



Smart Mobility Hubs (SMH) Master Test Plan

for the Smart Columbus
Demonstration Program

FINAL REPORT | October 11, 2019

Produced by City of Columbus

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- Central Ohio Transit Authority
- Ohio Department of Transportation
- Columbus Metropolitan Library – Linden Branch
- St. Stephen’s Community House
- Columbus State Community College
- Mobility Service Providers
- Orange Barrel Media/IKE Smart City, LLC.
- Franklin County Emergency Dispatch Center
- Columbus Emergency Dispatch Center
- Clinton Township Administration, Fire Chief’s Office, and Police Department

Abstract

The purpose of this Smart Columbus Master Test Plan is to establish a common framework for conducting testing activities in support of the Smart Mobility Hubs project. The plan facilitates processes among project stakeholders, including City of Columbus, Central Ohio Transit Authority, Ohio Department of Transportation, Columbus Emergency Dispatch Center, Franklin County Emergency Dispatch Center, Clinton Township (Administration, Fire Chief's Office, and Police Department), and other stakeholders. The plan categorizes all components that make up the system of interest, outlines the testing strategy, defines the test tasks, interactions with other system elements, and provides a governance scaffold over the execution of all testing activities. This includes the tools to be used for logging, tracking, monitoring, and reporting test outcomes.

The primary goals of the master test plan are to evaluate how well the system conforms to the allocated requirements and satisfies the system of interest intended use and user needs. This determination will include a blend of analysis, demonstration, inspection, and testing of various products, systems, and data in order to provide final acceptance of the system and move forward to the next phase in the project.

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Project Summary

PROJECT BACKGROUND

The Smart Columbus Smart Mobility Hubs (SMH) project is one of eight projects in the Smart Columbus program and is designed to foster a community of connections and accessibility with increased mobility options and free, easy to use trip planning tools – these were just some of the needs captured through public outreach surveys with area residents. The SMH is committed to delivering solutions that help close the First Mile/Last Mile (FMLM) gap and is considered the future of consolidated transportation centers.

The project is scoped to deploy a number of transportation amenities at six different facilities (the “smart mobility hub” – i.e., SMH). Listed below are the six facilities where the transportation amenities will be deployed.

1. Columbus State Community College
2. Central Ohio Transit Authority (COTA) Linden Transit Center
3. St. Stephen’s Community House
4. COTA Northern Lights Park & Ride
5. Columbus Metropolitan Library – Linden Branch
6. COTA Easton Transit Center

These transportation amenities at the facilities listed above work together to deliver mobility as a service (MaaS), a concept this Master Test Plan (MTP) will continue discussing through operational readiness testing. MaaS provides travelers with new and consolidated transportation options to move about the region using various modes, with a focus on empowering residents through information and technology, providing waiting areas with real-time transit information, microtransit connections for pedestrians, seamless transfer between modes, and local information on various points of interest to encourage city exploration.

PROJECT OBJECTIVES

Smart Columbus has partnered with a number of public and private agencies with a shared central focus on enhancing the user experience, quality of life, and customer satisfaction. The project has established intermediate goals and objectives which, when reached, will signal progress toward reaching successful outcomes. Performance will be evaluated through the collection of trip-generated data, application usage, as well as user surveys and evaluations. Two primary objectives Smart Columbus will monitor and measure include:

1. Mobility: improve physical access to multimodal trip planning and payment options.
2. Customer Satisfaction: improve customer satisfaction of the users.

Benefits of realizing these key objectives include enhanced integration and connectivity of the transportation system across and between modes, improved efficiency of the surface transportation system, and increased accessibility and mobility of travelers.

SYSTEM CONCEPT

The geographic service area for the SMH facilities where amenities will be deployed establishes a physical location for the traveler. The route extends over the Cleveland Avenue corridor coinciding with COTA’s bus rapid transit (BRT) service (CMAX) to the Easton commercial district and offers a wide range of site-specific amenities. Individual SMH facilities will vary in size, configuration, and available services since the goal of the sites is to incorporate amenities within existing physical constraints.

The amenities detailed below in **Table 1: Smart Mobility Hub System Amenities** are planned for deployment within this project.

Table 1: Smart Mobility Hub System Amenities

	<p>Interactive Kiosk</p> <p>The interactive kiosk (IK) is a stand-alone, self-service system that provides a communication platform to deliver a variety of services to travelers as described in the sections to follow. The IK is comprised of several subsystems:</p> <ul style="list-style-type: none"> • Traveler Information Service – this subsystem will leverage the kiosk communication interface to provide travelers transportation related and community centric information services. This includes web-based access to Multimodal Trip Planning Application’s (MMTPA’s) Comprehensive Trip Planning (CTP) service and access to other systems via software interfaces. It encourages city exploration by providing information on various points of interest, business listings, and live transit info using the touchscreen. • Emergency Call Service – this subsystem consists of a physical button, an addition to the kiosk, that when activated will send notification of the help request directly to the 911 emergency call center(s) and initiate an audio connection between the distressed traveler and an operator at the emergency call center. • Wireless Internet – this subsystem provides complimentary, publicly accessible Wi-Fi at SMH locations for travelers using a personal wireless device to access the internet services.
	<p>Ride-Hailing Pickup/Drop-Off Zone</p> <p>Pick-up and drop-off zones will be made available at selected SMH facilities in the form of pull-off lanes and/or parking spaces located away from travel lanes that allow the safe transfer of passengers for ride-hailing opportunities.</p>
	<p>Car-Share</p> <p>Car-share is a service that provides access to a vehicle for short-term use. Travelers who are members of the car-share service can automatically rent a vehicle by the hour, the day, or overnight. A variety of makes and models are parked within designated car-share parking zones and are accessible 24/7.</p>
	<p>Dockless Device Parking</p> <p>Dockless parking services are areas that include designated zones for parking dockless devices such as scooters and e-bikes. Travelers will be able to continue a trip by renting a dockless bicycle, scooter, or e-bike at one location and end the trip anywhere they choose.</p>
	<p>Park & Ride</p> <p>Designated parking spaces will be available at select SMH locations and allow a traveler the option to complete a segment of his or her trip using a personal vehicle and parking at a SMH facility, where he or she can utilize the SMH amenities to continue his or her trip using alternate modes of transportation.</p>

	<p>Bike-Share Docking Station</p> <p>Bike-share services are a transportation service designed to provide travelers with a convenient way to make short trips along the corridor. Amenities associated with this service includes bike rentals, privately operated bike-share docking stations, and the back-end software system. These bikes are intended to move from station to station and be parked at a dock.</p>
	<p>Bicycle Parking</p> <p>Outdoor bicycle racks are a common short-term bike parking option offered at the SMH facilities for personal bicycles.</p>
	<p>Bus Service</p> <p>COTA will provide access to its existing transportation facilities along the Cleveland Avenue corridor to facilitate development of the proposed SMH amenities and ease of access to COTA CMAX and other transit services for travelers. Most of the facilities were located at or near CMAX stations.</p>
	<p>Electric Vehicle Charging Station</p> <p>An electric vehicle (EV) charging station is equipment that provides a source of electricity to charge plug-in electric vehicles at designated SMH facilities. Deployment of EV supply equipment is important to City of Columbus zero emission vehicle planning. While not available for initial SMH testing, EV charging stations are expected to be deployed at Northern Lights and the Columbus State Community College SMH locations in 2020.</p>
	<p>Autonomous Vehicle Shuttle Service</p> <p>The City of Columbus is currently planning on enabling pick-up and drop-off transportation using autonomous vehicle (AV) shuttles at select SMH facilities.</p>

Source: City of Columbus

Chapter 1. Introduction

1.1. OVERVIEW

This MTP has been prepared for the verification of the SMH project elements in order to commission the system for operation. Verification evaluates the functional deployment against its intended function and implementation of the system design. The MTP will accomplish this by establishing a set of test cases intended to evaluate the degree to which each amenity and its functions conform to the system requirements. The MTP will also develop test scenarios to verify the status of technical progress on the project, substantiate the achievement of technical performance, and certify operational readiness to move forward with validation.

It is important to note that this project is attempting to solve a complex, society-based problem through partnerships and collaboration with public and private entities. The target outcome of these efforts will produce a transportation mobility network (as a service) in the heart of Columbus to move people to new places, using various modes, while delivering new capabilities (Wi-Fi, emergency response, etc.). SMH is an exemplary case of a blended and integrated system of systems (SoS) that requires participation from architectural and civil engineering, construction, the deployment and integration of data systems, communications, and the cooperation of various public and private agencies, vendors, and mobility providers to enable the realization of a successful system while considering the complete problem.

The MTP will establish a common framework for testing. This includes describing various testing types, methods, and setting expectations of which method(s) should be used and when. The document provides information on what system components and features will be tested, what will not be tested, identifies the various tester roles, outlines which tools testers will need, instructs on how testers are to capture defects, defines the pass/fail criteria, and provides testers with a set of Test Cases (**Chapter 6**) and Acceptance Test Scenarios (**Chapter 7**) intended to evaluate the degree to which system functionality conforms to the system requirements, which are traced to user needs.

Due to the unique composure of this SoS, additional testing types will be emphasized during testing to ensure holistic, successful outcomes. The MTP will provide guidance on amenity verification, employing one or more of the following methods as appropriate: (a) testing information systems characterized by data and communications, (b) testing usability in terms of transportation safety and mobility, (c) testing operational readiness with a focus on infrastructure, and (d) testing policy and compliance across all elements of the system. Additional information surrounding these testing approaches, will be addressed in the approach section of this document and will be further defined in the MTP report matrix.

An outline of the project's test report is included in **Appendix A**. However, note, this document is not a test report. Therefore, once testing activities have been completed in whole, the test report will be updated for traceability purposes and submitted for review.

1.2. REFERENCES

The SMH system is constructed to meet the user needs and features identified in the Concept of Operations (ConOps) and meet the requirements set forth in the System Requirements (SyRS). This document is also supported by other systems engineering documents including interface, design, architecture, and standards documents, as well as safety and performance management plans. The documents listed in **Table 2: References** provide additional detail in achieving the outcomes for the project:

Table 2: References

Doc. No.	Title	Rev.	Pub. Date
–	Ohio Manual of Uniform Traffic Control Devices. Ohio Department of Transportation http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/traffic/OhioMUTCD/Pages/OMUTCD2012_current_default.aspx	–	Jan. 13, 2012
	IEEE 829 Test Plan Outline https://standards.ieee.org/standard/829-2008.html		Jul. 18, 2008
	Central Ohio Transit Authority (COTA) – Long Range Transit Plan https://www.cota.com/wp-content/uploads/2016/04/LRTP.pdf	–	April 2016
–	City of Columbus Americans with Disabilities Act (ADA) Rules and Regulations https://www.columbus.gov/publicservice/Design-and-Construction/document-library/Curb-Ramp-Construction/	–	April 1, 2018
–	Traffic Signal Design Manual. City of Columbus, Department of Public Service https://www.columbus.gov/WorkArea/DownloadAsset.aspx?id=2147506380	–	Oct. 1, 2018
–	IKE Smart City applications https://www.ikesmartcity.com/#applications		
–	Smart Columbus Demonstration Program Smart Mobility Hubs Concept of Operations https://d2rfd3nxvhnf29.cloudfront.net/2019-06/SCC-F-Safety%20Management%20Plan_2019_05_21_City_Submission%20EDITED_CLEAN.pdf		Jul 30, 2018
–	Smart Columbus Demonstration Program Smart Mobility Hubs System Requirements https://d2rfd3nxvhnf29.cloudfront.net/2019-06/SCC-B-SMH-SyRS-FINAL-v2.pdf		Nov 15, 2018
–	Smart Columbus Demonstration Program Smart Mobility Hubs Interface Control Document https://d2rfd3nxvhnf29.cloudfront.net/2019-06/SCC-B-SMH-ICD-FINAL-v2.pdf		Feb 15, 2019
–	Smart Columbus Demonstration Program Smart Mobility Hubs System Design Document https://d3hzipmmz6qe4.cloudfront.net/2019-07/Smart%20Mobility%20Hubs%20System%20Design%20Document.pdf		May 29, 2019

Doc. No.	Title	Rev.	Pub. Date
–	Smart Columbus Demonstration Program System Architecture and Standards Plan https://d3hzplpmmz6qe4.cloudfront.net/2019-07/Smart%20Columbus%20System%20Architecture%20and%20Standards%20Plan_0.pdf		Mar 15, 2019
–	Smart Columbus Demonstration Program Demonstration Site Map and Installation Plan https://d3hzplpmmz6qe4.cloudfront.net/2019-07/Smart%20Columbus%20Demonstration%20Site%20Map%20and%20Installation%20Schedule_0.pdf		Apr 15, 2019
–	Smart Columbus Demonstration Program Performance Measurement Plan https://d2rfd3nxvhnf29.cloudfront.net/2019-08/Smart%20Columbus%20Performance%20Measurement%20Plan.pdf		Jun 1, 2019
–	Smart Columbus Demonstration Program Safety Management Plan https://d2rfd3nxvhnf29.cloudfront.net/2019-06/SCC-F-Safety%20Management%20Plan_2019_05_21_City_Submission%20EDITED_CLEAN.pdf		Apr 1, 2019

Source: City of Columbus

A copy of the Smart Columbus Demonstration Program documents can also be obtained by sending a request to: **City of Columbus**, Attn: Department of Public Service, 111 North Front Street, Columbus, Ohio 43215.

This master test plan was adopted from the Institute of Electrical and Electronics Engineers (IEEE) 829-2008 Test Plan Outline and includes tailored project-specific processes as recommended by the specification, addressing management life cycle test processes.

Chapter 2. Risks and Contingencies

There are several parts of the SMH project that are not within the control of the kiosk integration but have direct impacts on the process and must be validated. The list below outlines the risks and contingencies for the SMH project.

- An off-the-shelf IK provided by the kiosk vendor was selected to meet the objectives of the SMH service. Although the system will be customized to fit user needs, there may be risks associated with existing software architectures that may require changes to the initial system design envisioned. The stakeholder group will work closely with the vendor to review appropriate requirements and provide a mechanism to capture and track change requests.
- Integration between the kiosk elements (field units, data sources, central management system) with external systems such as the MMTPA and Common Payment System (CPS) applications or the Operating System (OS) may present risks that lead to schedule delays during testing. First, managers must prioritize the early development of application programming interfaces (APIs) between systems to allow sufficient time to work through issues while the software applications are being developed. If additional delays associated with external systems are experienced, the test manager will work alongside the kiosk software development manager to ensure the issue is not temporal, to collect the necessary information, and schedule a technical review with external providers to resolve any issue(s) with high priority.
- Communications with the kiosks will be performed over Wi-Fi, which could present risks if the signal is weak, bandwidth is nearing capacity, or other provider issues are experienced. Degraded application service due to communication quality of service (QoS) is a common, yet hard and time-consuming issue to troubleshoot. The technical tester will work closely with the test manager during testing to identify defects logged due to lagging service, loss of communications etc., and ensure (a) the issue is not temporal, (b) the issue can be duplicated, (c) QoS is not acceptable and (d) the issue is server-side. If these criteria are met, it's likely an issue with the software, interface, or communication infrastructure that must be addressed.
- Risks associated regarding agreements with vendors and mobility providers. Mobility providers will be asked to sign an agreement with the landowner for each SMH location. Smart Columbus will not be a party to those agreements but will be assisting in making the introductions and serving as an assistant in those negotiations. The IK vendor will be contracting with a Smart Columbus partner, Experience Columbus. Smart Columbus will sign a Memorandum of Understanding with Experience Columbus to define the expected terms for the IK vendor.
- In a cloud environment, database protection and access-level permissions are critical to information security, especially for data shared between components in the system [i.e., IK- Central Management System (CMS) to the OS]. The test manager will be required to work with each system owner to establish an access control list (ACL) which defines and verifies users of the system, roles, and permission levels.
- Resource availability issues or unfilled positions may affect the testing schedule, leading to a delay in acceptance testing. The City will leverage additional resources from the Smart Columbus consultant contract for additional support. Testers will also be required to leverage the test tools, which will provide an up-to-date snapshot for new testers to quickly get up to speed on test procedures, expectations, and progress.

- Certain services provided to SMH travelers rely, almost entirely, on the availability and ability of external systems to produce that service. For instance, MMTPA and CPS are apps fully independent from SMH or the platform serving up these apps. If those external systems experience unplanned failures or degraded service, SMH would not be able to provide travelers with services, which could lead to adverse perceptions from community members. The technical team will work with external systems to mitigate this risk by coordinating service level agreements (SLAs), high avail + disaster recovery (HADR) strategies, monitoring, and notification services in a service-oriented coupling between systems.

Chapter 3. Test Items

3.1. TEST COMPONENTS

Various amenities will be deployed at six strategically selected SMH deployments extending along the Cleveland Avenue corridor coinciding with COTA's BRT service (CMAX) to the Easton commercial district. Individual SMH facilities will vary in size, configuration and available services since the goal of the sites is to incorporate the amenities within the existing physical constraints. The amenities that will be deployed and verified are described in **Table 3: Deployed Mobility Infrastructure at SMH Facility**.

Table 3: Deployed Mobility Infrastructure at SMH Facility

Facility Name	Current Amenities	Mobility Infrastructure Being Deployed
Columbus State Community College (CSCC)	<ul style="list-style-type: none"> • Wi-Fi • Bike-sharing • Bike Rack • Real-Time Display 	<ul style="list-style-type: none"> • Car-sharing • Dockless parking zone • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service
COTA - Linden Transit Center	<ul style="list-style-type: none"> • Wi-Fi • Bike Rack • Real-Time Display 	<ul style="list-style-type: none"> • Bike-sharing • Ride-hailing • Dockless parking zone • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service
St. Stephen's Community House	<ul style="list-style-type: none"> • Bike Rack 	<ul style="list-style-type: none"> • Bike-sharing • Car-sharing • Ride-hailing • Dockless parking zone • Park and Ride • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service ○ Wi-Fi

Facility Name	Current Amenities	Mobility Infrastructure Being Deployed
Columbus Metropolitan Library (CML) – Linden Branch	<ul style="list-style-type: none"> • Bike Rack 	<ul style="list-style-type: none"> • Bike-sharing • Car-sharing • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service ○ Wi-Fi
COTA - Northern Lights Park and Ride	<ul style="list-style-type: none"> • Park and Ride • Wi-Fi • Ride-hailing • Real-Time Display • Bike Rack 	<ul style="list-style-type: none"> • Bike-sharing • Car-sharing • Ride-hailing • Dockless parking zone • Park and Ride • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service
COTA - Easton Transit Center	<ul style="list-style-type: none"> • Wi-Fi • Real-Time Display 	<ul style="list-style-type: none"> • Bike-sharing • IK <ul style="list-style-type: none"> ○ CTP ○ IVR ○ Emergency Call Service

Source: City of Columbus

The amenities of the SMH system are grouped into two testing categories with individual test components. The first category is the IK and its subsystem applications, and the second category is the mobility infrastructure components. In order for the SMH system to function properly and optimally, all components of the system must function accurately and must integrate with one another in a seamless and intuitive fashion. The individual functions and capabilities for each of these components are broken out and listed in the following sections.

3.2. FEATURES TO BE TESTED

3.2.1. Interactive Kiosk

The IK is a stand-alone machine used to deliver a variety of services to travelers. In addition to the amenities described in **Table 1: Smart Mobility Hub System Amenities**, the IK is the primary information dissemination interface for travelers. It also includes hardware that enables services for other amenities, such as ECB and Wi-Fi, and it delivers the standards necessary to meet enterprise compliance, policy, and regulatory constraints. The following features will be verified through testing:

3.2.1.1. IK TECHNOLOGY AND ADMINISTRATION

1. Hardware interfaces

- a. Capacitive touchscreen
 - b. ECB
 - c. Video camera
 - d. Audio hardware
 - e. Wi-Fi network interface
 - f. 4G modem
2. Standards of Compliance
 - a. File formats
 - b. Data transfers
 - c. Communication security
 - d. Language
 - e. Americans with Disabilities Act (ADA) compatibility
3. API and Data Collection
 - a. MMTPA/CPS
 - b. ECB
 - c. Wi-Fi
 - d. IK-CMS
 - e. Operating System

3.2.1.2. TRAVELER INFORMATION SUBSYSTEM

1. MMTPA/CPS Integration (CTP)
 - a. Account management
 - i. Login (account holders)
 - b. Scheduling
 - i. Schedule an on-demand trip
 - ii. Schedule a multimodal trip
 - iii. Cancellation of a trip
 - c. Mobility providers
 - d. Route optimization
 - e. Payment
 - f. IVR
 - i. Trip planning and booking
 - ii. MMTPA support
 - g. Data collection
2. Application based services

- a. Local content

3.2.1.3. EMERGENCY CALL SERVICE

1. ECB
 - a. Call activation
 - b. ECC
 - c. Audiovisual
2. Digital video recording (DVR) and data retention

3.2.1.4. WI-FI ACCESSIBILITY

1. Wireless Internet
 - a. Onboarding (guest access)
 - b. Wi-Fi internet
 - c. MTPA Accessibility
2. Compliance
 - a. Monitoring
 - b. Logging

3.2.2. Mobility Infrastructure

3.2.2.1. DESIGNATED ZONES

1. Bike-share parking
2. Car-share parking
3. Ride-hailing parking
4. Dockless parking for e-bikes and scooters
5. AV shuttles
6. Park & ride

3.3. FEATURES NOT TO BE TESTED

There are some items that will not be specifically addressed. All testing in these areas will be indirect, inferred, or assumed as a result of other testing efforts.

1. End-to-end system testing for external software
 - a. **Real-Time Displays** – COTA provides real-time displays at CMAX BRT stations. Real-time data on the CMAX BRT alerts, trip updates, and vehicle positions are published online on the COTA website (<https://www.cota.com/trip-planner/?viewschedule=schedule#viewschedules>) as well as the Operating System (<https://cota.smartcolumbusos.com/#/101>).
2. Data collection for existing, non-instrumented infrastructure

- a. **Mobility Park & Ride** – designated park & ride parking spaces will be available at select SMH locations to give travelers the option to complete a segment of his or her trip using a personal vehicle. All park & ride amenities are pre-existing. The SMH will provide the appropriate signage to inform travelers of this feature’s availability. However, park & ride lots do not have instrumentation and no data is expected to be collected by the project.
 - b. **Bike Racks** – stationary bike racks are a pre-existing, short-term bike parking option included within the mobility portfolio at select SMH facilities. Although the existence of bike racks will be verified during the testing period, typically there is no instrumentation on the racks to collect usage data.
 - c. **Construction Elements** – the presence of construction-related design elements will be verified, not tested. Any testing or regulatory verifications associated with architectural design, engineering, and construction will remain the under the authority and responsibility of the owning team. This includes items such as:
 - i. Construction materials
 - ii. Geometric design layouts per facility
 - iii. Adherence to building codes or other construction-related compliance items
3. System Requirements that are deferred and tested as part of other Smart Columbus projects are listed in **Table 4: Deferred SMH System Requirements**

Table 4: Deferred SMH System Requirements

Req. ID	Description	Testing Project	Timeline
SMH-IF2315-V01	The CPS shall be deployed and available for use at the IK display through the MMTPA app.	MMTPA/CPS	11/2019 – 12/2019
SMH-MT2391-V01	Each vehicle shall have a unique identifier that is visible to the User.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2291-V02	The bikeshare docking station shall accept a secure code generated (through verified payment via MMTPA and CPS) for unlocking the bikes.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2343-V02	Verify the MMTPA sends SMH location, trip mode, and timestamp data to OS for all trips generated at the respective IK.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2294-V02	The docking station shall report the number of bikes currently docked to the MMTPA.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN3057-V01	Car-sharing provider utilizing SMH facility shall report the number of available shared vehicles located at each SMH location to the MMTPA.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2298-V02	The docking station shall report the operational status of the docking station to the MMTPA.	MMTPA/CPS	11/2019 – 12/2019

Req. ID	Description	Testing Project	Timeline
SMH-FN2296-V01	The bikeshare docking station shall track the date and time when a bike is unlocked.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2297-V01	The bikeshare docking station shall track the date and time when a bike is locked.	MMTPA/CPS	11/2019 – 12/2019
SMH-FN2298-V02	The docking station shall report the operational status of the docking station to the MMTPA.	MMTPA/CPS	11/2019 – 12/2019

Source: City of Columbus

3.4. TEST PLAN SCHEDULE

Table 5: SMH Project Testing Schedule below lists the timeline for infrastructure installation, post verifications and other major deliverables before the project is live.

Table 5: SMH Project Testing Schedule

Deliverable	Timeline
Infrastructure Improvements	8/6/2019 – 12/2/2019
Kiosk Installation	10/2/2019 – 12/2/2019
Post Installation Component Verification	12/3/2019 – 12/16/2019
Post Installation System Verification	12/17/2019 – 12/23/2019
Conduct Acceptance Testing	1/22/2020 – 1/29/2020
Regression Testing Until Acceptance	2/11/2020 – 2/20/2020
Draft Test Report	3/19/2020
Go Live	2/21/2020
Webinar for Test Plan and Results	3/27/2020

Chapter 4. Approach

4.1. TESTING APPROACH

To deliver the SMH system in an efficient way, the systems engineering V-model approach is used. For projects using this approach the documentation is an important aspect, as the outputs generated at a particular phase most often become inputs into the next phase, providing guidance, constraint, and governance on what to expect for the next phase.

A key aspect of documentation is the use of software tools that enable development, tracking, and traceability through the process. Operational scenarios from the project ConOps as well as requirements and design elements specified in the System Design Document (SDD) form the basis of **Chapter 7** and make up the acceptance criteria for the operational readiness at each SMH facility.

4.2. TESTING TYPES

SMH is a strategic project focused on establishing a multimodal transportation network service (i.e., MaaS) to meet the expressed needs of various stakeholders. In most cases, this normally involves trade studies, analysis, and depth of understanding to introduce the right set of existing transportation (and related) services to effect positive change in the way society perceives and uses transportation in a highly-dense area. For example, SMH encourages Columbus State Community College students living in Linden to use multiple modes of transportation to get to/from school rather than using their private vehicle. This is accomplished through the provisioning of dedicated pick-up and drop-off zones to attract and encourage a shift in modes and a shift in thinking from personal car use to shared modes.

This MTP will orient testers to view SMH pieces as a whole during testing. As such, various testing methods, techniques, and approaches must be layered to ensure the multidisciplinary elements of this “system of systems (SoS)” are appropriately verified such that the system is equipped for validation and performance is positioned/activated for success. Due to the unique composure of this SoS, additional testing types will be emphasized during testing to ensure holistic, successful outcomes. The MTP will provide guidance on amenity verification, employing one or more of the following methods as appropriate.

4.2.1. Information Systems

The SMH project has several amenities that are characterized by the information (data and communications) they produce such as real-time displays, kiosks, MMTPA, etc. These systems are commercial off-the-shelf (COTS). With these systems, testing will focus primarily on the following:

- **Factory acceptance testing (FAT)** – a comprehensive inspection performed on equipment to verify the integrity of equipment, that it conforms to design criteria, functionality, exposure to weather conditions, and meeting other contractual specifications. In general, FAT provides proof of functionality avoiding costly risks due to equipment failures on delivery. In this case, FAT will be performed at the kiosk delivery site.
- **Integration testing** – when code interacts with a database, communicates across the network, touches file systems, or otherwise leaves the bounds of its own process, it is integrating with other system elements. Integration tests are repeatable (steps and outcome) and should run exactly the same way every time, regardless of which order they are run or the state of the machine prior to running them. The best integration tests have a narrow focus; each checks just one aspect of the program’s ability to talk to the outside world. The number of focused integration tests in the test plan should be proportional to the types of external interactions the program has, not the overall size of the program.

- **System testing** – exercises a larger view of the system, starting with the user interface, passing through the business layer, touching the database, and measuring the returning output. In this case, each module or essential function of the system will be tested.

4.2.2. Usability

The SMH will also test the usability of the system by way of demonstration from the perspective of the traveler as it relates to how well the system meets multimodal transportation and safety goals. This will be accomplished through the scenarios defined in **Chapter 7**. For instance, asking questions such as is a user able to easily locate the kiosk, can a user connect to the Wi-Fi, can a user locate the comprehensive trip planning application on the IK, can a user walk to the bike docking station, etc., will determine the usability of the system and if there are challenges, how quickly can the user find answers or work around issues.

4.2.3. Policy and Compliance

At the system component level, the SMH will also test the adherence to policy and compliance between and across all elements of the system either through physical inspection, testing, or analysis. For instance, compliance of Wi-Fi usage, incident logging/recording for emergency calls, verification of record-keeping requirements, inspection of the appropriate, and planned amenities deployed per site, etc.

4.2.4. Operational Readiness

The presence of construction-related design elements will be verified through inspection. Any testing or regulatory verifications associated with architectural design, engineering, and construction will remain under the authority and responsibility of engineering and construction.

Finally, once integration and system tests have been completed, the City of Columbus will focus on testing the system of interest (SOI) from end-to-end. Various test scenarios have been established which define the project’s acceptance criteria for the production release of the SMH elements as outlined in **Chapter 7**.

4.3. ROLES

The following table identifies the anticipated tester roles and responsibilities for the SMH elements.

Table 6: Tester Roles and Responsibility Matrix

Tester	Role	Responsibility
System Owner	City of Columbus representative overseeing the completion of all projects and testing.	Andy Wolpert
Facility Owners	SMH facility owners represent the physical location where amenities will be deployed to verify site compliance on the respective property.	COTA, CSCC, CML, St. Stephen’s Community House
Test Manager	Develops testing report summaries and scheduling.	Jeff Kupko, Michael Baker Intl.

Tester	Role	Responsibility
Emergency Call Taker/Dispatcher	An authorized individual (or service) responding to an ECB activation.	911 services
Data Consumer	An authorized individual (or service) that consumes trip and travel data from the OS.	OS
Data Producer	A system or systems that will produce usage data to be sent to the OS.	Mobility Providers, IKE Smart City, LLC.
Kiosk System Administrator	An individual responsible for configuring, troubleshooting, or resolving issues with IK services.	IKE Smart City, LLC.
Stakeholders	General testing role with domain knowledge in the area of transportation.	Matt Graf, HNTB COTA
Traveler	End users of the SMH SOI, including residents and visitors of Columbus who utilize COTA's fixed-route bus service and rely on additional modes of transportation [Transportation Network Company (TNC), bike-share, etc.] along the Cleveland Avenue corridor.	Matt Graf, HNTB Jess Baker, HNTB Sai Geetha Koganti, HNTB Sherry Kish, HNTB Jeff Kupko, Michael Baker Intl.
Technical Tester	A technically advanced user able to perform advanced system tests, such as validate point-to-point data protection.	Ram Boyapati, Battelle (Lead) Matt Graf, HNTB Jess Baker, HNTB IKE Smart City, LLC.
Construction Inspector	An inspector who is able to inspect and test all the construction elements.	Sonja Summer, City of Columbus

Source: City of Columbus

4.4. TEST TOOLS

4.4.1. Trace Test Matrix

The SMH project relies on the Helix ALM tool to manage the test cases, scenarios, testing outcomes, and maintain traceability back to user needs. The tool will be used to export the data that testers will need to perform tests. The testers will rely on a Trace Test Matrix (TTM), which will be distributed prior to the testing period commencing. The TTM will contain a list of all test objectives, linked back to the system requirements from the SyRS. Testers should read each requirement description carefully to enhance their understanding of each test objective. For each test case, the matrix will also provide test steps and expected results per objective. Finally, the matrix will assign the type of role to test the case. Testers will be required to enter their name, run date, result, and comment where applicable. A copy of the TTM will be included in **Appendix A** and will provide a view into the type of information that will be collected and reported through the TTM.

4.4.2. Defect Tracker

A defect tracker is provided in the TTM for testers, which will be used to record anomalies detected during the execution of a test case or scenario. An observation is considered a defect when the result of an activity does not match the expected outcomes outlined in the test procedure.

Testers are encouraged to include as much information as possible when recording defects, so vendors and integrators can use this information (inputs, conditions, step at which failure occurred, etc.) to try to repeat, identify root cause, and resolve the issue. This includes referencing the appropriate test identifier(s), expected results, actual results, defect frequency (every time, intermittent, etc.). An assessment of the severity of the defect needs to be performed and assigned as critical, high, medium, low – where critical is the most serious classification with the feature or product being unusable. Defects of this severity should be brought to the immediate attention of the test manager for further inspection, coordination, and decision-making. A defect with a low severity indicates the observation is cosmetic in nature.

The test manager will monitor the defect log for corrective action. The team is responsible for understanding and reproducing (where possible) the defect, summarizing a response and the activities taken to resolve the issue, and capturing metadata associated with the resolution (e.g., assigned name, date, status, description, etc.). If a conflict arises between a design element that ties to a requirement and the deployed amenity, the test manager will coordinate with the appropriate vendor and the system owner to determine if a change to the design and/or requirement is appropriate. The City of Columbus project manager (who is also the system owner) will be responsible for reviewing and approving all requests to make a change that impacts the system design and requirements. All change requests will be captured by the change logger tool (refer to **Section 4.4.3** for additional information).

The defect tracker will also be leveraged (with the TTM) to measure the feasibility and readiness of the software to be promoted to production. Additional information can be found in **Section 4.6**.

4.4.3. Change Logger

The ability to track system design changes or changes to requirements associated with a feature is a fundamental strategy for configuration management and an important aspect of managing projects and maintaining traceability across the Smart Columbus program. The TTM provides testers with a change tracking mechanism to capture and justify requests for change, which often derive from a defect or an enhancement request. The City of Columbus project manager is responsible for assessing the impact of the change as it relates to the project objectives, schedule, cost, etc., and providing final authorization on the request through the tool. Table 17: Change Request Log in the appendix provides a record of all the change requests logged throughout the testing process along with justifications and authorization status.

4.5. ENVIRONMENTAL NEEDS

Testers must have a Wi-Fi enabled device capable of connecting to the internet to test the Wi-Fi feature available at the kiosks. They should also be familiar with ways to capture screenshots from their testing device in the event an error occurs, or the expected result is not achieved. Screenshots aid in debugging as it provides documentation of the event for the development team.

4.6. MEASURES AND METRICS

The TTM contains a defect tracker which testers will use to capture anomalies, incongruencies, errors, or any other output inconsistent with the expected test case result. The TTM, combined with the defect tracker will capture the following testing metrics:

- Total number of test cases

- Number of tests runs per case
- Number and percentage of test cases passed
- Number and percentage of test cases failed
- Number and percentage of test cases deferred
- Number and percentage of defects found (relative to total cases)
- Number and percentage of high severity defects
- Number and percentage of defects accepted
- Number and percentage of defects rejected
- Number and percentage of defects deferred
- Total number of testers

The City of Columbus will leverage these data points to determine the feasibility and operational readiness of the SMH project to receive final acceptance test approval as outlined in the test summary **Appendix A.3**.

4.7. TEST CRITERIA

4.7.1. Item Pass/Fail/Canceled

Each test case consists of several unique properties which should be considered holistically during the testing evaluation process. Properties include but are not limited to: test identifier (ID), test objective, procedure, expected outcome, number of test runs that must be completed, and status. The TTM maintains the following status for each test case:

1. Planned – the test case has been defined, role identified, testers assigned, and is logged in the TTM ready for testing.
2. In Progress – the test case is underway but has not been completed.
3. Pass – a pass value indicates tests have completed the defined number of runs by various testers without error and the expected result has been achieved. It is expected that each time this test is performed, independent of who is testing, the same successful results will be achieved. There may be instances when a tester identifies a defect during the procedure, yet the test case still achieves the stated outcome. The case can still pass, but the testers must log the defect and bring it to the attention of the test manager. This can happen when there are minor bugs detected not critical to the essential functionality of the feature being tested such as an image being out of alignment or a misspelling.
4. Fail – a test case is marked as failed when the case does not meet part or all of its expected outcome. For instance, to test the IVR function, a tester must first book a trip using MMTPA's comprehensive trip planner. If the trip was scheduled successfully, but a reservation code did not appear, this would be an example of a failed test case, since it partially met the expected outcome. In this case, a defect would be logged, and a brief note entered in the comments column, listing the defect ID for traceability. For all failed test cases, one or more defects must be logged to capture the details surrounding the failure and to track its status.

5. Deferred – a test case is marked as deferred when the case is unable to be performed at the current time of testing or when there is a change in requirements. Most often this will occur when a software product is being released in increments and the functionality is not ready when it's time to test the current release. This also applies to any features the system may include where testing will be performed outside of the scope of this Master Test Plan (MTP) (see **Section 3.3**). If a test is deferred, the tester should provide a brief reason in the comment's column of the TTM. The test manager is responsible for tracking deferred cases and evaluating the most appropriate time and/or response for addressing the case.
6. Canceled – a test case is marked canceled when the requirement affiliated with the test case is no longer applicable to the project.

4.7.2. Testing Suspension and Resumption

There are cases when a critical, severe defect is detected that is significant enough that – if not addressed – would require one or more iterations of the same tests to be performed again. In these situations, it is better to suspend testing until the defect is resolved to prevent wasting the project budget and the testers' time. The test manager should be notified immediately and will work with vendors and facility owners as appropriate to correct the issue as quickly as possible. Testing will resume once the test manager has successfully confirmed the issue has been resolved.

The following situations would cause testing to be suspended:

1. One or more defects found associated with the structural integrity of kiosks.
2. Failure of communications network rendering kiosk isolated from systems required for normal operation.
3. Any situation that could potentially lead to bodily injury or significant damage to property.

Chapter 5. Test Deliverables

The United States Department of Transportation and City of Columbus Cooperative Agreement identifies one deliverable for the SMH project, specifically the delivery of this MTP document. However, during testing there will be additional artifacts that extend this plan to support and enhance the testing process. The following artifacts make up part of this testing plan:

- Test cases
- Test scenarios
- Testing matrix
- Defects matrix with corrective actions
- Change request log
- Error logs, bug reports, and/or screen captures (where feasible)
- Acceptance (see **Appendix A**)
- SMH test report webinar

Chapter 6. Test Cases

6.1. INTERACTIVE KIOSK

The test cases designed for this MTP will focus on testing the system requirements, interfaces, data, and system design for the IK system. The scenarios will expand on these essential functions to test the system holistically. The number of testers shown in the tables below were derived by the type of testers that would be knowledgeable in the test objective and how important the objective is to the overall SMH. The following test cases are planned as outlined.

IK Pre-Flight checklist and IK Field Installation Support checklist are attached in Appendix C and Appendix D respectively. These checklists will be signed-off by the vendor and City of Columbus after testing the kiosks and its functionality and will be attached to the test report. Appendix E lists the system requirements that will be verified based on the Agreements. This checklist will also be signed off by the City of Columbus and will be attached to the test report.

Table 7: Interactive Kiosk Test Cases

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP001-V01	Operational Readiness	Comprehensive Trip Planning	Demonstration	Verify user is able to locate and open the Pivot app on the IK touchscreen interface.	All SMH locations	<p>DESCRIPTION User is able to locate and open the Pivot app on the kiosk.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch the screen on the kiosk to begin. • User locate and open the Pivot app. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • Find and open the pivot app on the kiosk. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met when both testers were able to successfully locate, select and open the Pivot app, as intended at the IK, without experiencing errors or external influences.	SMH-IF2316-V01 SMH-IF2356-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP002-V01	Operational Readiness	Comprehensive Trip Planning	Demonstration	User is able to plan a trip using the Pivot app on the kiosk.	All SMH locations	<p>DESCRIPTION User plans a trip through the Pivot app on the kiosk without an account to the Pivot app.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to exit the stand-by mode. • Open the "Pivot" app on the touchscreen, click on the human icon on the top left corner of the app click 'continue as guest'. • Enter the address to destination in the "where to" tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • Identify and open the settings icon on the right top corner of the screen to edit language, results preferences and preferred modes as needed. • Route options will be presented for the user to review and choose based on the transportation preferences selected. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • App provides directions to the destination entered and by preferred modes of transportation. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met when both testers were able to successfully locate, select and utilize Pivot app to plan a trip.	SMH-IF2356-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP003-V01	Integration	Comprehensive Trip Planning	Demonstration	Verify that Pivot app provides route options when user selects ride-hailing as preferred mode under settings.	All SMH Locations except CSCC	<p>DESCRIPTION User plans a trip by selecting ride-hailing as a travel mode.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to begin. • Open the “Pivot” app, click on the human icon on the left top corner of the app and click ‘continue as guest’. • Enter the address to destination in the “where to” tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • Identify and open the settings icon on the right top corner of the screen. • Click Preferred modes under Transportation preferences and select ride hail option as the preferred mode. • App to provide route options using ride-hailing. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • App allows user to select ride-hailing as the preferred mode under transportation preferences in settings. • App provides route options using ride-hailing as the service. 	Traveler	Verification by one tester.	Criteria considered met when traveler is able to select ride-hailing as a transportation mode and app provides route options using that mode.	SMH-IF2356-V02 SMH-IF2357-V01 SMH-IF2389-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP004-V01	Integration	Comprehensive Trip Planning	Demonstration	Verify that Pivot app provides route options when user selects bike-sharing as preferred mode under settings.	All SMH locations except at COTA Northern Lights Park & Ride.	<p>DESCRIPTION User plans a trip by selecting bike-share as a travel mode.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to begin. • Open the “Pivot” app, click on the human icon on the left top corner of the app and click ‘continue as guest’. • Enter the address to destination in the “where to” tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • Identify and open the settings icon on the right top corner of the screen. • Click Preferred modes under Transportation preferences, select “BIKE” option and select “COGO”. • App to provide route options using bike-sharing. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • App allows user to select bike-sharing as the preferred mode under transportation preferences in settings. • App provides route options using bike-sharing as the transportation mode. 	Traveler	Verification by one tester.	Criteria considered met when traveler is able to select bike-sharing as a transportation mode and app provides route options using that mode.	SMH-IF2356-V02 SMH-IF2357-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP005-V01	Integration	Comprehensive Trip Planning	Demonstration	Verify that Pivot app provides route options when user selects scooter as preferred mode under settings.	All SMH locations except at COTA Easton Transit Center.	<p>DESCRIPTION User plans a trip by selecting scooter as a travel mode.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to begin. • Open the “Pivot” app, click on the human icon on the left top corner of the app and click ‘continue as guest’. • Enter the address to destination in the “where to” tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • Identify and open the settings icon on the right top corner of the screen. • Click Preferred modes under Transportation preferences, select “Scooter” and select “LIME”, “BIRD”, “LYFT” and “SPIN”. • App to provide route options using scooter. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • App allows user to select scooter as the preferred mode under transportation preferences in settings. • App provides route options using scooter as the mode of travel. 	Traveler	Verification by one tester.	Criteria considered met when traveler is able to select scooter as a transportation mode and app provides route options using that mode.	SMH-IF2356-V02 SMH-IF2357-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP006-V01	Integration	Comprehensive Trip Planning	Demonstration	Verify that Pivot app provides route options when user selects car-sharing as preferred mode under settings.	All SMH Locations except CSCC	<p>DESCRIPTION User plans a trip by selecting car-share as a travel mode.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to begin. • Open the "Pivot" app, click on the human icon on the left top corner of the app and click 'continue as guest'. • Enter the address to destination in the "where to" tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • Identify and open the settings icon on the right top corner of the screen to edit language, results preferences. • Click Preferred modes under Transportation preferences and select car-share option as the preferred mode. • App to provide route options using car-sharing. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • App allows user to select car-sharing as the preferred mode for the transportation options. • App provides route options using car-sharing as the service. 	Traveler	Verification by one tester.	Criteria considered met when traveler is able to select car-sharing as a transportation mode and app provides route options using that mode.	SMH-IF2356-V02 SMH-IF2357-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-CTP007-V01	Integration	Comprehensive Trip Planning	Analyze	Validate that the IK will send GPS information of the location to Pivot app.	All SMH locations	<p>DESCRIPTION Verify that the current location in the Pivot app is accurate.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch on the IK screen to begin. • Open the "Pivot" app, click on the human icon on the left top corner of the app click 'continue as guest'. • Enter the address to destination in the "where to" tab and select from the drop-down list of suggested addresses. • User can enter the address, the name of the destination or set the location on the map. • User to make sure current location shown on the app is correct. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • Pivot app has the correct current location information to accurately provide directions to the destination. 	Technical Tester	Validation by two testers.	Criteria met when each IK successfully meets the interface standards and data exchange requirements as defined in the ICD for this interface (IX2431, IX2432).	
SMH-ECB001-V01	Interface	Emergency Call Button	Test	Verify when user pushes the ECB, the ECB system establishes a bidirectional voice-enabled communication medium and user is able to communicate with the ECC from the IK.	All SMH locations	<p>DESCRIPTION When user hits the ECB, user is able to communicate with the emergency call operator.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User locates the ECB • Push the ECB to activate. • Able to communicate with the Emergency call operator. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should be able to interact with the emergency call operator after ECB is pushed. 	Traveler	Verification by two testers.	Criteria considered met if the testers were able to activate the ECB and verbally interact with ECC.	SMH-FN2323-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-ECB002-V01	Interface	Emergency Call Button	Test	Verify when an ECB is activated by the user; the ECB system activates the IK camera and records video to the local DVR and IKE can retrieve the video.	All SMH locations	<p>DESCRIPTION When user hits the ECB, the DVR should record video for retrieval.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to follow the steps listed under SMH-ECB001-V01. • Tester to make note of the date and time when the ECB button was activated. • Tester will request the video recording from the IK vendor. • Tester to make sure video recorded matches with the date and time the ECB was activated. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • Tester should be able to match the date and time of the video recording with the date and time the ECB was activated. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met if the testers were able to activate IK video when ECB alarm is triggered and match the recording date and time with the actual date and time the ECB was activated.	SMH-FN2323-V02
SMH-ECB003-V01	Interface	Emergency Call Button	Test	Verify when an ECB is in an inactive mode, the IK camera is not activated.	All SMH locations	<p>DESCRIPTION When no ECB activation has occurred, no video recording is taking place.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to follow the steps listed under SMH-ECB002-V01. • Tester to make sure no video is recorded when the ECB was not active. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • No video should be recorded when the ECB is an inactive mode. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met if the testers were able to verify the video was not recorded when ECB was not active.	SMH-FN2323-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-ECB004-V01	Interface	Emergency Call Button	Inspection	Verify that user is able to alert the ECC officials in an emergency situation through the ECB interface at the IK.	All SMH locations	<p>DESCRIPTION User hits the ECB in an emergency situation to alert ECC officials.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> User locates the ECB. User pushes the ECB to activate. User able to communicate with the emergency call operator and alert them with the situation. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> User uses ECB to alert officials in an emergency situation and emergency officials can identify the location requesting assistance. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met if the testers were able to get in contact with the emergency officials through ECB.	SMH-IF2325-V01
SMH-ECB005-V01	Interface	Emergency Call Button	Test	Verify that the IK-CMS records the time, date, and location upon ECB activation.	All SMH locations	<p>DESCRIPTION When user hits the ECB, user should be able to communicate with the emergency call operator.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> Tester to follow the steps listed under SMH-ECB002-V01 Tester to make note of the date and time when the ECB button was activated. Tester will request for the logged data of all times the ECB was active from the IKE vendor. Tester to make sure that logged date, time and location match with the date, time and location the test was conducted at that location. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> Tester should be able to match the date, time and location of logged data with the date, time and location when the ECB was tested at that location. 	Technical Tester	Verification by two testers.	Criteria considered met if the testers were able: 1) to activate the ECB and 2) to verify the recorded time, date, and location log that is stored upon ECB activation in the IK.	SMH-DR2320-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-ECB006-V01	Interface	Emergency Call Button	Test	Verify that the ECB system is capable of transmitting Global Positioning System (GPS) location coordinates to the ECC to notify dispatchers of location of the help request.	All SMH locations	<p>DESCRIPTION Emergency call operator to know the location of the user through the GPS of the ECB system.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> User locates the emergency call button. User pushes the ECB. Communicates with the emergency call operator and operator identifies the location by GPS and confirms with the user. User to confirm the location. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> Emergency call operator to identify the correct location of the user through ECB system GPS. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met if the testers were able: 1) to activate the ECB 2) to alert ECC officials 3) to verify that the GPS coordinates were transmitted to the ECC and officials reach the correct location.	SMH-FN2322-V02 SMH-DR2321-V02
SMH-IKE001-V01	Integration	Interactive Kiosk	Analyze	Validate the data exchange over the interface(s) between the IK-CMS and OS.	All SMH locations	<p>DESCRIPTION Verify data exchange is accurate between OS and IK-CMS.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> Testers to access OS database and IK-CMS database. Verify the data exchange takes place between the OS and IK-CMS. Verify the data exchange between OS and IK-CMS is accurate. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> Tester to verify the data exchange takes place between the systems. Testers to verify the accuracy of data transfer between OS and IK-CMS. 	Technical Tester	Validation by two testers.	Criteria considered met when each kiosk at each SMH facility successfully meets the interface standards and data exchange requirements as defined in the ICD for this interface (IX3254, IX3255, IX3256).	

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE002-V01	System	Interactive Kiosk	Inspection	Verify that user is able to select the language of choice (English and Spanish) at the kiosk	All SMH locations	<p>DESCRIPTION User selects the language of choice (English or Spanish) at the kiosk.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch the screen on the kiosk to exit stand-by mode of the kiosk. • Click “Language” tab on the screen. • Select preferred language. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should be able to locate the language options. • Select language preferences (English or Spanish) at the kiosk. • Language on the apps should change to the language selected. 	Traveler	Verification by two testers.	Criteria considered met with both testers were able to update the language settings from English to Spanish.	SMH-FN2335-V02 SMH-FN3058-V02
SMH-IKE003-V01	System	Interactive Kiosk	Demonstration	Verify the IK system resets back to the English after one minute of inactivity.	All SMH locations	<p>DESCRIPTION Language on the kiosk change to English after one minute of inactivity.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch the screen on the kiosk to begin. • Click “Language” tab on the screen. • Select preferred language. • User to make no clicks on the IK touch screen for a min. • Screen changes to ad loop. • User touch the screen again on the kiosk to begin. • Language shown on the icons should be English. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should be able to locate the language options. • Select language preferences (English or Spanish) at the kiosk. • Language on the icons should change to English after one minute of inactivity. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers change the default language on the kiosk during a browsing session and the kiosk defaults back to its default language (English) after one minute of inactivity.	SMH-FN2441-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE004-V01	System	Interactive Kiosk	Test	Verify that the IK maintains English as the default language.	All SMH locations	<p>DESCRIPTION Language on the kiosk should be English when the user session begins.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch the screen on the kiosk to exit stand-by mode. • Verify that the language on the screen is English. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • Language on the icons should to English when the users starts a session. 	Traveler	Verification by one tester.	Criteria considered met when tester successfully verifies that the language on the screen is English when the kiosk exits stand-by mode.	SMH-FN3058-V01
SMH-IKE005-V01	Policy & Compliance	Interactive Kiosk	Demonstration	Verify that traveler with ADA requirements can access IK controls and apps on the touchscreen.	All SMH locations	<p>DESCRIPTION Touchscreen interface and its controls adjust to the height as per the ADA requirements.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User touch the screen on the kiosk to begin. • Click on the wheelchair icon located on the bottom left corner of the screen. • Height of controls and IK apps adjust as per the ADA requirements. <p>EXPECTED RESULTS Person with ADA requirements should be able to access all controls and app provided on the IK.</p>	Traveler, Technical Tester	Verification by one tester.	Criteria considered met when the tester verify the kiosk apps meet height, requirements for ADA: <ul style="list-style-type: none"> • Pivot app • Other apps loaded on IK 	SMH-FN2346-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE006-V01	System	Interactive Kiosk	Demonstration	Where source data is not available in real-time, verify the touchscreen utilizes portable document format (PDF) and/or service board websites in the short term such as transit route maps, location-specific services or tourism information, etc.	All SMH locations	<p>DESCRIPTION User looks for static transit map when there is no internet connectivity.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to turn off the modem at the kiosk. • Touch on the IK screen to exit the stand-by mode. • Open the transit map app on the touchscreen. • Transit map options will be presented for the user to review. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • Application to provide offline transit map access to the user. 	Technical Tester	Verification by two testers.	Criteria considered met when technical tester demonstrates the accurate content is configured for each kiosk as outlined in this test objective and the traveler tester successfully accesses the information through the IK touchscreen display when internet connectivity has been turned off.	SMH-FN2351-V01
SMH-IKE007-V01	Usability	Interactive Kiosk	Demonstration	Verify that the kiosk provides instructions to the user to exit standby mode.	All SMH locations	<p>DESCRIPTION User is able to locate instructions on how to access the kiosk when in a stand-by mode.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User to approach the kiosk. • Top panel of the kiosk to say, "TOUCH SCREEN TO START". • User is able to locate and read the instructions without any difficulty. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User is able to locate and read the instructions to activate the screen without any difficulty. 	Technical Tester	Verification by two testers.	Criteria considered met when tester observe the information on how to exit the stand-by mode on the kiosk.	SMH-FN2352-V02 SMH-FN3059-V01
SMH-IKE008-V01	Operational Readiness	Interactive Kiosk	Inspection	Verify all hardware undergoes factory acceptance, installation, and performance testing procedures.	All SMH locations	Refer to IKE Manufacturing Pre-Flight checklist attached in Appendix C and IK Field Support checklist attached in Appendix D that lists the steps for the verification of factory acceptance installation and performance testing.	Technical Tester	Verification by one tester.	Criteria considered met when the test manager inspects and provides final sign-off on the testing outlined in this objective.	SMH-EN2331-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE009-V01	System	Interactive Kiosk Administration	Test	Verify the IK system detects and automatically notifies the IK system administrator (operating vendor) when the kiosk is unable to communicate through an interface.	All SMH locations	<p>DESCRIPTION IK system administrator gets an alert when modem on the kiosk is offline.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to turn modem offline installed at the kiosk location. • Verify that the IK system administrator receives an alert. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • IK system administrator gets an alert when modem is offline. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers successfully verify the IK administrator has received the correct alert, containing the correct incident details as outlined in this test objective.	SMH-FN2336-V01
SMH-IKE010-V01	System	Interactive Kiosk Administration	Test	Verify the IK system detects and automatically notifies the IK system administrator (operating vendor) when it is unable to send/receive data.	All SMH locations	<p>DESCRIPTION IK system administrator is notified when the modem on the kiosk is offline and doesn't receive any usage data from the IK to IK-CMS.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to turn modem offline installed at the kiosk location. • Verify that the IK system administrator receives an alert. • Verify the data received from the IK to IK-CMS. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • IK system administrator gets an alert when modem is offline and is unable to send/receive data from the IK. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers successfully verify the IK administrator has received the correct alert, containing the correct incident details as outlined in this test objective.	SMH-FN2336-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE011-V01	System	Interactive Kiosk Administration	Test	Verify the IK system detects and automatically notifies the IK system administrator (operating vendor) when invalid or missing data has been detected.	All SMH locations	<p>DESCRIPTION IK system administrator gets an alert when user tries to access invalid data through the kiosk.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester locates and opens the app that navigates to the URL like 'COTA' app on the touch screen interface. • Deletes the URL of that app and tried to access other web pages. • IK system administrator is notified with an alert when attempted to access invalid data at the kiosk. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • IK system administrator to receive an alert about accessing invalid data at a kiosk. • Alert to also contain unique identifier which can identify the kiosk location. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers successfully verify the IK administrator has received the correct alert, containing the correct incident details as outlined in this test objective.	SMH-FN2336-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE012-V01	System	Interactive Kiosk Administration	Test	Verify the IK touchscreen interface maintains a unique identifier for each IK to diagnose system malfunctions, provides information to the ECB service, as well as customize content per SMH location (location awareness).	All SMH locations	<p>DESCRIPTION IK system administration to verify each IK has unique identifier through the interface.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Tester to turn modem office. • Confirm with IK system. administration Tester to turn modem off line installed at the kiosk location. • Verify that the IK system administrator received an alert. • Verify that the alert is identified by a unique identifier to identify location of the malfunctions. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • IK system administrator gets an alert along with a unique identifier that is used for each kiosk when there is any malfunction at the kiosk. • Unique identifier should match with the kiosk unique identifier when IK system administrator receives an alert about a system malfunction. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers verify each kiosk has a unique identifier and that data is shared upon qualifying triggered events, including ECB activation and location-based advertising and content as outlined in the IK interfaces: <ul style="list-style-type: none"> • IX3254 Kiosk usage • IX2431 Pivot app integration • IX3256 Operating System • IX2433 ECB 	SMH-FN2348-V01
SMH-IKE013-V01	System	Interactive Kiosk App Content	Demonstration	Verify the IK touchscreen provides users with a link to display any current alerts that describe events having a significant impact on transportation services.	All SMH locations	<p>DESCRIPTION User is able to access travel alerts on the IK.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User to open the Pivot app on the IK. • User to select 'Transit Alerts' within the app. • User is able to view the current alerts within the system. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User is able to locate and access the travel alerts within Pivot. 	Traveler	Verification by one tester.	Criteria considered met when tester demonstrates the accurate application content (event alerts) is configured for each kiosk as outlined in this test objective and the traveler tester successfully accesses the information through the IK touchscreen display.	SMH-IF2359-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE014-V01	System	Interactive Kiosk App Content	Demonstration	Verify the IK touchscreen provides users with a link to COTA static maps within the SMH demonstration area.	All SMH locations	<p>DESCRIPTION User able to access COTA maps at the IK.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User exit the stand-by mode by touching the IK screen. • Locate and open 'COTA' app on the touch screen interface. • App will provide maps to various bus routes. • User can click on the different bus routes to check the schedule. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should be able to locate and open the COTA app available on the IK touchscreen interface. • App should navigate to the static maps on the COTA website. • User should be able to open the bus routes for more information on bus schedule and fares. 	Traveler	Verification by two testers.	Criteria considered met when tester demonstrates the accurate application content (static maps) is configured for each kiosk as outlined in this test objective and the traveler tester successfully accesses the information through the IK touchscreen display.	SMH-IF2361-V02 SMH-DR2328-V01 SMH-DR2329-V01
SMH-IKE015-V01	System	Interactive Kiosk Security	Demonstration	Verify that user has access to only approved apps, services, and features offered through the interactive display, including trip-planning and payment via the Pivot app.	All SMH locations	<p>DESCRIPTION Verify that user has only access to apps and features at the IK.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Testers to inspect functionality of all apps and features listed on the IK. • Testers to verify user does not have access to open internet browsing on the kiosk to perform other functions on the kiosk other than using the listed app and features. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • No access to browser on the touch screen interface for users to access other apps. 	Traveler, Technical Tester	Verification by two testers.	Criteria considered met when testers test all the app provided by the IK touchscreen and has no access to internet to download or access any content.	SMH-FN2341-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-IKE016-V01	System	Interactive Kiosk Security	Test	User tries to access OS through the IK touchscreen interface.	All SMH locations	<p>DESCRIPTION Verify that user does not have administrative access to OS through the IK touchscreen interface.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Testers to inspect functionality of apps and features listed on the IK. • Testers to verify that user does not have administrator access to OS through the IK. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • No apps at the IK touchscreen interface provide user with administrative access to OS. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers successfully test all the app provided by the IK touchscreen and not have access to OS.	SMH-FN2345-V01
SMH-IKE017-V01	System	Interactive Kiosk Security	Test	Users access apps and other data that is not presented through the IK touch screen interface.	All SMH locations	<p>DESCRIPTION Verify that user has only access to apps and features at the IK.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Testers to inspect all the app and features listed on the IK. • Testers to verify that user does not have access to internet on the kiosk to access other apps and data on the kiosk. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • No access to data on the IK or from the IK-CMS other than what is presented through the apps. 	Technical Tester	Verification by two testers.	Criteria considered met when both testers successfully configure identity management and access control lists.	SMH-FN2349-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-WFS001-V01	Interface	Wi-Fi Enabled	Demonstration	User is able to connect to Wi-Fi provided through the kiosk on all electronic devices equipped with internet capabilities (phone, tablet, computer).	All SMH locations	<p>DESCRIPTION User connects to the internet via Wi-Fi at the kiosk on their phone, tablet and computer.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to "IKE Free WiFi". • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • Check "I agree the Terms & Conditions" and click "CONNECT". • Click "Done" to connect to the Wi-Fi at the kiosk. • Follow the steps listed above to connect to Wi-Fi on tablet and computer. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User is able to connect to Wi-Fi on all devices and use the internet. • If the user does not accept terms and conditions, user should not be able to connect to the Wi-Fi. 	Traveler	Verification by two testers.	Criteria considered met if the testers were able to successfully connect to internet via Wi-Fi at all SMH locations on their: 1) Phone 2) Tablet 3) Computer	SMH-FN2403-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-WFS002-V01	Interface	Wi-Fi Enabled	Test	User accepts the terms and conditions of Wi-Fi usage service, and an active session with internet access is provisioned.	All SMH locations	<p>DESCRIPTION User connects to the internet via Wi-Fi at the kiosk on their phone, tablet and computer.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to “IKE Free WiFi”. • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • Check “I agree the Terms & Conditions” and click “CONNECT”. • Click “Done” to connect to the Wi-Fi at the kiosk. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User able to connect to Wi-Fi on all devices and use the internet after the terms and conditions are accepted. • If the user does not accept terms and conditions, user should not be able to connect to the Wi-Fi. 	Traveler	Verification by two testers.	Criteria considered met if the testers were able to successfully access internet without any errors after the user accepts terms and conditions.	SMH-FN2407-V01
SMH-WFS003-V01	Interface	Wi-Fi Enabled	Test	User declines the terms and conditions of Wi-Fi usage service, and an active session with internet access is not provisioned.	All SMH locations	<p>DESCRIPTION User connects to the internet via Wi-Fi at the kiosk on their phone, tablet and computer.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to “IKE Free WiFi”. • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • User does not click “I agree the Terms & Conditions” and “CONNECT” button is greyed out. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should not be able to connect to the Wi-Fi without accepting the terms and conditions. 	Traveler	Verification by two testers.	Criteria considered met if the testers were: 1) prompted with terms and conditions while trying to connect to the internet via Wi-Fi on their PWD at the kiosks. 2) rejects the terms and conditions. 3) not able to connect to the internet.	SMH-FN2408-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-WFS004-V01	Interface	Wi-Fi Enabled	Test	Verify that access to a webpage is denied when user tries to access a website that is a violation of Wi-Fi usage policy.	All SMH locations	<p>DESCRIPTION Block websites that are a violation of the usage policy.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User has already completed SMH-WFS001-V01. • User attempts to connect to a website blacklisted due to terms of service violation. For testing, the website will be www.netflix.com. • User is prevented from accessing the website. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User cannot access a site that violates the Wi-Fi usage policy. 	Traveler	Verification by two testers.	Criteria considered met if the internet access is denied while trying to access the sites that are a violation of the IK Wi-Fi technology usage.	SMH-SR2421-V01
SMH-WFS005-V01	Interface	Wi-Fi Enabled	Test	Verify that Wi-Fi technologies terminate a connection if the connection has extended beyond 15 minutes.	All SMH locations	<p>DESCRIPTION The active session of Wi-Fi is terminated 15-minutes following connection.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • User has already completed SMH-WFS001-V01. • User records the time of connection. • After 15 minutes from the recorded connection time, verify that the Wi-Fi connection has terminated. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • The Wi-Fi connection terminates 15 minutes after connection is established. 	Traveler	Verification by two testers.	Criteria considered met successfully if the internet access is denied when connected to IK Wi-Fi services for more than 15 minutes at a time.	SMH-SR2421-V01

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-WFS006-V01	Interface	Wi-Fi Enabled	Test	Verify that Wi-Fi technologies present the user with a terms of use page designated by vendor to display the free Wi-Fi terms and conditions of service.	All SMH locations	<p>DESCRIPTION User is presented with the terms and conditions when trying to connect to the Wi-Fi at the kiosk.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to “IKE Free WiFi”. • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • Click on “Privacy Policy” and “Acceptable Use Policy” to open the agreements. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User should be able to open the “Privacy Policy” and “Acceptable Use Policy” before they accept the terms and conditions. 	Traveler	Verification by two testers.	Criteria considered met if the testers were prompted with terms and conditions on their PWD when trying to connect to the internet via Wi-Fi at the kiosks.	SMH-RG2415-V01
SMH-WFS007-V01	Interface	Wi-Fi Enabled	Test	To verify that the IK Wi-Fi services permits access to Pivot app on PWDs.	All SMH locations	<p>DESCRIPTION User is able to open the Pivot app on their PWD.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to “IKE Free WiFi”. • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • Check “I agree the Terms & Conditions” and click “CONNECT”. • Click “Done” to connect to the Wi-Fi at the kiosk. • Open Pivot app with no connection errors. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • User is able to connect to the Wi-Fi at the kiosk. • Open the pivot app without any errors using the Wi-Fi at the kiosk. 	Traveler	Verification by two testers.	Criteria considered met if the tester is able to access Pivot app on PIDs using the Wi-Fi at the Kiosk.	SMH-IF2356-V02

TEST CASE ID	TEST TYPE	FUNCTION	VERIFICATION METHOD	TEST OBJECTIVE	SMH TEST LOCATIONS	TEST PROCEDURE	TESTER ROLE	METRIC	PASS CRITERIA	SyRS Reference
SMH-WFS008-V01	Interface	Wi-Fi Enabled	Test	Wi-Fi technologies shall support a minimum of 10 simultaneously connected users or devices.	All SMH locations	<p>DESCRIPTION Ten users successfully connect to the Wi-Fi at the kiosk.</p> <p>PROCEDURE</p> <ul style="list-style-type: none"> • Open settings on the phone, under Wi-Fi connect to “IKE Free WiFi”. • A Log In page will open to accept terms and conditions and connect to the Wi-Fi. • Check “I agree the Terms & Conditions” and click “CONNECT”. • Click “Done” to connect to the Wi-Fi at the kiosk. • Connect Wi-Fi on all ten devices by following steps listed above. <p>EXPECTED RESULTS</p> <ul style="list-style-type: none"> • All ten devices successfully connect to the Wi-Fi at the same time at one location with no errors. 	Traveler, Technical Tester, Facility Owners, Test Manager, System Owner	Verification by ten testers.	Criteria considered met if all devices were able to connect to Wi-Fi at the same time at one location with no errors and lag.	SMH-PR2411-V02

Source: City of Columbus

6.2. MOBILITY INFRASTRUCTURE

The test cases designed for this MTP will focus on testing the elements of mobility infrastructure items. Test cases related to the infrastructure constructability elements with the verification method as inspection are listed below in **Table 8: Mobility Infrastructure Inspection Checklist**. This checklist will be signed-off by the testers after inspecting all the mobility elements installed at all SMH locations.

Table 8: Mobility Infrastructure Inspection Checklist

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
Field Installation Results			
Bike Racks			
Verify that the bike racks are located on paved or pervious surface with a slope no greater than 3 percent.	SMH-PY2278-V01		
The bike racks shall support a bicycle in a stable upright position.	SMH-FN3071-V01		
The docking station shall support a bicycle in a stable upright position.	SMH-FN3070-V01		
Verify that the bike racks have a vertical clearance of at least 6 feet.	SMH-PY2279-V01		
Verify that the bike racks have an access aisle with a minimum width of 5 feet.	SMH-PY2280-V01		
Verify that minimum number of bike racks per SMH location should be equal to 5 percent of the total number of parking spaces.	SMH-AR2274-V02		

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
Verify that the bike racks are modular in construction so that additional racks may be installed in the future with similar overall functional and aesthetic qualities.	SMH-LC2456-V01		
The City or Property Owner shall approve the locations of the bike racks. (Per final construction plans)	SMH-RG2276-V01		
The placement of bike racks shall not impede flow of vehicle or pedestrian traffic.	SMH-PR2275-V01		
Bike-Sharing			
Verify that the bike-share docking stations are located at SMH locations.	SMH-FN2290-V02		
The SMH shall provide an interface to the bike-share company.	SMH-DR2283-V02		
Verify that the docking stations are solar powered at SMH locations listed in the RFP.	SMH-FN2293-V01		
Verify that the bike-share docking station is located on paved or pervious surface with a slope no greater than 3 percent	SMH-PY2305-V01		
Verify that the bike-share docking station have a vertical clearance of at least 6 feet.	SMH-PY2306-V01		
Verify that the bike-share docking station have an access aisle with a minimum width of 5 feet.	SMH-PY2307-V01		

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
The docking station shall permit the locking of the bicycle frame and one wheel to the rack.	SMH-SR2308-V01 SMH-FN3070-V01		
Docking stations should be modular in construction so that additional racks may be installed in the future with similar overall functional and aesthetic qualities.	SMH-LC2457-V01		
Verify that the docking stations are primarily located within the public right-of-way, along public streets and sidewalk, parks, trails, parking lots/garages, events venues, etc., are located on private property, provided that the property owner agrees to allow 24/7 public access to the docking station.	SMH-RG2303-V01		
Verify that the City and property owner approve the locations of the docking stations.	SMH-RG2461-V02		
The bike-share docking station shall not impede flow of vehicle or pedestrian traffic	SMH-PR2301-V02		
Car-Sharing			
Verify that the SMH facility provides designated parking spaces for car-share vehicles.	SMH-FN2310-V02		
Verify that the car-share parking lots have a vertical clearance of at least 12 feet.	SMH-PY2312-V01		
Verify that the car-share parking lots are located on paved or pervious surfaces with a slope of less than 3 percent.	SMH-PY2313-V01		

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
Verify that additional parking spaces can be investigated if warranted by increased demand for car-sharing services.	SMH-LC2458-V02		
Dockless Device Zone			
Verify that additional space for dockless equipment zone can be made available by stakeholder agency if warranted by increased demand for this service.	SMH-LC2445-V02		
Verify that the City and property owner approve the locations of the dockless device zones.	SMH-RG2447-V01		
The dockless parking zone shall not be laid out in a manner which impedes the flow of vehicle or pedestrian traffic.	SMH-PR2450-V02		
Designated paved area shall be made available for dockless devices such as scooters and ebikes at the SMH facility.	SMH-FN2442-V01		
Boundaries, symbols and/or text description of designated area for dockless devices shall be clearly outlined on pavement with paint.	SMH-FN2443-V01		
Park & Ride			
Verify that the park & ride facility have a vertical clearance of at least 12 feet.	SMH-PY2386-V01		
Verify that the park & ride facility have an access aisle with a minimum width of 5 feet.	SMH-PY2387-V01		

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
Verify that the park & ride facility parking lots are located on paved or pervious surfaces with a slope of less than 3 percent	SMH-PY2454-V01		
Verify that at least one ADA-compliant parking space is available at each of the SMH locations for every 25 spaces. One out of six of the ADA-compliant spaces must be van accessible. An accessible car parking space must be a minimum of 96 inches wide, and a van space must be a minimum of 132 inches wide (a van space may be 96 inches if the access aisle is 96 inches or wider).	SMH-AR2381-V02		
The park and ride parking spaces shall allow 24/7 public access to the vehicles.	SMH-PR2382-V02		
The park-and-ride facility shall allow parked vehicles to maintain unimpeded access to roadway/driveway entrances and exits.	SMH-PR2383-V01		
The park and ride designated parking spaces shall be located in locations that do not impede the regular flow of travel in the public right of way.	SMH-PR2384-V02		
The park-and-ride facility shall ensure the vehicles not be parked in a way that impedes the 5 feet clearance on sidewalks needed for ADA compliance.	SMH-PR2385-V01		
Additional parking spaces should be made available if warranted by increased demand for park-and-ride services.	SMH-LC2455-V01		
The IK touch screen shall provide users with a link to the COTA Real-Time Display.	SMH-IF2360-V01		

Test Case	Req. ID	Pass/ Fail/ N/A	Comments
Ride-Hailing			
Verify that additional space for pick-up/drop-off zone can be made available if warranted by increased demand for ride-hailing services.			
Verify that the ride-hailing locations are approved by the City and property owner.	SMH-RG2393-V01		
Curb space shall be designated for pickup from ride-hailing and taxi services.	SMH-FN2388-V02		
The City and Property Owner may designate parking areas or restrict car parking within certain areas.	SMH-PR2392-V02		
Additional space for pickup/drop-off zone should be made available if warranted by increased demand for ride-sharing services.	SMH-LC2459-V01		

Source: City of Columbus

Inspection Completed By: _____

Date: ____/____/____

Chapter 7. Test Scenarios

Test scenarios are critically important to the acceptance of the SOI, as it tests the system holistically, end-to-end, from all active participant viewpoints. Scenarios are made up of a series of test procedures used to simulate the system in a real-world operational environment. This approach validates the system's ability to meet the concepts established through the project ConOps (SMH operational scenarios) and forms the basis of acceptance testing for the given production release.

The SMH system capability and performance will be deemed acceptable provided all testing elements within a scenario successfully passes the test from each participant's viewpoint.

The scenarios outlined below are reflective of the capabilities the system must be able to perform in order to receive acceptance of the IK system. The SMH capability and performance will be deemed acceptable provided all testing elements within a scenario successfully passes the test from each participant's viewpoint.

Table 9: Testing Scenarios with Requirements Traceability provides the comprehensive list of scenarios that will be tested with traceability to the requirement(s) published in the SyRS, Interface Control Document (ICD) and ConOps.

Table 9: Testing Scenarios with Requirements Traceability

FUNCTION	ACCEPTANCE TEST SCENARIO ID	SCENARIO DESCRIPTION	TEST CASE ID REFERENCE	REQUIREMENT ID REFERENCE
Interactive Kiosk	SMH-ATS100-V01	User is able to select the language of preference, English or Spanish at the kiosk.	SMH-IKE002-V01	SMH-FN3058-V01 SMH-FN2335-V02 SMH-UN012-V01
Mobility Providers at SMH locations	SMH-ATS102-V01	User is able to plan a trip and be able to select multiple transportation modes available at the location through the Pivot app.	SMH-CTP002-V01	SMH-FN2290-V02 SMH-FN2310-V02 SMH-FN2442-V01 SMH-UN001-V01 SMH-UN005-V01 SMH-UN011-V01
Comprehensive Trip Planning <ul style="list-style-type: none"> Data access 	SMH-ATS105-V01	User is able to access COTA static map information through the IK touchscreen interface for bus route and fare information.	SMH-IKE014-V01	SMH-DR2328-V01 SMH-IF2360-V01 SMH-IF2361-V02 SMH-IF2316-V01 SMH-UN001-V01 SMH-UN003-V01 SMH-UN006-V01 SMH-UN008-V01 SMH-UN009-V01 SMH-UN010-V01 SMH-IX2431-V01
Emergency Call Button <ul style="list-style-type: none"> Call activation 	SMH-ATS107-V01	User is able to activate the ECB service by pressing the button located at the kiosk to alert the ECC officials in any emergency.	SMH-ECB001-V01 SMH-ECB004-V01	SMH-IF2325-V01 SMH-UN007-V01 SMH-UN015-V01 SMH-IX2433-V01

FUNCTION	ACCEPTANCE TEST SCENARIO ID	SCENARIO DESCRIPTION	TEST CASE ID REFERENCE	REQUIREMENT ID REFERENCE
Emergency Call Button <ul style="list-style-type: none"> 24x7x365 ECB service 	SMH-ATS108-V01	User is able to use the ECB service 24 hours a day, seven days a week, 365 days a year.	Appendix E – SMH-AR2318-V01	SMH-AR2318-V01 SMH-UN007-V01 SMH-UN015-V01
Wi-Fi Accessibility <ul style="list-style-type: none"> Wireless internet 	SMH-ATS110-V01	Verify that users are able to connect to Wi-Fi on their wireless device when in close proximity to the kiosk.	SMH-WFS001-V01 SMH-WFS007-V01	SMH-IF2409-V01 SMH-UN004-V01 SMH-IX2438-V01
	SMH-ATS111-V01	User is able to login to Pivot app account on a personal device using the Wi-Fi internet access at the kiosk.		
Ride-Hailing	SMH-ATS112-V01	User is able to locate the designated pick-up and drop-off zones provided at all SMH locations except for Columbus State Community College location.	Appendix D: Interactive Kiosk Field Support Checklist	SMH-IF2357-V01 SMH-FN2388-V02 SMH-UN003-V01 SMH-UN005-V01 SMH-UN014-V01 SMH-IX2432-V01
Car-Share	SMH-ATS113-V01	User is able to locate designated car-share parking zones at designated SMH locations (Northern Lights, St. Stephens, Columbus State, Linden Library).	Appendix D: Interactive Kiosk Field Support Checklist	SMH-IF2357-V01 SMH-FN2310-V02 SMH-UN005-V01
Dockless Parking	SMH-ATS114-V01	User is able to locate designated dockless parking zones (scooters, ebikes and dockless bicycles) provided for parking dockless devices with marked pavement markings and signage (all locations except Easton Transit Center).	Appendix D: Interactive Kiosk Field Support Checklist	SMH-IF2357-V01 SMH-FN2442-V01 SMH-FN2443-V01 SMH-UN005-V01 SMH-UN003-V01 SMH-IX2432-V01

Appendix A. Test Result Summary

This appendix identifies the test results for each of the test scenario, a defect management tool, test metrics, exist criteria, and conclusion and sign-offs for the test results.

A.1 TEST RESULTS

A.1.1 Test Case Report

This section identifies the test results for each of the test cases which will be focused on the functionality of each essential function. All functions will be tested under leadership of the system owner, test manager, and test tech lead who tests each test case from the perspective of the user. Throughout this process, any bugs, inconsistencies, errors, etc., that were detected were captured in the defect tool and reported to the development team. The development team modified, updated, and enhanced the software to address issues that bubbled up during testing.

Table 10 presented in the following pages provides a detailed log of the final results of testing each case for this first segment.

Table 10: Test Case Results Matrix

TEST ID	FUNCTION	TEST OBJECTIVE	TEST PROCEDURE	TESTER ROLE	TEST STATUS	DATE RUN	TESTING COMMENT

Source: City of Columbus

A.1.2 Acceptance Test Scenario Report

Acceptance test scenario will be focused on verifying each of the SMH service options for operational readiness by conducting a set of tests that reflected usage of the system in real-world scenarios. This testing primarily consisted of the City of Columbus, stakeholders, and administrators of the system.

Throughout this process, all bugs, inconsistencies, errors, etc., detected will be captured in the defect tool and be reported to the development team. The development team modified, updated, and enhanced the software as appropriate to address issues that arose during acceptance testing.

Appendix A. Test Result Summary

Any scenario that may have failed was re-tested until either it successfully met the expected outcome or a low-risk decision to modify the design was made. **Table 11** below provides a log of the final results of this last test segment of testing.

Table 11: Acceptance Test Scenario Result Matrix

TEST ID	FUNCTION	TEST OBJECTIVE	TEST PROCEDURE	TESTER ROLE	TEST STATUS	DATE RUN	TESTING COMMENT

Source: City of Columbus

A.2 DEFECT MANAGEMENT TOOL

The defect tool was used during testing to capture, track, monitor, and address anomalies observed during the testing period. For each entry, the development team worked to understand and reproduce (where possible) the defect, identify the root cause, summarize a response and log the activities taken to resolve the issue. As outlined in **Section 4.4.2**, the defect tracker helps with prioritizing defects based on severity level (critical to low) and maintains traceability to the test ID as well as status. The status field provides a simplified view of the various states a defect passes through as it moves toward resolution and closure. A defect can have the following status values:

- **Opened** – indicates the defect has been logged and reported for correction.
- **Re-Opened** – indicates a defect was once closed and then re-opened for modification.
- **Closed** – indicates a defect was received, reviewed, and determined was not a defect (i.e., duplicate entry or a request for enhancement). In these cases, no corrective action is taken, and an explanation is provided by the development team while closing -out the defect ticket.
- **Canceled** – indicates a scenario or test case where the defect derived was canceled and therefore the defect is canceled by default.
- **Resolved** – indicates a defect has been successfully reviewed, verified, and a resolution was implemented to solve the problem along with the and resolution date when a defect was corrected.
- **Returned** – indicates the defect was returned to the tester for additional information.
- **Deferred** – indicates the defect has been designated for correction for a later date.

In cases when a conflict arose between a design element that tied to a requirement and the software product, the development manager coordinated with the test manager to determine if a change to the system design and/or requirement was appropriate. The City of Columbus project manager (who was also the MTP test manager) carefully reviewed all requests to make a change that impacts the system design and requirements. All change requests have been captured within the change logger tool.

Table 12 below provides an overview of the resulting defects captured and closed or resolved during testing.

Table 12: Defect Management Matrix

DEFECT NO.	DEFECT DESCRIPTION	SEVERITY	DEFECT STATUS	TEST ID	DATE FOUND	ASSIGNED TO	RESOLUTION DESCRIPTION	COMMENTS

Source: City of Columbus

A.3 TEST METRICS

This section identifies the test metrics from executing the test plan.

Table 13: Test Cases Planned vs Executed

Test Cases Planned	Test Cases Executed	Test Cases Passed	Test Cases Failed
0	0	0	0

Source: City of Columbus

Table 14: Defect Matrix Open vs Closed

Defect in Release	Open	Closed	Canceled	Resolved	Deferred
R1	0	0	0	0	0
R2	0	0	0	0	0

Source: City of Columbus

Table 15: Defect Matrix – by Priority/Type

Defect in Release	High	Medium	Low	Total
R1	0	0	0	0
R2	0	0	0	0

Source: City of Columbus

A.4 OUTSTANDING ISSUES

This section discusses any open defects the project is tracking along with the reason it remains open.

Table 16: Outstanding Issues

Defect ID	Defect Description	Severity	Defect Status	Notes

Source: City of Columbus

A.5 CHANGE REQUEST LOG

This section documents the Change Requests (CR) that have been captured, evaluated, and instantiated throughout the testing life cycle.

Table 17: Change Request Log

CR ID	Description	Justification	Defect ID	Requirement	Status

Source: City of Columbus

A.6 EXIT CRITERIA

This section gives the conditions that were fulfilled so as to stop testing.

Table 18: Test Exit Criteria

Criteria	Met/Not Met
All planned test cases and scenarios have been executed in Execution Tool	
Test scenarios achieve a 100% pass ratio (in relation to failures)	
All defects found have been recorded in the defect management tool	
All high-severity defects have been resolved and retested	
Outstanding issues have a plan and schedule for resolution	
MTP with Test Summary Report (this appendix) issued to stakeholders	

Source: City of Columbus

A.7 TEST ACCEPTANCE

The information being reported on this MTP is correct and grants permission for the project to move forward with the production deployment.

Table 19: Test Sign-offs

Role	Name	Date	Signature
Test Manager	Jeff Kupko		
Test Technical Lead	Ram Boyapati		

Source: City of Columbus

Appendix B. Terminology and Conventions

B.1 NUMBERING CONVENTION

Each testing element contains a unique identifier for traceability and configuration management. Test cases and scenarios for all projects in the Smart Columbus program will follow the same convention, each representing an identifiable attribute of the traced metric. The convention is as follows:

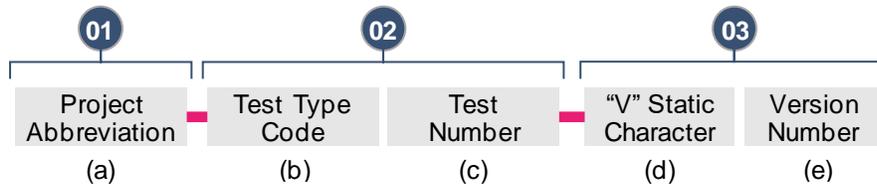


Figure 1: Numbering Convention

Source: City of Columbus

Table 20: Numbering Convention Definitions

Octet	Description	Data Type, Casing	Number of Characters or Digits
a. Project Abbreviation	The designated Smart Columbus project acronym (i.e., SMH)	String, upper case	Variable
b. Test Type Code	<ul style="list-style-type: none"> • IKE: Interactive Kiosk Environment • ECB: Emergency Call Button • CTP: Comprehensive Trip Planning • WFS: Wi-Fi Service 	String, upper case	3
c. Test Number	An integer incrementing by one, indicating the number of requirements established.	Integer	3
d. "V" Static Character	Static letter "V" represents the version for the particular test objective and procedure.	Character	1
e. Version Number	An integer incrementing by one, indicating the number of revisions made to the test element being traced.	Integer	2

Source: City of Columbus

An example of a test case for the integration of Emergency Call Button on the interactive kiosk would be SMH-ECB001-V01.

1. "SMH" is the project abbreviation.

2. "ECB001" is the test type code coupled with the three-digit test number.
3. "V01" is the static "V" coupled with the two-digit version number.

Appendix C. IKE Manufacturing Pre-Flight Checklist

Table 21 provides the checklist that will be inspected for each kiosk before the kiosk is packed and shipped for installation.

Kiosk Serial Number: _____

Purpose: This document is a preliminary assembly checklist for production of the “IKE 2.5”, for Dynascan, to ensure quality and completeness of each kiosk prior to shipping to Display Devices where final assembly and configuration will be performed.

Scope: Each step should be executed and signed off on every kiosk prior to packaging and shipping.

Table 21: IKE Manufacturing Pre-Flight Checklist

Display Devices	Document Title	Document Number	Effective Date
	Type of Document: Quality Control Checklist Product: Dual Sided 65” Pentagram IKE Kiosk		

Step	Procedure	Req ID	Notes	Initials
3.0	Review DDI Serial Number. Confirm all fields are complete	SMH-FN2348-V01		
4.0	Touchscreen: Confirm responses in all areas of the screen.	SMH-FN2347-V01		
5.0	Touchscreen: Confirm calibration is accurate	SMH-PY2370-V01 SMH-FN2347-V01		
6.0	Touchscreen: Visually inspect and record and photograph any visual defects in lamination.	SMH-FN2347-V01		
7.0	Visually inspect monitor for any image quality and debris.			
8.0	Visually inspect all letters and inserts. Confirm alignment and clarity.	SMH-PY2370-V01 SMH-FN2352-V02		

Appendix C. IKE Manufacturing Pre-Flight Checklist

Step	Procedure	Req ID	Notes	Initials
9.0	Visually inspect exterior. Record and photograph any defects (i.e. coat blemishes, dents, scratches, etc...).			
10.0	Test Emergency Call Panel (if installed).			
11.0	Selfie camera: Confirm that outer perimeter of ELP camera has been removed (cut off)			
12.0	Selfie camera: Confirm view is unobstructed, lens is clean, and camera is focused. Object that is 8 ft away from kiosk, and centered in front of screen, should be in center of visual field.			
13.0	Log into Linkett Wi-Fi and confirm network availability	SMH-IF2409-V01		
14.0	Confirm air gap between monitor & window is consistent @ - °» inch.			
15.0	Confirm D-foam is installed along vertical window brackets. Foam must be straight and make contact with monitor bezel for entire length.			
16.0	Visually inspect all external LED lights. Confirm function and brightness is consistent.	SMH-PR2452-V01		
17.0	Open and lock both doors. Confirm that a single person can open and shut the door easily and that no gaps are present.	SMH-PY2369-V01		
18.0	Confirm lock orientation is correct. Notches in key should match the direction of the Custom Cam Latch	SMH-PY2369-V01		
19.0	Confirm that silicon and gasket is applied to E911 button/Closure Panel interface.	SMH-PY2369-V01		
20.0	Confirm correct size TrimLock (9/32" bulb size) and P-foam are installed along door seals	SMH-PY2369-V01		

Step	Procedure	Req ID	Notes	Initials
21.0	Visually inspect A/C installation with sample A/C unit. Confirm fitment and clearance for conduit and/or wire raceway.	SMH-PY2370-V01		
22.0	Confirm that kinetic LED connectors are wrapped with electrical tape, or heat shrink.			
23.0	Confirm white LED panels are aligned and installed in correct orientation			
24.0	Confirm all desired options are installed.			
25.0	Confirm all power and communication lights are on the computer and router.			
27.0	Confirm PCAP board cover is installed and sealed by foam	SMH-PY2372-V01		
28.0	Confirm all cord grips are beyond hand tight (load center grips, may be tightened in the field).	SMH-PY2372-V01		
29.0	Inspect wire management. Note any pinch points or discrepancies.	SMH-PY2372-V01		
30.0	Check all electrical connections for secure connection by performing tug test on all power wires.	SMH-PY2372-V01		
31.0	Confirm that Elec panels cover are aligned and installed correctly.	SMH-PY2372-V01		
32.0	Confirm player 1 and 2 are installed and showing on network.			
33.0	Confirm all appropriate options are installed.			
34.0	If applicable, confirm NVR, security cameras, emergency call button and AQM are visible on network.			
35.0	Confirm that all necessary UL stickers are installed (see UL sticker location instructions).	SMH-PY3066-V01		

Appendix C. IKE Manufacturing Pre-Flight Checklist

Step	Procedure	Req ID	Notes	Initials
36.0	Confirm replacement gasket is installed on antenna and that antenna lock nut is securely fastened.			
37.0	Test the unit operation with sample AC board.			
38.0	Test each door with sample player.			
39.0	Are the network switches operating correctly?			

Source: IKE Smart City, LLC.

Inspection Completed By: _____

Date: ____ / ____ / ____

Appendix D. Interactive Kiosk Field Support Checklist

Table 22: Interactive Kiosk Field Inspection Checklist

Procedure	Req ID	Pass/Fail	Comments
Field Installation Results			
Verify that Kiosks are installed as per the construction as-built approved by City of Columbus.	SMH-RG2373-V01		
The IK system shall adhere to object-oriented design principles to facilitate replacement or modification of individual components of the IK system without impacting the overall system.	SMH-RG2374-V02		
The IK touch-screen interface display shall be at least 55" diagonal	SMH-PR3062-V01		
The IK shall include an integrated security camera and DVR.	SMH-FN3061-V01		
Once a unit is set up and powered on, perform the following checks on both sides of the unit:			
Ad-loop is cycling through ads	SMH-FN2353-V02		
When tapped, unit transitions from the ad-loop to the dashboard correctly	SMH-FN2354-V01		
Time and weather are displaying correctly based on current location and time zone	SMH-IF2362-V01 SMH-FN2344-V02		
City specific application designs are displaying	SMH-FN2344-V02		
Unit returns to the ad-loop after 60 seconds of inactivity	SMH-FN3059-V01		
Verify that the IK system reboots following a power loss.	SMH-FN2340-V02		
Directory Listing Applications (Choose one of Eat and Drink, Shop, Stay, Activities, Parks & Outdoor, Museums & Culture, Social Services, Civic Resources):			

Appendix D. Interactive Kiosk Field Support Checklist

Procedure	Req ID	Pass/Fail	Comments
Listings appear correctly – Name, address, category, directions with time, images (if present otherwise category icon)	SMH-IF2362-V01 SMH-FN2344-V02		
Can filter results by category			
Can search by name / category			
Tapping the card flips to the detail view and the map zooms to show directions			
Detail view has appropriate content	SMH-IF2362-V01 SMH-FN2344-V02		
Location specific information available at the kiosk when the system is offline	SMH-FN2448-V01		
Verify the IK system performs daily background verification of all external web links and provides immediate notification to the IK system administrator if any link fails verification.	SMH-IM2364-V01		
Hardware			
Wash glass face. Wash body of kiosk top to bottom.			
Remove Graffiti or other marks. If applicable, describe what graffiti was removed and where on kiosk it was located (example: spray paint on side, sticker on front base, etc.).			
Check for scratches or other damage	SMH-ST3072-V01		
Pick up and dispose of debris or garbage	SMH-DP2327-V01		
Connect to IKE Free Wi-Fi and verify it is operational	SMH-IF2409-V01		
The IK touch-screen interface shall be designed with flexibility to allow future expansion such as the addition of new software tools, data sources, or other needs that may emerge in the future.	SMH-LC2460-V02		
The IK system shall be designed with an open architecture intended to facilitate expansion of the functionality and/or scale of the IK system as new data sources, apps, features, standards and/or technologies emerge in the future.	SMH-EN2332-V02		

Procedure	Req ID	Pass/Fail	Comments
The IK touch-screen interface design elements and page renderings shall be flexible to enable future enhancements as information and data quantity and quality improves/evolves over time, including modular graphics, design templates controlling color schemes, fonts, backgrounds, etc., and implementation of web-development best practices, version control, notation and documentation.	SMH-EN2333-V01		
IK hardware shall be protected from environmental perils during transport, storage, installation and operation such as moisture, humidity, weather, dust, smoke, heat, static electricity, magnetic fields and vibration.	SMH-ST3072-V01		
The IK touch-screen interface shall be physically robust to withstand intentional or unintentional impacts normally expected for a commercial grade display accessible to the public.	SMH-PY3065-V01		
The IK unit shall be capable of withstanding wind loads of $v_{asd} = 80$ mph and $v_{ult} = 105$ mph for up to three seconds.	SMH-PY3067-V01		
SMH may consider IEEE 802.11ai to enable Fast Initial Link Setup (FILS) methods to enhance End-User experience in high-density Wireless Local Area Network (WLAN) environments.	SMH-FN2405-V01		
The IK touch-screen interface content shall include static and real-time Traveler information to the extent that each data element is available from the OS retrieved through the General Transit Feed Specification (GTFS) real-time data feed. The screen should display arrivals in the next hour for that location.	SMH-DR2329-V01		
Wi-Fi technologies shall follow IEEE 802.11 b/g/n standards to enable multi-gigabit throughput in the 2.4 GHz, 5GHz and 60GHz spectrum bands.	SMH-FN2406-V01		
The IK shall allow the User to enter trip feedback such as the operational status of the just docked bike. The operational status could include the need for preventative and repair maintenance.	SMH-FN2292-V02		

Appendix D. Interactive Kiosk Field Support Checklist

Procedure	Req ID	Pass/Fail	Comments
Verify the IK system detects and automatically notifies the IK system administrator (operating vendor) when service requests and queries extend longer than 10 seconds.	SMH-FN2336-V01		
Verify all IK communications links utilize TCP/Internet Protocol (IP) and possess high-speed bandwidth and availability to perform the functionalities described within the SyRS.	SMH-FN2338-V01		

Source: City of Columbus

Inspection Completed By: _____

Date: ____ / ____ / ____

Appendix E. Agreement Verification Requirements

The SMH system requirements listed in **Table 23** will be verified by a review of the agreements existing in the SMH project.

Table 23: SMH Requirements for Agreement Review

Req. ID	Description	Pass/Fail	Comments
SMH-IF2355-V02	The IK shall provide a secured, direct-connect interface to facilities for operational administration.		
SMH-MT2367-V01	The IK system shall be designed such that administrative and maintenance activities that require the system to be taken off line can occur at periods of lowest public utilization (e.g. overnight) to maintain maximum system availability for public Users.		
SMH-FN2337-V02	The IK system software shall be capable of the automatic resolution of system abnormalities, security incidents, faults, and errors (to the extent possible).		
SMH-FN2350-V01	The IK touch-screen interface shall utilize a commercial off-the-shelf Kiosk Operating System (KOS) that resides on top of the OS (latest version of Windows, Linux, or Raspberry Pi), in accordance with the software requirements outlined in this SyRS.		
SMH-MT2368-V01	The vendor shall maintain the IK and back-office IK system.		
SMH-FN2342-V01	The IK system shall be designed for unattended operation under normal circumstances, exclusive of manual data entry, public User access, and routine administrative functions.		
SMH-FN2449-V01	Verify the IK system files are “revolving” or self-appending so that old data is continually overwritten, and system data does not reach capacity of available memory.		
SMH-SR2379-V01	Verify the IK system detects and automatically alerts the IK system administrator when it detects IK access door has been opened.		

Appendix E. Agreement Verification Requirements

Req. ID	Description	Pass/Fail	Comments
SMH-SR2379-V01	Verify the IK system detects and automatically alerts the IK system administrator when it detects cybersecurity alert has been logged by the unified threat management software (antivirus, malware detection, etc.).		
SMH-AR2326-V02	The IK system shall incorporate system redundancies to the extent practical to guard against failure of individual hardware, software, network, or communications components and ensure maximum, persistent always-on availability, maintaining continuous operation outside of the scheduled maintenance 24 hours a day, seven days a week, 365 days a year.		
SMH-SR2453-V02	All IK software and security systems shall be reviewed quarterly by IK administrator for updates or as updated as new versions become available.		
SMH-SR2379-V01	To verify that the IK system detects and automatically alerts the IK system administrator when it detects the misuse of IK features such as recreational web browsing or attempts to intercept communications between interfaces.		
SMH-SR2380-V01	Verify the integrity of IK system apps, communications, and network links are secured through mechanisms such as password authentication.		
SMH-FN2339-V02	Verify IK system errors, warnings, and self-correcting actions are sent to the IK-CMS at regularly scheduled intervals to ensure there are no gaps in log file data.		
SMH-IM2365-V01	The IK system backup files (server clone snapshot and data backups) shall be tested quarterly for recoverability integrity.		
SMH-IM3069-V01	All IK software and security systems shall be reviewed quarterly for updates or as updated as new versions become available.		
SMH-IM2366-V01	The IK system shall capture and log all data entered through the touch-screen interface for further analysis at the back office for purposes of enhancing location aware services and improving safety at each designated location.		

Req. ID	Description	Pass/Fail	Comments
SMH-SR2376-V01	Verify the IK system components are protected by firewalls and equipped with security detection, prevention, and response mechanisms to guard against intentional and unintentional threats to the integrity of the system arising from unauthorized access, computer viruses and worms, system abnormalities or faults, and other sources of potential harm.		
SMH-SR2377-V01	Verify the IK system accommodates multiple tiers of user data security to allow distinct privileges to access data based on user roles (e.g. public user, IK administrative user and partner account administrator).		
SMH-SR2378-V01	Verify the IK system is designed to preserve the privacy of individual public users of the system and provide data protection, such as encrypting login credentials, payment information, and other sensitive data captured through the IK and transmitted over Wi-Fi or fiber.		
ECB System			
SMH-AR2318-V01	Verify that the ECB service is available 24 hours a day, seven days a week, 365 days a year		
SMH-EN2317-V01	Verify that the ECB service undergoes end-to-end testing by vendor on an annual basis.		
Wi-Fi System			
SMH-DR2401-V01	Verify that the SMH Wi-Fi technologies log user connection timestamp, IP, Media Access Control (MAC) address, OS, device manufacturer, sites visited, and connection status and length.		
SMH-DR2400-V01	Verify that the SMH Wi-Fi enabled technologies track number of clients per access point		
SMH-AR2399-V01	Verify that Wi-Fi network is fault tolerant and maintain continuous network uptime outside of the scheduled maintenance, 24 hours per day, 365 days per year.		
SMH-MT2410-V01	Verify that IK based Wi-Fi equipment shall be managed and maintained by IK vendor.		

Appendix E. Agreement Verification Requirements

Req. ID	Description	Pass/Fail	Comments
SMH-MT3068-V01	Verify that stakeholder agency-owned Wi-Fi devices are managed and maintained by the agency.		
SMH-PY2412-V01	Verify that Wi-Fi equipment withstands indoor and outdoor environmental conditions such as high and low temperatures, humidity, rain, snow, etc.		
SMH-SR2419-V01	Verify that usage shall be tracked on all Wi-Fi technologies, per device, to validate proper usage of public wireless as per COTA internet usage policy.		
SMH-SR2416-V01	Verify that a timer is implemented to track the length of time a Wi-Fi connection has been active.		
SMH-PR3063-V01	The upload and download speed on each Wi-Fi access point shall be tracked, monitored, and changed, as necessary.		
SMH-PR3064-V01	The load on each Wi-Fi access point shall be monitored and flagged when there is an overloading issue associated with the access point.		
SMH-RG2413-V02	Property Owner shall regulate use of all SMH Wi-Fi technologies.		
Mobility Infrastructure			
SMH-DR2284-V01	The bike-share company shall maintain and share monthly with the City a list of deployed bikes at the SMH, listed by unique identifiers		
SMH-DR2285-V01	The bike-share company shall maintain and share monthly with the City a list of lost, stolen and vandalized bikes.		
SMH-DR2286-V01	The bike-share company shall maintain and share monthly with the City a record of maintenance activities including but not limited to identification number and maintenance performed.		
SMH-AR2282-V01	The docking station shall be designed for persistent always-on availability, maintaining continuous operation 24 hours a day, seven days a week, 365 days a year.		
SMH-FN2298-V02	Verify docking station reports the operational status of the docking station to the MMTPA.		

Req. ID	Description	Pass/Fail	Comments
SMH-PR2302-V02	Bikes that are parked in violation of City codes or are vandalized or inoperable shall be reported by SMH locations to the bike-share company.		

Source: City of Columbus

Appendix F. Acronyms and Definitions

Table 24: Acronym List contains project specific acronyms used throughout this document.

Table 24: Acronym List

Abbreviation/Acronym	Definition
AC	Alternating Current
ACL	Access Control List
ADA	Americans with Disabilities Act
API	Application Programming Interface
AV	Autonomous Vehicles
BRT	Bus Rapid Transit
ConOps	Concept of Operations
CMAX	COTA's BRT line
CML	Columbus Metropolitan Library
CMS	Central Management System
COTA	Central Ohio Transit Authority
COTS	Commercial Off-the-Shelf
CPS	Common Payment System
CR	Change Request
CSCC	Columbus State Community College
CTP	Comprehensive Trip Planning
DMP	Data Management Plan
DPP	Data Privacy Plan
DVR	Digital Video Recording
ECB	Emergency Call Button
ECC	Emergency Call Center
EV	Electric Vehicle
FAT	Factory Acceptance Testing
FILS	Fast Initial Link Setup
FMLM	First Mile/Last Mile
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface

Abbreviation/Acronym	Definition
HADR	High Avail + Disaster Recovery
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICD	Interface Control Document
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
IK	Interactive Kiosk
IK-CMS	Interactive Kiosk – Central Management System
IP	Internet Protocol
IVR	Interactive Voice Response
MaaS	Mobility as a Service
MAC	Media Access Control
MMPA	Multimodal Trip Planning Application
MTP	Master Test Plan
MUTCD	Manual on Uniform Traffic Control Devices
OOTB	Out-of-the-Box
OS	Operating System
PDF	Portable Document Format
PID	Personal Information Device
PKI	Public Key Infrastructure
PWD	Personal Wireless Device
RFP	Request for Proposal
RTD	Real-Time Display
SDD	System Design Document
SLA	Service Level Agreement
SOI	System of Interest
SoS	System of Systems
SMH	Smart Mobility Hubs
SyRS	System Requirements
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TNC	Transportation Network Company
TTM	Trace Test Matrix
URL	Uniform Resource Locator

Appendix F. Acronyms and Definitions

Abbreviation/Acronym	Definition
USDOT	U.S. Department of Transportation
WFS	Wi-Fi Services
WLAN	Wireless Local Area Network

Source: City of Columbus

Appendix G. Glossary

Table 25: Glossary contains project specific terms used throughout this document.

Table 25: Glossary

Term	Definition
Data Retention	The continued storage of data for compliance or business reasons.
Data Security	The tools, policies, practices, and procedures used to protect data from being accessed, manipulated, or destroyed or being leveraged by those with a malicious intent or without authorization, as well as the corrective actions taken when data breaches are suspected or have been identified.
MaaS	Mobility as a Service refers to the shift in society from the use of mass-produced personal vehicles, which decentralizes human activities to a human-centric approach. Through the sharing of information, multiple modes of transportation are integrated and offered through a digital platform that provides FMLM mobility bookings, centralized payment, and ticketing across all modes, private and public.
Real-Time Data	Information that is delivered immediately after collection.
Test Number	An integer incrementing by one, indicating the number of tests established.
Transportation Network Companies (TNCs)	Private businesses, nonprofits, and quasi-governmental agencies that offer one or more types of transportation for use in exchange for payment.
Travelers	Travelers are users of the SMH SOI who access amenities and utilize the features at SMH facilities to plan, begin, pass through, or complete their trips.
Version Number	An integer incrementing by one, indicating the number of revisions made to a test case or scenario.
“V” Static Character	Static letter “V” represents the testing version.

Source: City of Columbus



THE CITY OF
COLUMBUS^{*}
ANDREW J. GINTHER, MAYOR