus. Working with bike and scooter companies.
41	Variable costs for software development due to emerging technologies	Cost	Enhanced Human Services	3 - MMTPA/CPS	Requirements	Threat	Variable costs for software development due to emerging technologies.	RFP	Yes	Moderate	Moderate	Moderate	No	18	Retired	ADW   MMTPA and CPS vendor costs area within estimated budgets.
42	Obtaining Agreements	Technical	Enhanced Human Services	4 - Smart Mobility Hubs	Design	Threat	Obtaining Agreements	Design	Yes	Low	Moderate	Moderate	No	12	Active	ADW   Met with City Real Estate department. Work Agreements will be required.



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43	AbleLink agreement	Contractual	Enhanced Human Services	5 - Mobility Assistance	Concept	Threat	AbleLink does not agree to contract terms	Contract negotiation	Yes	Low	Very High	High	Yes	18	Retired	ADW   AbleLink is under contract.
44	Need IRB approval for participant recruitment plan	Usability	Enhanced Human Services	5 - Mobility Assistance	Deployment	Threat	Institutional Review Board must approve participate recruitment and training.	Training	Yes	Low	Low	Moderate	Yes	10	Retired	ADW   Part 2 ammendment to the IRB will be submitted in February.
45	Finalize agreement with OSU	Contractual	Enhanced Human Services	5 - Mobility Assistance	Concept	Threat	Finalize agreement with OSU	Design	Yes	Low	Moderate	Moderate	No	12	Retired	ADW   OSU agreement is signed.
46	OSU faculty obtaining funding for technical assistance during planning, testing, and deployment	Cost	Enhanced Human Services	5 - Mobility Assistance	Requirements	Threat	OSU faculty obtaining funding for technical assistance during planning, testing, and deployment	Testing	Yes	Low	Moderate	High	Yes	14	Retired	ADW   OSU has a process of obtaining funding for faculty.
47	Develop procurement process for technology vendor that the Managed Care Plans can all agree to.	Usability	Enhanced Human Services	6 - Prenatal Trip Assistance	Procurement	Threat	Develop procurement process for technology vendor that the Managed Care Plans can all agree to.	RFP	Yes	Moderate	Moderate	High	Yes	21	Retired	ADW   City has reached agreements with the MCOs. MCOs are negotiating with Kaizen Health.
48	Accelerate schedule	Schedule	Enhanced Human Services	6 - Prenatal Trip Assistance	Concept	Threat	Inability to accelerate the schedule	RFP	Yes	High	Moderate	Very High	Yes	32	Retired	ADW   City was able to accelerate the procurement process.
49	Peloton agreement	Contractual	Emerging Technologies	9 - Truck Platooning	Concept	Threat	Peloton does not want to participate in a 12 month deployment.	Design	Yes	Very High	High	High	No	40	Retired	ADW   Peloton does not want to participate. Team will begin discussions with OEMs to determine interest in participating in a pilot.
50	Truck Platooning Project	Technical	Emerging Technologies	9 - Truck Platooning	Concept	Threat	The technology is not advanced enough to deploy in a live environment. Vendors/OEMs are not will to share data from a deployment.	RFI	Yes	High	High	High	Yes	32	Retired	ADW   The project is being removed from the program
51	Participant Incentives for MMTPA, MAPCD, CVE, PTA	Cost	All	All	Deployment	Threat	Projects will need to secure funds for monetary and non-monetary incentives to pilot participants.	Deployment phase	No	Moderate	High	High	Yes	24	Active	ADW   Need to compile list of all incentive asks and provide to leadership.
52	Risk of not being a fully open source environment by end of grant	Technical	OS	1 - OS	Deployment	Threat	If we don't have an open source environment, we won't meet the grant requirements. We need other communities/agencies to adopt and use the software. Active users will reduce O&M costs.	Development	Yes	Low	Moderate	Low	Yes	10	Active	ADW   Smart Columbus has a plan to leverage the Apache 2.0 license. The OS is developing a release schedule to meet open source requirements for the grant.
53	Data quality	Technical	OS	1 - OS	Requirements	Threat	Data received from outside sources must meet a standard of quality for use in research and evaluations.	Data ingestion	Yes	Moderate	High	Moderate	No	21	Active	ADW   Opportunity to develop data standards with city for data needed for the grant.
54	Ingesting data from all the projects	Technical	OS	1 - OS	Deployment	Threat	Each project must send data to the OS for evaluation.	Data ingestion	Yes	Low	Moderate	Moderate	Yes	12	Active	ADW   Each of the projects will develop test feeds for the OS to ensure data ingestion. User interfaces have been developed for all projects except CVE.
55	O&M and infrastructure costs	Cost	OS	1 - OS	O&M	Threat	Currently, the OS is being hosted on AWS platform. The AWS contribution ends 5/2020, then we will have ongoing costs.	O&M	Yes	Moderate	High	Moderate	Yes	21	Active	ADW   OS team is currently developing an O&M plan. Platform is agnostic. Plan will be completed by Q4 2019.
56	OS work within the scope of the cooperative agreement	Contractual	OS	1 - OS	Design	Threat	Manage OS to ensure that work supports the USDOT Smart City projects.	Development	Yes	Low	Moderate	Moderate	Yes	12	Active	ADW   As part of scope management, the team is monitoring requested tasks/duties to ensure the work is within scope
57	Outside parties compromising the OS	Technical	OS	1 - OS	Design	Threat	Outside parties may attempt to compromise the OS.	Development	Yes	Low	High	High	Yes	16	Active	ADW   Team is scheduling penetration testing in concert with release of data platform 2.0.
58	Cannot Recruit 1800Aftermarket Safety Device (ASD) Participants	Technical	Enabling Technologies	2 - CVE	Deployment	Threat	At conclusion of installation, less than 1800 units have been installed. Reduces amount of data collected and extends schedule	Deployment phase	Yes	Moderate	Low	High	Yes	18	Active	RJB   Tool has been spec'd with vendor to assist with outreach (no duplication)

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59	Do not have sufficient budget for full scale deployment (1800 participants)	Cost	Enabling Technologies	2 - CVE	Procurement	Threat	All three CVE projects (OBU & RSU integrators, and installation plans) exceed total budget (~\$10M)	Procurement phase	Yes	Low	Moderate	Low	Yes	10	Active	RJB   Based upon recommended OBU and RSU vendor proposals, the budget is within our estimate. Construction budget is anticipated to be within the projected budget.
60	Signal ownership along Franklin County corridor	Technical	Enabling Technologies	2 - CVE	Design	Threat	Alum Creek corridor has signals owned by multiple jurisdictions.	Design phase	Yes	Moderate	Low	Low	No	12	Active	RJB   The project could bypass a signal(s), if necessary.
61	Participant Incentives	Cost	Enabling Technologies	2 - CVE	Deployment	Threat	Incentives are needed to recruit participants to install OBUs in vehicles. Final dollar amount is being determined.	Deployment phase	Yes	High	Moderate	Moderate	No	24	Active	RJB   Assuming 1400 public participants, we would need upward of \$70k in incentives (assuming \$50/participant).
62	Developing business/cost model to sustain the CPS after the life of the grant	Cost	Enhanced Human Services	3 - MMTPA/CPS	O&M	Threat	COTA has agreed to own the CPS.	Deployment phase	Yes	Moderate	Low	Low	No	12	Active	ADW   COTA will be the CPS owner after the grant period.
63	EPM vendor will not integrate with the CPS	Technical	Enhanced Human Services	3 - MMTPA/CPS	Deployment	Threat	The EPM vendor and parking providers may not integrate with the CPS.	Negotiations with vendor and providers	Yes	Low	Moderate	Low	No	10	Active	ADW   Once vendor is selected for EMP and CPS, discussion need to occur to determine integration requirements.
64	Marketing and outreach to Central Ohio to ensure public is aware of the system's abilities and deployment for public use	Usability	Enhanced Human Services	3 - MMTPA/CPS	Deployment	Threat	Lack of appropriate MMTPA/CPS marketing and outreach will result in insufficient adoption by targeted end users.	Deployment phase	Yes	Very High	Low	Moderate	Yes	25	Active	ADW   City is currently discussing importance of outreach with the USDOT to ensure needed resources for a successful deployment are available.
65	Outside Stakeholders	Organizational	Enhanced Human Services	4 - Smart Mobility Hubs	Design	Threat	Incorporating interests from all the various stakeholders	Agreements	Yes	Low	Low	Moderate	Yes	10	Active	JJK   Through ongoing discussions and upcoming meetings, stakeholder interests will be addressed.
66	MMTPA integration into kiosks	Technical	Enhanced Human Services	4 - Smart Mobility Hubs	Requirements	Threat	IKE will integrate the MMTPA into the kiosks. Will require coordination with MTECH.	Development	Yes	Low	Low	Moderate	Yes	10	Active	JJK   Will schedule kickoff meeting between vendors. Orange Barrel is aware of schedule.
67	Custom integration to meet kiosk requirements	Technical	Enhanced Human Services	4 - Smart Mobility Hubs	Requirements	Threat	IKE will meet the system requirements identified for the kiosks. Some items include the USB port, COTA real time, emergency call button. OS integration is needed.	Development	Yes	Low	Low	Moderate	Yes	10	Active	JJK   Through the ICD development, team is addressing integration risks.
68	Participant recruitment	Organizational	Enhanced Human Services	5 - Mobility Assistance	Deployment	Threat	OSU, COTA, and ARC will be recruiting 15 - 30 participants for a one year study.	Pre-deployment	Yes	High	Low	High	Yes	24	Active	ADW   OSU has been working with multiple agencies/organizations to help identify potential participants.
69	AbleLink addresses issues identified in testing prior to training period.	Technical	Enhanced Human Services	5 - Mobility Assistance	Design	Threat	AbleLink needs to resolve and issues identified in the acceptance testing process	Design	Yes	Low	Low	High	Yes	12	Retired	ADW   AbleLink is currently updating the application and web portal to address issues identified in acceptance testing.
70	Training participants and caregivers	Organizational	Enhanced Human Services	5 - Mobility Assistance	Design	Threat	OSU and COTA will be training participants and caregivers over a one month period. Depending on the user's capabilities, training may be extensive.	Pre-deployment	Yes	Moderate	Low	High	Yes	18	Active	ADW   OSU has developed a training plan for pilot participants.
71	OS ingest test data from AbleLink	Technical	Enhanced Human Services	5 - Mobility Assistance	Design	Threat	The OS must be able to receive data from the WayFinder application for evaluation purposes.	Pre-deployment	Yes	Low	Low	Moderate	No	10	Retired	ADW   OS was able to ingest test data from AbleLink
72	MCOs execute contracts with Kaizen Health	Schedule	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	MCOs must finalize contract with Kaizen to maintain the schedule	Procurement	Yes	Low	Low	Very High	Yes	14	Active	ADW   MCOs and Kaizen continue to negotiate contract terms. Andy is requesting weekly updates from the MCOs and Kaizen.
73	MCOs execute data sharing agreements with OSU	Schedule	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	MCOs must execute data sharing agreements with OSU to maintain the schedule	Deployment	Yes	Low	Low	Moderate	Yes	10	Active	ADW   OSU has worked through agreement with the MCOs. Upon IRB approval, the agreements will be signed.
74	MCOs execute data sharing agreements with City	Schedule	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	MCOs must execute data sharing agreements with city to maintain the schedule	Deployment	Yes	Low	Low	Very High	Yes	14	Active	ADW   City has received Molina's data agreement and is currently reviewing. CS has yet to send. Andy will keep pushing CS.

Project Risk Register

	Retired	Active	Total
Low priority: 0-19	17	39	56
Medium priority: 20-29	9	10	19
High priority: 30+	4	2	6
<b>Total</b>	<b>30</b>	<b>51</b>	<b>81</b>

Risk Identification										Qualitative Baseline Assessment					Monitoring & Control	
No.	Name	Risk Group	Category	Project	Phase	Type	Description (Cause, Effect)	Risk Trigger	Engage USDOT	Probability of Occurrence	Impact to Cost	Impact to Schedule	On or near CP?	Rank	Status	Status Notes as of 3/31/19
75	Participant recruitment	Schedule	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	The project will recruit 500 participants over a 4-6 month period	Deployment	Yes	High	Low	High	Yes	24	Active	ADW   Communications team is developing a robust grass roots plan to engage and recruit participants. This includes, medical offices/providers, community organizations, churches, pregnancy assistance programs, etc. Developing alternative plans to include other areas of Franklin County, if needed.
76	Participant incentives	Cost	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	Standard study procedures recommend participant incentives to gain participation. Cash incentives of \$100 will be provided along with a gift bag at the birth of the child.	Development	Yes	Low	Low	Moderate	Yes	10	Active	ADW   USDOT has approved expenditures for participant incentives.
77	Meeting the MVP Milestone Date	Technical	Enhanced Human Services	6 - Prenatal Trip Assistance	Design	Threat	A USDOT milestone is 3/31/19 for the MVP	Design	Yes	Low	Low	Moderate	Yes	10	Retired	ADW   Kaizen developed the MVP
78	OS integration with MCOs	Technical	Enhanced Human Services	6 - Prenatal Trip Assistance	Design	Threat	The OS must integrate with the MCOs to receive participant data.	Design	Yes	Moderate	Moderate	Moderate	Yes	18	Active	ADW   MCOs will be transferring data via secure ftp site or secure emails
79	OS integration with Kaizen Health	Technical	Enhanced Human Services	6 - Prenatal Trip Assistance	Design	Threat	The OS must integrate with Kaizen Health to receive participant data.	Design	Yes	Low	Low	Low	Yes	8	Active	ADW   Kaizen has an API already developed.
80	Communications with media	Organizational	Enhanced Human Services	6 - Prenatal Trip Assistance	Deployment	Threat	Media communications must meet standards that do not compromise the integrity of the study	Deployment	Yes	Low	Low	Moderate	Yes	10	Active	ADW   Communications team must continue to work with OSU researchers to ensure communications are acceptable to the IRB and does not compromise the study. Any media requests must stick to the approved talking points.
81	Path forward due to USDOT feedback on proposed approach with existing City vendor.	Schedule	Enhanced Human Services	7 - Event Parking Management	Procurement	Threat	City submitted an approach to leverage an existing city vendor to deliver the project.	Procurement	Yes	High	High	Very High	Yes	36	Active	RJB   Providing response back to USDOT during week of 4/15/19. Will await USDOT concurrence.





This Project Management Plan has been approved by City of Columbus Program Manager:

\_\_\_\_\_ Date: \_\_\_\_\_

Mandy K. Bishop  
City of Columbus Program Manager



THE CITY OF  
**COLUMBUS**  
ANDREW J. GINTHER, MAYOR