



Multimodal Trip Planning Application User Acceptance Testing Test Plan

for the Smart Columbus
Demonstration Program

FINAL REPORT | October 21, 2020

Produced by City of Columbus

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Acknowledgment of Support

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

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Acknowledgments

The Smart Columbus Program would like to acknowledge the MMTPA project team and project testers, which consisted of representatives from various agencies and stakeholders, for their support and valuable input.

- Central Ohio Transit Authority
- Ohio Department of Transportation
- Mid-Ohio Regional Planning Commission
- The Ohio State University
- The Columbus Partnership
- Mobility Service Providers (Yellow Cab, Lime, Lyft, Bird, Spin)

Abstract

The purpose of this User Acceptance Testing Test Plan is to establish a common framework for testing the Multimodal Trip Planning Application. The plan facilitates processes among project stakeholders, including the City of Columbus, the Central Ohio Transit Authority, the Mid-Ohio Regional Planning Commission, The Ohio State University, the Columbus Partnership, and others. The plan categorizes all components that make up the system of interest, outlines the testing strategy, defines the test tasks and 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 User Acceptance Testing Test Plan are to evaluate how well the system conforms to the allocated requirements and satisfies the system of interest's intended use and user needs. This determination will include analysis, demonstration, inspection, and testing of various products, systems, and data to provide final acceptance of the system and move to the next phase in the project.

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Executive Summary

PROJECT BACKGROUND

The United States Department of Transportation's Smart City Challenge, launched in December 2015, was designed to encourage mid-sized cities to develop ideas for an integrated smart transportation system that would use data, applications, and technology to help people and goods move more quickly, cheaply, and efficiently. As part of the City of Columbus's response to the Smart City Challenge, Mayor Ginther and other City leaders focused in part on determining how an integrated smart transportation system would encourage use of multimodal trips, since citizens in urban areas increasingly view mobility as a service, and expect seamless connections as they move from mode to mode. Motivation for the Multimodal Trip Planning Application (MMTPA) project stemmed from this discussion. Additional considerations were gaps in the current system, such as lack of access to coordinated multimodal options, and lack of ability to compare prices across modes. The MMTPA project will provide these new functionalities and improve on existing functionality.

PROJECT OBJECTIVES

The three main goals for the MMTPA with respect to positive societal outcomes, which tie back to the original intent of the Smart City Challenge, are:

1. Enhanced mobility
2. Enhanced access to opportunities and service
3. Increased customer satisfaction

SYSTEM CONCEPT

The MMPTA is a complete multimodal trip planning solution for travelers in the Columbus region. Travelers download and install the MMTPA (Pivot app) from Android and iOS app stores.

The MMTPA is integrated with mobility providers through application programming interfaces (APIs).

Chapter 1. Introduction

1.1. OVERVIEW

This User Acceptance Testing (UAT) Test Plan was prepared to validate the software requirements for the Multimodal Trip Planning Application (MMTPA). The plan governs the complete testing effort, including the overall approach to testing and the evaluation of results to determine final acceptance of the system. The UAT Test Plan also demonstrates to project stakeholders that all aspects of the testing effort have been considered adequately to demonstrate readiness of the MMTPA (Pivot app) for production use.

1.2. OBJECTIVES

The UAT Test Plan supports the following specific objectives:

- Ensure conformance to functional and non-functional requirements
- Validate the suitability of the combined MMTPA solution for its intended use
- Demonstrate that all contract requirements have been satisfied
- Verify necessary functions, communications, and operational interfaces
- Identify how each testable requirement will be demonstrated, including the method for performing the test
- Identify the criteria that will constitute success for each test
- Identify the resources required to complete each test
- Identify all the deliverables that will result from completing the testing
- Document issues identified during testing and the action plan to resolve them
- Ensure that bugs and issues are identified and fixed before go-live

1.3. REFERENCES

The MMTPA is designed to meet the user needs and requirements specified in the Professional Services Contract between the City of Columbus and MTECH Solutions, LLC. This Test Plan has been developed based on the Institute of Electrical and Electronics Engineers (IEEE) 829 Test Plan Outline and is informed by other systems engineering documents for the Smart Columbus program listed in **Table 1**.

Table 1: References

Document No.	Title	Publication Date
–	IEEE 829 Test Plan Outline https://standards.ieee.org/standard/829-2008.html	Jul 18, 2008

Document No.	Title	Publication Date
–	Multimodal Trip Planning Application/Common Payment System (MMTPA/CPS) Concept of Operations for the Smart Columbus Demonstration Program https://d3hgzplpmmz6qe4.cloudfront.net/2019-07/Multi-Modal%20Trip%20Planning%20System%20Concept%20of%20Operations.pdf	Aug 08, 2018
–	Common Payment System (CPS) System Requirements for the Smart Columbus Demonstration Program https://d3hgzplpmmz6qe4.cloudfront.net/2019-07/Common%20Payment%20System%20System%20Requirements.pdf	Dec 19, 2018
–	System Architecture and Standards Plan for the Smart Columbus Demonstration Program https://d2rfd3nxvhnf29.cloudfront.net/2020-02/SCC-B-SASP-UPDATED_2-25-2020.pdf	Feb 25, 2020
–	Demonstration Site Map and Installation Schedule for the Smart Columbus Demonstration Program https://d2rfd3nxvhnf29.cloudfront.net/2020-01/SCC-B-DSP-IS-FINAL-20200124.pdf	Jan 24, 2020
–	Performance Measurement Plan for the Smart Columbus Demonstration Program https://d2rfd3nxvhnf29.cloudfront.net/2019-08/Smart%20Columbus%20Performance%20Measurement%20Plan.pdf	Jun 1, 2019
–	Safety Management Plan for the Smart Columbus Demonstration Program https://d2rfd3nxvhnf29.cloudfront.net/2019-06/SCC-F-Safety%20Management%20Plan_2019_05_21_City_Submission%20EDITED_CLEAN.pdf	Dec 5, 2019

Source: City of Columbus

More information about the Smart Columbus Demonstration Program is on the Smart Columbus website.¹

This UAT Test Plan was adopted from the IEEE 829-2008 Test Plan Outline and includes tailored project-specific processes recommended in that document addressing management life cycle test processes.

1.4. TEST TEAM ROLES AND RESPONSIBILITIES

Table 2 identifies MMTPA tester roles and responsibilities.

¹ <https://smart.columbus.gov>

Table 2: Test Team Roles and Responsibility Matrix

Role	Description	Tester(s), Affiliation
System owner	City of Columbus representative overseeing completion of all projects and testing. Responsible for overseeing adherence to individual policies of service providers.	Andy Wolpert, City of Columbus
Test manager	Responsible for test report summaries and scheduling.	Jeff Kupko, Michael Baker International
Deputy test manager	Responsible for updates to the Requirements Traceability Matrix (RTM) and confirmation of status.	Sai Geetha Koganti, HNTB
Travelers I	Basic testing role with domain knowledge in mobile apps and/or familiarity with MMTPA requirements. Traveler I test procedures can be completed remotely and do not require testers to execute and pay for trips.	Andy Wolpert, City of Columbus
		Sherry Kish, HNTB
		Sonja Summer, City of Columbus
		Chris Toth, WSP
		Jeff Kupko, Michael Baker International
		Alex Kavanagh, HNTB
		Diane Newton, HNTB
Travelers II	Advanced testing role with domain knowledge in deep linking with third-party apps and/or familiarity with MMTPA requirements. Traveler II test procedures must be completed in Columbus, OH and will require testers to execute trips and pay for services using a personal credit card.	Jeff Kupko, Michael Baker International
		Sai Geetha Koganti, HNTB
		Chris Toth, WSP
		Sherry Kish, HNTB
		Sonja Summer, City of Columbus
Travelers II – Gohio	Subset of the Traveler II test group who can form a local carpool for test purposes.	Jeff Kupko, Michael Baker International
		Sherry Kish, HNTB
		Sai Geetha Koganti, HNTB
		Chuck Ratliff, MORPC
Travelers II – Kiosk	Subset of the Traveler II test group with knowledge of the Smart Mobility Hubs project and related requirements for MMTPA integration.	Andy Wolpert, City of Columbus
		Jeff Kupko, Michael Baker International
		Sai Geetha Koganti, HNTB
		Sherry Kish, HNTB

Role	Description	Tester(s), Affiliation
Technical	A technically advanced user able to verify Pivot app load testing results and data ingestion into the Smart Columbus Operating System.	Jarred Olsen, Accenture
MTECH	Representative(s) of MTECH Solutions, (Pivot app vendor) responsible for technical testing of the Pivot app in coordination with other testers.	Darlene Magold, MTECH
		Jon Woyame, Etch

Source: City of Columbus

1.5. TEST PLAN SCHEDULE

Table 3 shows major tasks, start and finish dates, and responsibilities for the UAT Test Plan. This schedule should be used to manage progress and to inform stakeholders how UAT will be reviewed, tracked, and approved.

The dates provided below are contingent on Columbus’ plan to move forward with re-opening due to the COVID-19 virus.

Table 3: Test Schedule

Task Name	Start	Finish	NOTES
Release 4	Tue 9/8/20	Fri 10/9/20	Service providers are Bird, Yellow Cab, Lyft/Uber (ride-hailing), possibly CoGo
Traveler I UAT	Mon 10/5/20	10/9/20	(1 week)
Traveler II Release Testing	Mon 10/12/20	10/16/20	(1 week)
Review test results with MTECH	Mon 10/19/20	Mon 10/19/20	Identify and prioritize revisions
MTECH revisions based on test results	Mon 10/19/20	Fri 10/23/20	(1 week)
Regression testing until acceptance / Traveler II UAT	Mon 10/26/20	Fri 10/30/20	(1 week)
Prepare for launch	Mon 11/2/20	Fri 11/6/20	Digital ads and messaging to be complete by this time
Go-Live (Public Launch)	Mon 11/9/20	Mon 11/9/20	Coincide with EPM launch
Prepare and submit MMTPA Test Report	Fri 10/30/2020	Fri 1/8/2021	(8 weeks)

Source: City of Columbus

Chapter 2. Risks and Contingencies

Several parts of the MMTPA are outside the project team's control but have direct impacts on the process and must be validated. The risks and assumptions for MMTPA testing are:

- The COVID-19 pandemic has impacted the Pivot development, testing and overall launch in various ways. The State of Ohio implemented a stay-at-home order and travel restrictions from March 22, 2020 to May 19, 2020. The State of Ohio and City of Columbus are currently under a state of emergency. As a result of these orders, COTA's current service is limited and fare collection is suspended.
- Early adopter testers who are members of the public may experience usability issues, risks, and/or annoyances common to early-stage product testing and may, as a result, be dissuaded from using the system in the future. Educating early adopters on the need and importance for early-stage testing will help mitigate this risk.
- Resource availability issues or unfilled positions may affect the testing schedule, leading to a delay in acceptance testing. The City will use additional resources from the Smart Columbus consultant contracts for additional support. Testers will also be required to use 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. Training material will be provided to the testers before testing to familiarize the testers with testing tools. Testing team and vendor will meet regularly to discuss features and functionality of the system to understand the application as a whole while testing.
- Certain services provided to travelers through the MMTPA rely on the ability of external systems to produce that service. For example, the MMTPA relies on various mobility providers' APIs. If those external systems undergo unplanned failures or degraded service, the MMTPA could not provide travelers with services, which could lead to adverse perceptions from community members. The project team will work with external systems to mitigate this risk by coordinating service-level agreements and strategies for monitoring and notification in case of service disruption.

Chapter 3. Approach

This section describes the overall approach to user acceptance testing, as well as major activities, techniques, and tools used to test the designated groups of features. The testing strategy was designed to ensure that each major group of features or feature combinations was adequately tested.

3.1. TESTING APPROACH

This UAT Test Plan contains the approach for testing the MMTPA. The MMTPA has undergone release testing throughout the development as part of the Agile development process led by each application vendor. Feedback from release testing during Agile development was then provided as inputs to application developers for continuous refinement and improvement of the MMTPA.

An Agile development methodology was selected to develop the MMTPA to allow for iterative and incremental delivery and to respond quickly to changes during development. Using an Agile methodology also ensures the development work is aligned to the highest business value for the City of Columbus and its stakeholders.

The MMTPA was developed in incremental releases according to an Agile release plan. The features and functionality that will be tested as part of this UAT Test Plan were developed over the course of four releases for the MMTPA (Releases 1, 2, 3, and 4). Requirements listed in the request for proposal (RFP) are grouped into test cases for testing purposes and assigned an appropriate testing methodology and traceability method based on each individual functional requirement. Testers are responsible for executing test cases in accordance with the features being tested. For example, a “technical tester” with advanced knowledge of security and privacy will be responsible for testing requirements that fall under the feature class of Administration, Policy, and Compliance. A tester with the role of “traveler” will be responsible for testing requirements that pertain to application usage features.

Requirements that share functionality in common or are derived from similar user needs may be grouped to allow for efficient test procedures. In other cases, requirements may have two or more test objectives and set of test procedures, depending on the nature and complexity of the requirement.

A description of all functionality that will be tested and verified as part of this UAT Test Plan is provided in **Chapter 3**, including requirements that are deferred or obsolete because of timing or project externalities. The individual test cases for MMTPA are listed in **Chapter 5**.

3.2. TESTING APPROACH AFTER UAT

Agile testing will occur for deferred requirements (**Section 4.3**) which are developed after User Acceptance Testing as described in the UAT Test Plan schedule (**Section 1.5**), as well as for service providers who are brought into the system over time as new agreements with the City are formed. Existing test cases and test procedures will be utilized for testing integration with new service providers, or new test cases will need to be created. For deferred requirements which are developed after UAT, new test cases and test procedures will be written and performed to verify the features and functionality are ready for production. In this case, user acceptance testing will be performed at the end of each development sprint, with the goal of updating the production environment, as opposed to at the end of the project. Likewise, regression tests will be performed prior to new features and functionality being released into the production environment.

3.3. DELIVERABLES

The following deliverables will result from the UAT testing process:

- Test cases and test scenarios
- Requirements Traceability Matrix (RTM)
- Defects matrix with corrective actions
- Change request log
- Error logs, bug reports, and/or screen captures (where feasible)
- Acceptance sign-off
- Test results report
- Test and go-live webinar

3.4. TESTING METHODOLOGIES

Testing methodologies are strategies and testing types used to certify that the MMTPA meets client expectations. Test methodologies include functional and non-functional testing to validate the requirements. The following are examples of test methodologies used in this UAT Test Plan. Each methodology has a defined test objective, strategy, and pass/fail criteria (expected result).

- **System testing** – System testing is the process of testing the MMTPA to verify that it meets requirements specified in the SyRS.
- **Integration testing** – Integration testing is performed to expose defects in the interfaces and in the interactions between the MMTPA and the integrated components or systems.
- **API testing** – API testing involves testing APIs directly to determine whether they meet expectations for functionality, reliability, performance, and security. API testing is performed manually, as opposed to automated API testing, which is the developers' responsibility.
- **Installation testing** – Installation testing follows a set of procedures that are necessary before the software can be used and tested.
- **Unit testing** – Unit tests are performed by the developer. Individual units or software components are tested to validate that each unit or component performs as designed.
- **Regression testing** – Regression testing is performed against all requirements to verify that recent code changes, defect fixes, or performance updates have not adversely affected existing features.

3.5. PASS/FAIL CRITERIA

Pass/fail criteria apply to all test cases except early adopter testing, which uses survey questions instead of test cases. Survey questions may require a “Yes” or “No” response, which may indicate functionality not working as desired or as intended. Developers will use survey results to refine backlog and in preparation for release testing.

3.6. TEST CRITERIA

3.6.1. Test Status

Each test case consists of several unique properties that 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 testers required to perform the test, and status. The RTM maintains the following status for each test case:

- **Planned** – The test case has been defined, its role has been identified, testers have been assigned, and the test case is logged in the RTM as ready for testing.
- **In Progress** – The test case is underway but has not been completed.
- **Passed** – A “passed” value indicates the defined number of tests have been completed 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.
- **Failed** – A test case is marked as “failed” when it does not meet part or all its expected outcomes. In this case, a defect is logged, and a brief note is 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.
- **Deferred** – A test case is marked as “deferred” when it cannot be performed at the time of testing or when requirements changed. If a test is deferred, the tester should provide a brief reason in the Comments column of the RTM. The test manager is responsible for tracking deferred cases and evaluating the most appropriate time and/or response for addressing them.
- **Canceled** – A test case is marked “canceled” when the requirement affiliated with the test case no longer applies to the project, in which case it should be logged in the Change Request Log (Section 3.7.4).

3.6.1.1. ENTRY/EXIT CRITERIA

Entry criteria:

- Successful completion of MMTPA Release 1 – Minimally Viable Product (MVP)
- Successful completion of MMTPA Release 2 – Provider Buildout
- Successful completion of MMTPA Release 3 – Operational Stabilization
- Successful completion of MMTPA Release 4 – Go-Live
- Test cases, scenarios, and procedures added to the RTM
- Mobility Provider agreements in place for two providers of different modes

Exit criteria:

- All planned test cases and scenarios have been executed
- 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
- A plan and a schedule for resolution exist for all outstanding issues

3.6.2. Suspension and Resumption Criteria

If a defect or defects severe enough to suspend testing are identified in test cases, the test manager should be notified immediately so efforts to correct the issue may be started as quickly as possible. Testing will resume once the test manager has confirmed the issue has been resolved.

The following situations may cause testing to be suspended:

- **App crash** – Inability to execute a test case without crashing the app
- **Inaccurate information** – Incorrect information associated with the planning or execution of a trip
- **Network failure** – Failure of network connection required for normal operation
- **Injury** – Any situation that could potentially lead to bodily injury or significant damage to property

3.7. TEST TOOLS

3.7.1. Requirements Traceability Matrix

The RTM will be used to ensure that 100% of the requirements are tested. The RTM is a spreadsheet that links requirements to test cases and provides pre- and post-conditions for each test. The test manager and deputy test manager will be responsible for updating the RTM in coordination with other testers to indicate the status of test cases and to record any applicable defects, notes, or observations. A test case may be deferred if it is not yet possible to test certain functionality because of dependencies on requirements, or if the functionality is simply not yet available for testing and must be deferred to a subsequent application update. Deferred tests must be assigned to a subsequent update to ensure 100% of the requirements are tested. A test case may be cancelled if the requirement for which the test case is written is determined to be obsolete. Obsolete requirements must follow a change request process that includes capturing the rationale for why the requirement is no longer needed. Canceled test cases do not count toward the goal of ensuring that 100% of the requirements are tested. Obsolete, cancelled, and deferred requirements identified to date are identified in this test plan and will continue to be documented going forward.

3.7.2. Defect Log

A defect tracking sheet will be used during testing to capture, track, monitor, and address anomalies observed during UAT. For each entry, the development team will work to understand and reproduce (where possible) the defect, identify the root cause, summarize a response, and log the activities taken to resolve the issue.

3.7.3. Bug and Crash Reporting in Pivot App

App testers will use Bugsee² for mobile devices (Android and iOS) to report issues by device type, operating system version, and time. Developers will be able to view all HTTP and HTTPS requests and responses from and to the app, video capture of the issue, and all system traces and events (e.g., connectivity, orientation). Direct integration with Asana³ will streamline the response cycle from end user to developer.

² <https://www.bugsee.com/>

³ <https://asana.com/>

Testers will be instructed to include as much detail as possible when recording issues using Bugsee, to help identify root cause. This includes referencing the appropriate test ID(s), expected results, actual results, and defect frequency (e.g., every time, intermittent).

3.7.4. Change Request Log

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 RTM 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, and so forth, and for providing final authorization on the request through the tool. **Appendix A.1.4** provides a template for all the change requests logged throughout the testing process, along with justifications and authorization status.

3.8. HARDWARE AND SOFTWARE REQUIREMENTS

The following hardware and software requirements apply to MMTPA testing only:

- iOS
 - Operating system – Version 9.0 or later; compatible with iPhone, iPad, and iPod touch
 - Storage size – Minimum 65.9 MB
- Android
 - Operating system – Version 4.1 or later
 - Storage size – Minimum 17 MB

3.9. INTERNET BROWSER REQUIREMENTS

The following internet browsers (current versions) may be used for testing the CPS traveler web portal and web-based back-office management system:

- Google Chrome
- Safari
- Edge
- Firefox

3.10. ENVIRONMENT REQUIREMENTS

Testers must have an internet connection as well as an Apple or Android smartphone to download and test the MMTPA. Testers should also be familiar with ways to capture screenshots in case an error occurs. Screenshots will document the application state when an error occurs and will assist the development teams in debugging.

3.11. CONTRACTUAL REQUIREMENTS

Table 4 contains the contractual requirements for the MMTPA to be completed before the end of the demonstration period. These requirements are included here for reference only.

Table 4: MMTPA Contractual Requirements

Project	Phase	Contractual Requirement	Status
MMTPA	Prior to UAT	Quality Assurance/Quality Control Plan	<i>Pending</i>
		Interfaces with External Systems and Other Smart Columbus Projects	<i>Pending</i>
		Training Plan	<i>Complete</i>
	Prior to deployment	Test Results Documentation	<i>Pending</i>
		Communications Plan	<i>Complete</i>
		Data Backup and Recovery Plan	<i>Pending</i>
		Overall System Schematic and Architecture	<i>Pending</i>
	After deployment	Operations and Maintenance Plan	<i>Pending</i>

Source: City of Columbus

3.12. MEASURES AND METRICS

The RTM contains a defect tracker, which testers will use to capture anomalies, incongruences, errors, or any other output inconsistent with the expected outcome of the test cases. The RTM and defect tracker will be used to capture the following testing metrics, which will also be reported in the test results report:

- Total number of test cases
- 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
- 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 MMTPA to receive final acceptance test approval as outlined in the test results in **Appendix A**.

Chapter 4. Test Items

This section contains lists of all contractual, functional, and non-functional requirements that will be tested and verified as part of UAT prior to final acceptance.

4.1. FEATURES TO BE TESTED

The following MMTPA features will be tested as part of UAT. Tests procedures may include one or more features depending on the nature of the requirements being tested.

- Trip itineraries
- User preferences
- Trip changes
- User interface
- User preferences
- Trip data
- Booking and reservations
- Notifications and alerts
- Smart Mobility Hubs integration
- User feedback
- Language support
- Educational material
- Ridesharing providers
- Metrics

4.2. FEATURES NOT TO BE TESTED

The following items will not be tested as part of UAT. In most cases, functionality in these areas will have been tested and verified as part of development release testing, or may be indirect, inferred, or assumed because of other testing efforts having occurred prior to UAT. A matrix of requirements and test status will be provided in the final test report for the MMTPA project.

- **Network security** – Inspection of individual transactions or packets will not be tested as part of this UAT Test Plan. It is sufficient to accept the secure socket layer (SSL) protection as configured, which secures communication to the end user.
- **Trip optimization and integration with the Smart Columbus Operating System** – The Pivot routing engine (trip optimization) currently resides in the Pivot back-office (AWS cloud-hosted system). Migration of the routing engine from the Pivot back-office to the Smart Columbus Operating System will be evaluated after UAT is complete.

- **3rd party incentives and rewards programs** – The timeframe for integration with 3rd party incentives and rewards programs has not been determined. Requirements for Pivot-managed loyalty and rewards (“My Incentives / Rewards”) have been prioritized to support go-live and user adoption of the Pivot app. Integration with 3rd party incentives and rewards programs will be evaluated following go-live.
- **Paratransit service integration** – Integration with COTA/First Transit is not included in the UAT Test Plan. Integration will occur when COTA/First Transit is able to provide a data feed for the Pivot app. The timeframe for integration is unknown.
- **Non-functional requirements** – Achievement of requirements related to information management (IM), lifecycle (LC), availability and recovery (AR), maintainability (MT), disposal (DP), policy and regulation (RG), support environment, modes of operation, certification and accreditation, and operations and maintenance (O&M) will be demonstrated through submittal and acceptance of the Data Backup and Recovery Plan, Overall System Schematic and Architecture, and the MMTPA/CPS Operations and Maintenance Plan as part of contractual requirements listed in **Section 3.11**.
- **Performance** – The Pivot app will be tested for operational performance and load testing (stress testing) as part of UAT. Capacity, throughput, high availability, and disaster recovery are inherent in the requirements in the RFP and managed through the contract awarded to MTECH.
- **Data requirements** – Data requirements, and the associated **Operating System Integration Requirements**, will be verified in accordance with the Smart Columbus Operating System and Data Privacy Plan (DPP) and the data curation process outlined therein. Inspection of the API and data transmitted to the Operating System will ensure that all requirements have been met and that no PII has been transferred to the Operating System.
- **Deferred or obsolete requirements** – Requirements that are deferred are listed in **Table 5** in **Section 4.3**. Requirements that are obsolete are listed in **Table 6** in **Section 4.4**.

4.3. DEFERRED REQUIREMENTS

This section describes deferred requirements that are not included in user acceptance testing and the rationale for this change in status. MMTPA requirements may be deferred for several reasons, such as lack of service provider agreements, timing of integration with COTA services such as paratransit, or additional design work required such as is the case with third-party loyalty program integration. Deferred requirements that are not available for testing at the time of UAT will be reevaluated and tested as part of subsequent release testing. All changes to requirements, including revisions, are tracked in a separate Change Management Log (**Table 32**) linked to **Table 5** by change request ID. A description of the impact of these changes, as well as key decision points, is also included in the Change Management Log.

Table 5: Deferred Requirements

Change Request ID	RFP No.	Description	Rationale
CR-MMTPA-003	4.1.3.1.5	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include car preference (for car-sharing services).	Car-sharing services not available. Sway to begin service in Spring of 2021.

Change Request ID	RFP No.	Description	Rationale
CR-MMTPA-015	6.5.1	The MMTPA shall be configured such that it will request paratransit services.	Deferred until COTA/First Transit feed is available and can be incorporated into the Pivot app. Dependent upon COTA fare system upgrade in 2021.
CR-MMTPA-016	6.5.1.1	Paratransit mobility providers will provide an API that allows for trip optimization in the Operating System. The API will, at a minimum, contain: <ul style="list-style-type: none"> • Trip origin and destination • Number of travelers • Specify ridesharing trip • Arrival window • • Vehicle information • Real-time arrival information • Estimated costs 	Planned for paratransit when COTA/First Transit can provide feed. Dependent upon COTA fare system upgrade in 2021.
CR-MMTPA-021	6.6.1	The MMTPA shall be configured such that it will broadcast a mobile e-ticket through the mobile device NFC.	NFC-enabled device testing is not a requirement for go-live because there are currently no participating service providers in Columbus who support it. Availability of NFC functionality on COTA fareboxes is planned for 2021. This requirement will be reevaluated for future releases of the MMTPA/CPS solution. QR codes will be available for testing.
CR-MMTPA-026	4.2.5.1	The MMTPA shall be configured such that it will provide APIs consistent with the General Bikeshare Feed Specification (GBFS) and extend the API such that it may provide for carshare services integration. It will at a minimum contain: <ul style="list-style-type: none"> • Space ID and/or location of car/bike at station • Description of vehicle/bike (e.g., color, make, model, color, plate ID) • Code to access vehicle/bike and activation method (NFC, QR, smart card, keypad entry, etc.) • Rates charged will be processed periodically (monthly, weekly) in the business account • Columbus will certify the users with agreed upon process (credit card holder or registered user at customer service location, with government ID for unbanked users) 	Deferred until a carshare provider agreement is in place.

Change Request ID	RFP No.	Description	Rationale
CR-MMTPA-042	6.1.2	6.1.2 The MMTPA shall provide personalized traffic information including early warning in case of an increasing travel time and possible alternative routes and/or modes.	Data is not available yet; this requirement will be reevaluated following go-live.

Source: City of Columbus

4.4. OBSOLETE REQUIREMENTS

This section lists obsolete requirements that are not included in user acceptance testing and the rationale for this change in status. Requirements become obsolete because they are no longer necessary for deployment of the MMTPA solution or because of architectural changes to the solution. All changes to requirements including revisions are tracked in a separate Change Management Log (**Table 32**) linked to **Table 6** by Change Request ID. A description of the impacts of these changes, as well as key decision points, is also included in the Change Management Log.

Table 6: Obsolete Requirements

Change Request ID	RFP No.	Description	Rationale
CR-MMTPA-004	4.1.3.1.6	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include maximum price per mode.	This requirement was built in to accommodate flexible pricing strategies. The user still can cap the price of the total trip; the project team determined this ability to be most critical to the success of the application.
CR-MMTPA-005	4.1.3.1.7	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include maximum trip duration.	Background calculation limits trips to 3 hours maximum, but the user cannot control this setting. The project team decided that allowing a user to set a shorter duration and limit the results would not be useful.
CR-MMTPA-013	4.2.6.5	The MMTPA shall be configured such that it will be capable of streaming the rideshare event data to the Operating System.	Gohio Commute not able to support this requirement and send vehicle data to the Operating System.
CR-MMTPA-018	6.11.1	The MMTPA shall be able to interface with an IVR system. Predefined and prepaid trip plans will be saved to be executed from the IVR system.	An IVR system will not be included as part of integration with Smart Mobility Hubs. Travelers will be able to pay for trips at kiosks through integration with the Pivot app.
CR-MMTPA-023	5.2.1	The MMTPA shall be integrated to the Identity and Access Management (IDAM) system such that it can administer user access through the PMO.	Because the MMTPA is not hosted within the Operating System, this requirement is no longer valid.

Change Request ID	RFP No.	Description	Rationale
CR-MMTPA-024	5.5.2	To test integration of the MMTPA security environment with the Operating System IDAM.	Because the MMTPA is not hosted within the Operating System, this requirement is no longer valid.
CR-MMTPA-043	6.10.1	The MMTPA shall query the CPS for available funds in the user account when requested to execute a trip by the user. If funds are available, then the CPS request to debit the funds from the user account and credited to the service provider will be made during the appropriate time during the trip. If funds are not available, then MMTPA will launch CPS pages that will allow the user to manage the account.	This requirement is obsolete due to the discontinuation on the CPS project.
CR-MMTPA-044	SMH-IF2315-V01	The CPS shall be deployed and available for use at the IK display through the MMTPA app.	The CPS project is no longer a part of the Smart Columbus program.
CR-MMTPA-045	SMH-FN2291-V02	SMH-FN2291-V02 The bikeshare docking station shall accept a secure code generated (through verified payment via MMTPA and CPS) for unlocking the bikes.	The CPS project is no longer a part of the Smart Columbus program.
CR-MMTPA-046	6.6.2	6.6.2 The MMTPA shall be configured such that it will have access to the CPS display of an optical QR code (mobile e-ticket) or NFC signal on the MMTPA which can be activated at COTA fareboxes.	The CPS project is no longer a part of the Smart Columbus program.
CR-MMTPA-039	6.3.1	The MMTPA shall make 3rd party company loyalty points/status available for the traveler through a link to the external loyalty program data.	Not possible to integrate 3 rd party loyalty and rewards program through deep linking.
CR-MMTPA-040	6.3.2	The MMTPA trip optimization should give special consideration to those solutions that integrate loyalty status within the trip selection process.	Not possible to integrate 3 rd party loyalty and rewards program through deep linking.
CR-MMTPA-041	6.4.3	User feedback shall be interfaced with the incentives program.	Not possible to integrate 3 rd party loyalty and rewards program through deep linking.

Source: City of Columbus

Chapter 5. Acceptance Test Cases

This section contains lists of all contractual, functional, and non-functional requirements that will be tested and verified as part of UAT prior to final acceptance.

5.1. TEST CASES

Test procedures are critically important to the acceptance of the system and are provided to test the system's ability to meet the requirements holistically, end-to-end, from all active participant viewpoints (test groups). Scenarios are made up of a series of test cases 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 MMTPA ConOps and provides a decision gate for the production release of the Pivot app.

Test procedures are grouped by test role (**Table 2**) as follows. Each test case must meet the stated test objective to pass.

Travelers I (TRA)

1. Getting Started
 - a. Installation
 - b. Terms and conditions
 - c. Help and educational material
 - d. Account registration
 - e. Password recovery
2. Settings
 - a. General settings
 - b. Results preferences
 - c. Transportation preferences
 - d. Notifications
3. Getting Around
 - a. Where To?
 - b. Nearby rides
 - c. Transit alerts
 - d. Scheduled trips
4. Usability
 - a. Offline use
 - b. User Interface
 - c. Languages

Travelers II (TRB)

5. On-Demand Trips
 - a. Bird
 - b. Lime
 - c. CoGo
6. Scheduled Trips
 - a. Lime to COTA
 - b. COTA to Bird
 - c. CoGo to COTA

d. Yellow Cab to COTA

Gohio Commute (GOH)

Smart Mobility Hubs Integration (SMH)

Load Testing (API)

5.1.1. Getting Started

This section includes requirements and test procedures for getting started using the Pivot app, including account registration.

Table 7: Getting Started Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.1.1 4.1.1.2	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02	Installation	The MMTPA shall operate on iOS and Android devices. The MMTPA shall be available for download through application repositories (app stores).	MMTPA-TRA001-V01	Installation	Demonstration	To successfully search for and install Pivot on iOS and Android devices.	The Pivot app is available in app stores and can be downloaded and installed on both Android and iOS devices.	<p><u>Pre-condition:</u> Tester has access to the app store for iOS and/or Android.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Access app store for the available device type (iOS or Android). 2. Search for the app using keywords “Columbus” and “Pivot”. 3. Initiate the install process. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: App appears in search results; app installs onto tester’s device; app icon appears on phone.</p> <p><u>Post-condition:</u> Pivot is installed and has not been opened.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
5.4.2	MMTPA/CPS-UN029-v02 MMTPA/CPS-UN031-v02	Terms and Conditions	The MMTPA shall require users to agree to providing anonymized transportation-related trip data to the Operating System to use the app.	MMTPA-TRA002-V01	System	Demonstration	To demonstrate the ability for a user to opt in or opt out of allowing anonymized trip data to be transmitted to the Operating System	Pivot app requires users to review and accept terms and conditions for using the app.	<p><u>Pre-condition:</u> Pivot is installed; Pivot has never been opened.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Open Pivot for first time. 2. Click 'Allow while using the app' to provide access for location in real-time. 3. Click 'Allow Notifications' to receive notifications within the app. 4. Review terms and conditions for providing data. 5. Click 'Accept' to agree to terms and conditions. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Tester has reviewed and agreed to the terms and conditions of the Pivot app.</p> <p><u>Post-condition:</u> Pivot is open.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.4.1 4.1.4.2	MMTPA/CPS-UN007-v02	Educational Material	<p>The MMTPA shall provide travelers with access to limited instructions for use of the application.</p> <p>---</p> <p>The MMTPA shall provide access to educational material outside of the application pertaining to each mode of service to understand how the service works. Access to instructions and educational material does not constitute training, either web-based or in-person.</p>	MMTPA-TRA003-V01	System	Demonstration	To provide user with instructions for use of the app and educational material pertaining to each mode of service.	Instructions for using the Pivot app are accessible and up to date.	<p><u>Pre-condition:</u> Pivot is open; tester does not have an account.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the menu button (three bars icon) at the top left of the screen and click "Help". 2. Click the "Show Me" button. 3. Review the instructions. 4. Verify the instructions aid in general understanding of the app and provide information relevant to each functionality and mode of service provided in the app. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Instructions are presented to the user to assist in general understanding of the app.</p> <p><u>Post-condition:</u> N/A</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.1.5 5.3.2	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02 MMTPA/CPS-UN029-v02 MMTPA/CPS-UN031-v02	Register Account	The MMTPA shall provide the capability to manage account settings. --- The MMTPA shall use multi-factor authentication for the registration of travelers into the system.	MMTPA-TRA004-V01	Regression	Demonstration	To successfully register a new Pivot account and verify user identity through process of two-factor authentication.	Tester can complete multi-factor authentication to register a new account.	<p><u>Pre-condition:</u> Pivot is open; tester does not have an account.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click the menu button (three bars icon) at the top left of the screen. 2. Click "SIGN UP." 3. Enter First Name, Last Name, Phone, Email Address, and Password (2x). 4. Press "Register." 5. Confirm your registration by selecting to receive a verification code via phone 6. Enter the 6-digit verification code in the app and press "Confirm" 7. Verify that registration completed successfully and click on the "Continue" button to be brought back to the map. 8. Press the menu button again (three bars icon) at the top left of the screen to verify that you are logged into the app. 9. Click on "View Profile" to verify your account information. 10. Change your profile information and click on the "Update" button 11. Close and reopen the app to verify that your profile information has been updated <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices: Tester has created an account and is logged in. Tester can access and update profile information.</p> <p><u>Post-condition:</u> Registration is complete; tester is logged in.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.12	MMTPA/CPS-UN029-v02 MMTPA/CPS-UN031-v02	Recover password	The MMTPA shall provide a simple password reset function for travelers and administrators.	MMTPA-TRA005-V01	System	Demonstration	To demonstrate the ability for a user to reset his/her password if forgotten.	Tester can recover password.	<p><u>Pre-condition:</u> Pivot is open.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Open log in screen to type in email address associated with account. 2. Click the “forgot password” button to confirm email address. 3. Open email and click link to reset password. 4. Confirm password is valid by logging into Pivot. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices. Tester can change password through Pivot with confirmation email.</p> <p><u>Post-condition:</u> Tester is logged in.</p>	Traveler I	Planned	

Source: City of Columbus

5.1.2. Settings

This section includes requirements and test procedures for Pivot app settings and user preferences.

Table 8: Settings Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.1 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Preferred mode/service --- The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.	MMTPA-TRA006-V01	System	Demonstration	To incorporate individual preference for mode/service in search results	Trip itineraries are created in accordance with user preference for mode/service.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Select "Preferred Modes" option. 3. Select a mode(s) that was not previously selected. 4. Toggle next to "Push", "SMS" and "Email" to turn on notifications. 5. Return to the previous screen by selecting the left arrow. 6. Confirm the number of selected modes has updated. 7. Exit settings panel. 8. Plan a trip that includes the new mode in the trip search results. 9. Verify that the new mode is included in the trip search results. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Preferred mode/service is reflected in the trip search results.</p> <p><u>Post-condition:</u> Settings panel is closed; preferred modes are updated.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.2 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Maximum total cost --- The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.	MMTPA-TRA007-V01	System	Demonstration	To incorporate individual preference for maximum total cost in search results	Trip itineraries are created in accordance with user preference for max cost.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Press the dollar amount next to "Max Cost Per Trip." 3. Use the slider to change the amount, then press "Apply." 4. Confirm that the dollar amount displayed next to "Max Cost Per Trip" changed to the selected amount. 5. Toggle next to "Push", "SMS" and "Email" to turn on notifications. 6. Exit the setting panel. 7. Plan a trip. 8. Verify that the max cost of the trip search results did not exceed the amount set under settings. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Max cost per trip is reflected in the trip search results.</p> <p><u>Post-condition:</u> Settings panel is closed; preferred modes are updated.</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.3 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	<p>The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Maximum number of trip segments.</p> <p>---</p> <p>The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.</p>	MMTPA-TRA008-V01	System	Demonstration	To incorporate individual preference for maximum number of trip segments in search results	Trip itineraries are created in accordance with user preference for max transfers.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Press the number next to “Max Transfers.” 3. Use the slider to change the number, then press “Apply.” 4. Confirm that the number displayed next to “Max Transfers” changed to the selected amount. 5. Toggle next to “Push”, “SMS” and “Email” to turn on notifications. 6. Exit the settings panel. 7. Plan a trip. 8. Verify that the max transfers amount is reflected in the trip search results (for example, search results now show a max of two transfers, whereas before, results showed three). <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Max transfers is reflected in the trip search results.</p> <p><u>Post-condition:</u> Settings panel is closed; preferred modes are updated.</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.4 4.1.2.1 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	<p>The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Preferred results presentation format (order by “cheapest” or quickest route).</p> <p>---</p> <p>The MMTPA shall provide the ability to compare trip itineraries by mode, travel time (i.e., quickest), and cost (i.e., lowest).</p>	MMTPA-TRA009-V01	System	Demonstration	To filter search results by cheapest or quickest route	Trip itineraries are ordered in accordance with user preference for cheapest or quickest route.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Enter an origin and destination to search for a trip. 2. Click “suggest” next to sort. 3. Select desired sorting option, either cheapest or quickest. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Results are sorted in order of cheapest or quickest route.</p> <p><u>Post-condition:</u> N/A</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.8 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Preferred maximum walking distance. --- The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.	MMTPA-TRA010-V01	System	Demonstration	To incorporate individual preference for maximum walking distance in search results	Trip itineraries are created in accordance with user preference for max walking distance.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Press the number next to “Max Walking Distance.” 3. Change the number, then press “Apply.” 4. Confirm that the number displayed next to “Max Walking Distance” changed to the selected amount. 5. Toggle next to “Push”, “SMS” and “Email” to turn on notifications. 6. Exit the settings panel. 7. Plan a trip. 8. Verify that the max walking distance is reflected in the trip search results (for example, search results now show an increase or decrease in walking distance for the walking portion of the trip). <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: User’s preferred maximum walking distance is updated and displayed in the trip itinerary. Note: If user selects a walking distance of 0, results will be returned with a minimum walk distance necessary to get to mode.</p> <p><u>Post-condition:</u> Settings panel is closed; preferred modes are updated.</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.9 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	<p>The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Accessible vehicle.</p> <p>---</p> <p>The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.</p>	MMTPA-TRA011-V01	System	Demonstration	To incorporate individual preference for accessible vehicle in search results that includes ride hailing	Trip itineraries exclude non-accessible vehicles.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Toggle on "Wheelchair Accessibility" to turn on the option. (Note: you can also click on the preferred modes in the settings to see which modes are active.) 3. Plan a trip to a destination. 4. Verify a non-ADA vehicle (e.g., scooter) is not presented. 5. Select a trip with ride hail (taxi). 6. Verify the vehicle that arrives can accommodate a wheelchair passenger. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Modes presented meet the disability requirements and the vehicle that arrives can accommodate those requirements.</p> <p><u>Post-condition:</u> An accessible vehicle arrives.</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.9 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	<p>The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Accessible vehicle.</p> <p>---</p> <p>The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.</p>	MMTPA-TRA012-V01	System	Demonstration	To incorporate individual preference for accessible vehicle in search results that includes COTA bus service	Trip itineraries exclude non-ADA vehicles.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; tester has wheelchair-accessible option active in preferences.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Toggle on "Wheelchair Accessibility" to turn on the option. 3. Plan a trip to a destination. 4. Verify a non-ADA vehicle (e.g., scooter) is not presented. 5. Select a trip with COTA. 6. Verify the vehicle that arrives can accommodate a wheelchair passenger. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Modes presented meet the disability requirements and the vehicle that arrives can accommodate those requirements.</p> <p><u>Post-condition:</u> An accessible vehicle arrives.</p>	Traveler 1	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.3.1.9 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Accessible vehicle. --- The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.	MMTPA-TRA013-V01	System	Demonstration	To incorporate individual preference for accessible vehicle in search results	Trip itineraries exclude non-ADA modes.	<u>Pre-condition:</u> Pivot is open and the tester is logged in. <u>Steps:</u> 1. Click on the gear icon at the top right of the screen. 2. Press the switch next to "Wheelchair Accessible" to enable this option. 3. Verify in the trip search that the options are wheelchair accessible and that other modes (e.g., scooters) have been removed from the options presented. <u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: The options presented to the user can accommodate wheelchairs. The options presented are walking (or rolling), car, public transit, and ride hail. Scooter and bike are not shown. <u>Post-condition:</u> The results presented are wheelchair accessible.	Traveler I	Planned	
4.1.3.1.10 4.1.2.3	MMTPA/CPS-UN004-v02 MMTPA/CPS-UN003-v02	User Preferences	The MMTPA shall support user preferences across all mobility provider categories. At a minimum, preferences shall include: Environmental impact or "greenest" trip. --- The MMTPA shall present trip itineraries to travelers in accordance with individual user preferences stored in the MMTPA.	MMTPA-TRA014-V01	System	Demonstration	To filter search results by environmental impact or "greenest" trip	Trip itineraries can be sorted by "eco-friendly".	<u>Pre-condition:</u> Pivot is open and the tester is logged in. <u>Steps:</u> 1. Enter an origin and destination to search for a trip. 2. Click "suggest" (next to sort). 3. Select "Eco-Friendly." 4. Verify results. <u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: User's preferred sorting method changed. Travel options updated to match this choice. <u>Post-condition:</u> N/A	Traveler I	Planned	

Source: City of Columbus

5.1.3. Getting Around

This section includes requirements and test procedures for creating trip itineraries and basic navigation using the Pivot app.

Table 9: Navigation Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.1.4	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02	Rides-Near-Me	The MMTPA shall have a rides-near-me feature.	MMTPA-TRA015-V01	System	Demonstration	To successfully search for nearby bus stops based on user's location.	A list of bus stops is presented to the traveler.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u> 1. Click on the "Bus Stops" button to view the list of available bus stop information.</p> <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Nearby bus stops are shown in the list; clicking on each stop updates the map and provides more information about the stop. Testers can see the same results by clicking on the bus stop on the map.</p> <p><u>Post-condition:</u> N/A</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.1.4	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02	Rides-Near-Me	The MMTPA shall have a rides-near-me feature.	MMTPA-TRA016-V01	System	Demonstration	To successfully search for a scooter based on user's location.	A list of scooter locations is presented to the traveler.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the "Rentals" button to view scooter options 2. Review ride options on the map. 3. Verify that rides appear by mode, by color, with mobility provider identified on the list. 4. Click on a mode to zoom to the location of selected ride. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Nearby scooter options are shown in the list; clicking on the ride updates the map with the location of the mode.</p> <p><u>Post-condition:</u> N/A</p>	Traveler I	Planned	
4.1.1.4	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02	Rides-Near-Me	The MMTPA shall have a rides-near-me feature.	MMTPA-TRA017-V01	System	Demonstration	To successfully search for a bike based on user's location.	A list of bike locations is presented to the traveler.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Press "Rentals" button to view bike options. 2. Review ride options on the map. 3. Verify that rides appear by mode, by color, with mobility provider identified on the list. 4. Click on interactive list to zoom to the location of selected ride. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: Nearby bike options are shown in the list; clicking on the ride updates the map with the location of the mode.</p> <p><u>Post-condition:</u> N/A</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.2.2	MMTPA/CPS-UN003-v02	Trip Itineraries	For services for which cost information is subject to change, the MMTPA shall update prices in near real time.	MMTPA-TRA018-V01	System	Demonstration	To successfully update prices in real time for ride-hailing.	Travel time and costs are updated in near real-time for ride-hailing trips.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Select "Preferred Modes" option. 3. Click on the Ride-hailing options to turn on. 4. Return to the previous screen by selecting the left arrow on top left side of the screen. 5. Enter destination address in the "Where To?" search bar. 6. Enter start address or choose current location as a starting point of the trip. 7. Click "LEAVE NOW" to select the date and time of the trip start time or arrival time. 8. Plan a trip to the selected destination. 9. Review the trip options and find one with ride-hailing (taxi). 10. Record or screenshot the results, noting the travel time and cost. 11. Enter a different destination address in the search bar that is at least 0.5 mile away from the original location. 12. Review trip option and find one with ride-hailing. 13. Verify that the travel time and cost have updated. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: After changing the destination location, the travel time and cost will have updated accordingly for ride-hailing.</p> <p><u>Post-condition:</u> An updated trip itinerary is presented.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.2.2	MMTPA/CPS-UN003-v02	Trip Itineraries	For services for which cost information is subject to change, the MMTPA shall update prices in near real time.	MMTPA-TRA019-V01	System	Demonstration	To successfully update prices in real time for scooters.	Travel time and costs are updated in near real-time for scooter trips.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the gear icon at the top right of the screen to open settings panel. 2. Select "Preferred Modes" option. 3. Click on the scooter option to turn on. 4. Return to the previous screen by selecting the left arrow on top left side of the screen. 5. Enter destination address in the "Where To?" search bar. 5. Enter start address or choose current location as a starting point of the trip. 6. Click "LEAVE NOW" to select the date and time of the trip start time or arrival time 7. Plan a trip to the selected destination. 8. Review the trip options and find one with scooter. 9. Record or screenshot the results, noting the travel time and cost. 10. Enter a different destination address in the search bar that is at least 0.5 mile away from the original location. 11. Review trip option and find one with scooters. 12. Verify that the travel time and cost have updated. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: After changing the destination location, the travel time and cost will have updated accordingly for travel by scooter.</p> <p><u>Post-condition:</u> An updated trip itinerary is presented.</p>	Traveler I	Planned	

Source: City of Columbus

5.1.4. Usability

This section includes requirements and test procedures which related to user interface and usability (ease of use) of the Pivot app.

Table 10: Usability Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.1.1.3 5.6.1.8 6.1.5	MMTPA/CPS-UN002-v01 MMTPA/CPS-UN012-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN019-v02 MMTPA/CPS-UN028-v02 MMTPA/CPS-UN014-v02 MMTPA/CPS-UN008-v02	Offline Use	The MMTPA shall support offline use. --- The MMTPA shall support the following modes of operation: Offline. --- The MMTPA shall notify user when system is in offline mode.	MMTPA-TRA020-V01	System	Demonstration	To successfully plan a trip when internet connectivity is temporarily lost.	Traveler is alerted when Pivot is offline and when network connectivity is restored. --- Traveler is alerted to being offline and is still able to view cached information in the Pivot app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Use the map to select destination location. 2. Plan a route that involves one or more of the following modes: bike, scooter, and public transit. 3. Place the app into "Airplane mode" in which internet connection is lost, and the application is unable to retrieve real-time updates or operate as intended. 4. Verify the user is alerted of lost connectivity and impact on service. 5. Confirm your ability to view last known information for bikes, scooters, and/or public transit without real-time data by using the map to set location. 6. Turn off airplane mode on the phone to restore internet connectivity to the app. 7. Verify that offline alerts are removed, and that service is restored. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: User is alerted that app is offline; user can plan trip without real-time data; user can view nearby rides without real-time data; user cannot book trip while offline. User is alerted when connectivity is restored.</p> <p><u>Post-condition:</u> Connectivity is restored.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.2.3.1	MMTPA/CPS-UN012-v02	User Interface	The MMTPA shall provide a graphical user interface (GUI) that displays maps, text, and other graphical information to allow effective use of the application.	MMTPA-TRA021-V01	System	Demonstration	To demonstrate that the GUI allows for effective use of the application	The GUI is intuitive and easy to use, and allows for effective use of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Verify that GUI elements such as map, text, icons, and font are organized to be intuitive and easy to understand to allow for effective use of the application. 2. Confirm the ability to navigate between screens without loss of data or having to start over. 3. Confirm that the GUI elements appear professional and exhibit a consistent "look and feel." <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: The app provides a GUI that passes basic tests for effective use.</p> <p><u>Post-condition:</u> N/A</p>	Traveler I	Planned	
6.7.1	MMTPA/CPSUN032-v02	Languages	The MMTPA shall provide the ability to select English or Spanish (at a minimum) as a preferred language at any point before or during any transaction and present all dynamic text and audible words (if applicable).	MMTPA-TRA022-V01	System	Demonstration	To demonstrate ability to set preferred language in the app	Travelers can select English or Spanish as the display language in Pivot.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Press the gear at the top right of the screen. 2. Press 'English' under display language option. 3. Change the desired language to Spanish. 4. Verify the display language updates to Spanish. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: The display language shows the selected language. The text updates to the selected language.</p> <p><u>Post-condition:</u> App displays text in Spanish.</p>	Traveler I	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
6.7.2	MMTPA/CPSUN032-v02	Languages	Training and educational material shall also support the traveler's preferred language.	MMTPA-TRA023-V01	System	Demonstration	To demonstrate access to training and educational material in user's preferred language - Spanish	Travelers can view education material in either English or Spanish.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Press the gear at the top right of the screen. 2. Press 'English' under display language option. 3. Change the desired language to Spanish. 4. Verify the display language updates to Spanish. 5. Go back to the home page of the app. 6. Press the menu button (three bars icon) at top left of screen. 7. Press "Ayuda". 8. Click "Muéstrame". 9. Verify that the help site is displayed in Spanish. <p><u>Pass criteria:</u> Verification by at least two independent testers on Android and iOS devices: The help site is displayed in Spanish.</p> <p><u>Post-condition:</u> The app remains open in the background as the help site opens.</p>	Traveler I	Planned	

Source: City of Columbus

5.1.5. On-Demand Trips

The section includes requirements and test procedures for on-demand trips through deep linking with service providers: Bird, Lime, and GoGo.

5.1.5.1. BIRD

This section includes test procedures for Bird electric scooters.

Table 11: Bird Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB001-V01	System	Demonstration	To demonstrate the ability to plan trips in accordance with Bird's electric scooter sharing policies.	Tester is directed to the app/play store to download and install the Bird scooter app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Bird scooter app is not installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab. 2. Tester selects a Bird scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken to app/play store to download and install the Bird scooter app. 4. Tester downloads the Bird app from the app store on the smartphone. 5. Tester opens the Bird app 6. When prompted for location services, select "Allow While Using App" to enable location services. 7. Enter the email address or sign in with Apple or Google. 8. When prompted to use Bluetooth, select "Don't Allow or "OK". <p><u>Expected result:</u> Tester is directed to download and install the Bird scooter app.</p> <p><u>Post-condition:</u> Bird scooter app is installed on smartphone.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB002-V01	System	Demonstration	To demonstrate the ability to plan trips in accordance with Bird's electric scooter sharing policies.	Tester is directed to the smartphone's Bird scooter app when selecting a Bird electric scooter trip.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Bird app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a Bird scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken directly to the Bird scooter app on the smartphone. 4. Tester can log into the Bird scooter app (if not already logged in). 5. Tester is directed to the Bird scooter that was selected within Pivot. <p><u>Expected result:</u> Tester is directed to the installed Bird scooter app on smartphone.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	
4.2.2.3	MMTPA/CPS-UN022-V02	Payment	Deep linking to third-party mobility providers shall be performed by the Offeror.	MMTPA-TRB003-V01	System	Demonstration	To demonstrate seamless deep linking from Pivot to external apps for payment.	Tester can complete payment for a Bird scooter trip and execute trip.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Bird scooter app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a Bird scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken directly to the Bird scooter app on the smartphone. 4. Tester can log into the Bird scooter app (if not already logged in). 5. Tester will be directed to the Bird scooter location that was selected within Pivot. 6. Tester clicks on camera icon to scan the scooter's QR code located on the Bird scooter to unlock the scooter. 7. Tester pays and executes the scooter trip. <p><u>Pass criteria:</u> Tester can pay for Bird scooter trip.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Source: City of Columbus

5.1.5.2. LIME

This section includes test procedures for Lime electric scooters.

Table 12: Lime Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB004-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with Lime's electric scooter sharing policies.	Tester is directed to the app/play store to download and install the Lime scooter app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lime scooter app is not installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab. 2. Tester selects a Lime scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken to app/play store to download and install the Lime scooter app. 4. Tester downloads the lime app from the app/play store on the smartphone. 5. Tester opens the Lime app. 6. Sign in with Apple or click 'Other options' and select 'Phone number', 'Email' or 'Social' to register with Lime app. 7. A confirmation link will be sent to the registered email. Click on the link emailed on the mobile device to confirm registration, 8. When prompted to use Bluetooth, select 'Don't Allow or "OK"'. 9. When prompted for location services, select "Allow While Using App' to enable location services. 10. In Apple, when prompted for notifications, select 'Don't Allow' or 'Allow' to enable notifications. 11. Enter the email address or sign in with Apple or Google. 12. When prompted to use Bluetooth, select 'Don't Allow or "OK"'. 13. Tester now created an account with Lime app. <p><u>Expected result:</u> Tester is directed to download and install the Lime scooter app.</p> <p><u>Post-condition:</u> Lime scooter app is installed on tester's smartphone.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB005-V01	System	Demonstration	To demonstrate the ability to plan trips in accordance with Lime's electric scooter sharing policies.	Tester is directed to the smartphone's Lime scooter app when selecting a Lime electric scooter trip.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lime app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a Lime scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken directly to the Lime scooter app on the smartphone. Lime app is now open 4. Tester can log into the Lime scooter app (if not already logged in). 5. Tester is directed to the Lime scooter that was selected within Pivot. <p><u>Expected result:</u> Tester is directed to the Lime scooter app on smartphone.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Test Status	Comments
4.2.2.3	MMTPA/CPS-UN022-V02	Payment	Deep linking to third-party mobility providers shall be performed by the Offeror.	MMTPA-TRB006-V01	System	Demonstration	To demonstrate seamless deep linking from Pivot to external apps for payment.	Tester can complete payment for a Lime scooter trip and execute trip. Trip information is transmitted to Pivot.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lime scooter app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a Lime scooter from the list or map and clicks on the link icon to the right of the selected scooter. 3. Tester is taken directly to the Lime scooter app on the smartphone. Lime app is now open 4. Tester can log into the Lime scooter app (if not already logged in). 5. Tester will be directed to the Lime scooter that was selected within Pivot. 6. Click on the three lines located on top of the screen, click on 'Wallet' to add payment method. 7. Click 'Manage Payment Methods' and select 'Add Card' to enter credit card information. 8. Either add funds to the account using the credit card or use credit card for payment. 9. Tester clicks 'Scan to Ride' to scan the scooter's QR code located on the Lime scooter to unlock the scooter. 10. Tester pays and executes the scooter trip. <p><u>Pass criteria:</u> Tester can pay for Lime scooter trip.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Source: City of Columbus

5.1.5.3. COGO

This section includes test procedures for CoGo bike share.

Table 13: CoGo Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB007-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with CoGo's bike share policies.	Tester is directed to the app/play store to download and install the Lyft app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lyft app is not installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab. 2. Tester selects a CoGo bike from the list or map and clicks on the link icon to the right of the selected bike. 3. Tester is taken to app/play store to download and install the Lyft app. 4. Tester downloads the Lyft app from the app/play store on the smartphone. 5. Tester opens the Lyft app. 6. Click 'Get Started'. 7. when prompted for location services, click 'Allow While Using App' to enable location services. 8. Enter mobile number to register with the Lyft and click the side arrow. 9. Enter the confirmation code sent to the registered phone number. 10. Enter First name and last name. 11. Enter email address. 12. Click 'I Agree' to accept Lyft Terms of Service. 13. Enter payment information or select apple pay (iOS only) for payments. 14. Enter 15. View and select all CDC guidelines and click 'I accept'. 16. Click 'Allow' for notifications or click 'x' located on top left to exit the screen. 17. Tester has now created an account with Lyft app. <p><u>Expected result:</u> Tester is directed to download and install the Lyft app.</p> <p><u>Post-condition:</u> Lyft app is installed on tester's smartphone.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-TRB008-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with CoGo's bike share policies.	Tester is directed to the smartphone's Lyft app when selecting a CoGo bike trip.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lyft app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a CoGo bike from the list or map and clicks on the link icon to the right of the selected bike. 3. Tester is taken directly to the Lyft app on the smartphone. 4. Tester can log into the Lyft app (if not already logged in). 5. Camera is turned on to scan the QR code on bike. <p><u>Expected result:</u> Tester is directed to the CoGo bike share app on smartphone.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	
4.2.2.3	MMTPA/CPS-UN022-V02	Payment	Deep linking to third-party mobility providers shall be performed by the Offeror.	MMTPA-TRB009-V01	System	Demonstration	To demonstrate seamless deep linking from Pivot to external apps for payment.	Tester can complete payment for a CoGo bike trip and execute trip.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; the Lyft app is installed.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Tester clicks on the Rentals tab 2. Tester selects a CoGo bike from the list or map and clicks on the link icon to the right of the selected bike. 3. Tester is taken directly to the Lyft app on the smartphone. 4. Tester can log into the Lyft app (if not already logged in). 5. Camera is turned on to scan the QR code on vehicle. 6. Tester scans the QR code on the bike 7. Tester selects the option to pay for bike. 8. Tester executes the bike trip. <p><u>Pass criteria:</u> Tester can pay for CoGo bike trip.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Source: City of Columbus

5.1.6. Scheduled Trip Plans

This section includes requirements and test procedures which demonstrate single and multimodal trips based on the MMTPA ConOps operational scenarios. Included within this section are requirements and test procedures for providing user feedback and accessing trip metrics.

5.1.6.1. LIME TO COTA

This section contains test procedures for Lime to COTA scheduled trips.

Table 14: Lime to COTA Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.4.1	MMTPA/CPS-UN005-v02 MMTPS/CPS-UN013-v02	Planning and Booking User Feedback	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted. --- The MMTPA shall support user feedback per each segment, and overall trip experience.	MMTPA-TRB010-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with individual mobility providers and to receive confirmation	Traveler can book a multimodal trip in accordance with policies of Lime scooter	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and Lime scooter as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on "Where To?" and enter a destination in Columbus, OH. 2. Select trip 3. Press "Start" to begin the trip. 4. Click 'Ok to agree to the scooter policy. 5. Walk to the location of the Lime scooter. 6. Click on the 'Chain' next to Lime within the trip to open the Lime app. 7. Click "Scan the code" to the scan the barcode on the scooter. 8. Pay and unlock the scooter. 9. Ride the Lime scooter to the next segment of the trip. 10. Click 'Lock' in the Lime app to finish the scooter ride. 11. Verify Pivot app provides notifications alerting of the next trip segment. 12. Open Pivot app and note the COTA bus number. 13. Wait for the COTA bus at the bus stop. 14. Take COTA bus to the next segment of the trip. 15. Walk to the destination which is the last segment of the trip. 16. Click end trip to see a popup to provide feedback on the screen once the trip is completed. 17. Enter rating and click 'Ok" <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience.</p> <p><u>Post-condition:</u> Trip has completed; updated trip metrics will be available in 24 hours in the pivot app.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB011-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the menu button (three bars icon) at the top left of the screen and click "Trip Metrics". 2. Review updates to the walk, bus and scooter metrics. <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.6.2. COTA TO BIRD

This section contains test procedures for COTA to Bird scheduled trips.

Table 15: COTA to Bird Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.4.1	MMTPA/CPS-UN005-v02 MMTPS/CPS-UN013-v02	Planning and Booking User Feedback	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted. --- The MMTPA shall support user feedback per each segment, and overall trip experience.	MMTPA-TRB012-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with individual mobility providers and to receive confirmation	Traveler can book a multimodal trip in accordance with policies of Bird scooter	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and Bird scooter as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> Click on "Where To?" and enter a destination in Columbus, OH. Select trip Press "Start" to begin the trip. Click 'Ok to agree to the scooter policy. Note the COTA bus number and walk to the bus (if CBUS or CMAX the bus will not be labeled). Wait for the COTA bus at the bus stop. Take COTA bus to the next segment of the trip. Verify the Pivot app provides navigation to the scooter (note: if scooter is not available at the next trip segment, tester will be notified) Walk to the location of the Bird scooter. Click on the 'Chain' next to Bird within the trip to open the Bird app. Click "Scan the code" to scan the barcode on the scooter. Pay and unlock the scooter. Ride the Bird scooter to the next segment of the trip. Click 'Lock' in the Bird app to finish the scooter ride. Walk to the destination which is the last segment of the trip Click end trip to see a popup to provide feedback on the screen once the trip is completed. Enter rating and click "Ok" <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience.</p> <p><u>Post-condition:</u> Trip has completed; updated trip metrics will be available in 24 hours in the pivot app.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB013-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u> 1. Click on the menu button (three bars icon) at the top left of the screen and click "Trip Metrics". 2. Review updates to the walk, bus and scooter metrics.</p> <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.6.3. COGO TO COTA

This section contains test procedures for CoGo to COTA scheduled trips.

Table 16: CoGo to COTA Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.4.1 SMH-FN2296-V01 SMH-FN2297-V01	MMTPA/CPS-UN005-v02 MMTPS/CPS-UN013-v02	Planning and Booking User Feedback	<p>The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.</p> <p>---</p> <p>The MMTPA shall support user feedback per each segment, and overall trip experience.</p> <p>---</p> <p>The bikeshare docking station shall track the date and time when a bike is unlocked.</p> <p>---</p> <p>The bikeshare docking station shall track the</p>	MMTPA-TRB014-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with individual mobility providers and to receive confirmation	Traveler can book a multimodal trip in accordance with policies of CoGo bike	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and CoGo bike as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u> 1. Click on "Where To?" and enter a destination in Columbus, OH. 2. Press "Start" to begin the trip. 3. Walk to the location of the CoGo bike. 4. Click on the 'Chain' next to CoGo within the trip to open the Lyft app. 5. Click "Scan the code" to the scan the barcode on the bike. 6. Pay and unlock the bike. 7. Ride the CoGo bike to the next segment of the trip.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
			date and time when a bike is locked.						<ol style="list-style-type: none"> 8. Dock the bike to the CoGo docking station to finish the bike ride. 9. Verify Pivot message to click on Trip in Progress and navigate to the bus stop. 10. Walk to the COTA bus stop. 11. Wait for the COTA bus at the bus stop. 12. Take COTA bus to the next segment of the trip. 13. Walk to the destination which is the last segment of the trip. 14. Click end trip to see a popup to provide feedback on the screen once the trip is completed. 15. Enter rating and click 'Ok' <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience.</p> <p><u>Post-condition:</u> Trip has completed; updated trip metrics will be available in 24 hours in the pivot app.</p>			
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB015-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the menu button (three bars icon) at the top left of the screen and click "Trip Metrics". 2. Review updates to the walk, bus and bike metrics. <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.6.4. COTA TO UBER

This section contains test procedures for COTA to Uber scheduled trips.

Table 17: COTA to Uber Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.1.3 6.1.6 6.4.1	MMTPA/CPS-UN005-v02 MMTPA/CPS-UN008-v02	Planning and Booking Notifications and Alerts User Feedback	<p>The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.</p> <p>---</p> <p>The MMTPA shall notify travelers when reaching an important step during travel.</p> <p>---</p> <p>Notifications and alerts shall include push notifications, email, and text message.</p> <p>---</p> <p>The MMTPA shall support user feedback per each segment, and overall trip experience.</p>	MMTPA-TRB016-V01	System	Demonstration	To demonstrate the ability to book and complete a multimodal trip.	<p>Pivot app notifies travelers when reaching a termination point or a transfer point.</p> <p>---</p> <p>Pivot app alerts travelers to alternative routes and/or modes in cases of increased travel time.</p>	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and ride-hail as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on "Where To?" and enter a destination in Columbus, OH. 2. Click on a trip option which has ride-hail and COTA as modes of transportation. 3. Select 'Uber' as ride-hail option. 4. Click "Start" to begin the trip. 5. Walk to the COTA bus stop. Note the bus number from the Pivot trip details. 6. Take the COTA bus and reach the next trip segment. 7. Click on the arrow within the trip segment next to Uber to open the Uber app. 8. Pay and execute the Uber ride to the trip destination. 9. Click 'End' to end the trip within the Pivot app. 10. A popup to provide feedback will be prompted on the screen once the trip is completed. 11. Enter rating and click 'Ok'. <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience. Tester is able to open the Uber app through the Pivot app to book the ride.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB017-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> Click on the menu button (three bars icon) at the top left of the screen and click "Test Metrics". Review updates to the bus and ride-hail trip metrics. <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.6.5. COTA TO LYFT

This section contains test procedures for COTA to Lyft scheduled trips.

Table 18: COTA to Lyft Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.1.3 6.1.6 6.4.1	MMTPA/CPS-UN005-v02 MMTPA/CPS-UN008-v02	Planning and Booking Notifications and Alerts User Feedback	<p>The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.</p> <p>---</p> <p>The MMTPA shall notify travelers when reaching an important step during travel.</p> <p>---</p>	MMTPA-TRB018-V01	System	Demonstration	To demonstrate the ability to book and complete a multimodal trip.	<p>Pivot app notifies travelers when reaching a termination point or a transfer point.</p> <p>---</p> <p>Pivot app alerts travelers to alternative routes and/or modes in cases of increased travel time.</p>	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and ride-hail as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> Click on "Where To?" and enter a destination in Columbus, OH. Click on a trip option which has ride-hail and COTA as modes of transportation. Select 'Lyft' as ride-hail option. Click "Start" to begin the trip. Walk to the COTA bus stop. Note the bus number from the Pivot trip details. Take the COTA bus and reach the next trip segment. Click on the arrow within the trip segment next to Lyft to open the Lyft app. 	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
			<p>Notifications and alerts shall include push notifications, email, and text message.</p> <p>---</p> <p>The MMTPA shall support user feedback per each segment, and overall trip experience.</p>						<p>8. Pay and execute the Lyft ride to the trip destination.</p> <p>9. Click 'End' to end the trip within the Pivot app.</p> <p>10. A popup to provide feedback will be prompted on the screen once the trip is completed.</p> <p>11. Enter rating and click 'Ok'.</p> <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience.</p> <p><u>Post-condition:</u></p>			
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB019-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> Click on the menu button (three bars icon) at the top left of the screen and click "Test Metrics". Review updates to the bus and ride-hail trip metrics. <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.6.6. YELLOW CAB TO COTA

This section contains test procedures for Yellow Cab to COTA scheduled trips.

Table 19: Yellow Cab to COTA Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1 6.1.3 6.1.6 6.4.1 SMH-MT2391-V01	MMTPA/CPS-UN005-v02 MMTPA/CPS-UN008-v02	Planning and Booking Notifications and Alerts User Feedback	<p>The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.</p> <p>---</p> <p>The MMTPA shall notify travelers when reaching an important step during travel.</p> <p>---</p> <p>Notifications and alerts shall include push notifications, email, and text message.</p> <p>---</p> <p>The MMTPA shall support user feedback per each segment, and overall trip experience.</p> <p>---</p> <p>Each vehicle shall have a unique identifier that is visible to the User.</p>	MMTPA-TRB020-V01	System	Demonstration	To demonstrate the ability to book and complete a multimodal trip.	<p>Pivot app notifies travelers when reaching a termination point or a transfer point.</p> <p>---</p> <p>Pivot app alerts travelers to alternative routes and/or modes in cases of increased travel time or when the planned transportation mode is no.</p>	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Public Transit and Yellow Cab as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> Click on "Where To?" and enter a destination in Columbus, OH. Click on a trip option which has ride-hail and COTA as modes of transportation. Select 'Yellow Cab' as ride-hail option. Click "Start" to begin the trip. A pop-up appears on the screen to confirm the taxi order. Click 'OK' to confirm. Walk to the ride-hail pickup location. Taxi arrives at the location. Confirm the car number. Take the yellow cab and reach the next trip segment. Verify Pivot app provide notifications alerting of the next ride timings. Walk to the COTA bus stop. Note the bus number from the Pivot trip details. Take the COTA bus to the next trip segment. Verify Pivot app provides notifications alerting of the next trip segment. Walk to the destination. Click 'End' to end the trip within the Pivot app. A popup to provide feedback will be prompted on the screen once the trip is completed. Enter rating and click 'Ok' <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book a trip and receive notifications of when the service will arrive. Tester can complete a trip and provide feedback on each segment and overall trip experience.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
6.1.2	MMTPA/CPS-UN008-v02	Trip Changes	The MMTPA shall provide personalized traffic information including early warning in case of an increasing travel time and possible alternative routes and/or modes.	MMTPA-TRB021-V01	System	Demo	To demonstrate the ability to notify users of increased travel time and alternate routes and/or modes	Travelers are notified of increased travel time and suggested other routes and/or modes.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in. Tester has selected Transit as the only preferred modes. Tester has notifications (Push, SMS, and Email) toggled on.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Enter an origin and destination address to begin trip search 2. Book a trip 3. Ensure the trip will have an increased travel time (https://www.cota.com/rider-service-alerts/) 4. Verify that the user is warned of the increased travel time in advance 5. Verify that the user is suggested other routes and/or modes <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Travelers should be warned of increased travel time and suggested other routes and/or modes.</p> <p><u>Post-condition:</u></p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
4.1.5.1 4.1.5.2 4.1.5.3	MMTPA/CPS-UN010-v02	Trip Changes	<p>The MMTPA shall allow changes to an existing trip. This includes changes or cancelations prior to the start of the trip or changes made during a trip (if applicable). Cancelations or changes will be subject to the policies of individual mobility providers.</p> <p>---</p> <p>The MMTPA system needs to notify mobility providers if a reserved trip is canceled or modified by a traveler, so they can process the request and make the necessary changes as allowed.</p> <p>---</p> <p>The MMTPA must notify a traveler if a cancellation or unavailability of a resource has changed their planned trip (example: dockless bikes/scooters taken before arrival).</p>	MMTPA-TRB022-V01	System	Demo	To allow user to make changes to an existing trip.	<p>Traveler can make changes to an existing trip and cancel the scheduled trip.</p> <p>---</p> <p>Mobility providers are notified of changes to an existing reservation.</p>	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on "Where To?" and enter a destination in Columbus, OH that is accessible by Taxi from your current location. 2. Press "Leave At" and change the start time of the trip to occur two hours from now. 3. Press "Book" to book the trip. 4. Review the scheduled trip showing the trip departure date/time, and from/to locations. A pop-up appears on the screen to confirm the taxi order. Click 'OK' to confirm. 5. Click on the red "x" to cancel the trip. 6. Press "Yes" when prompted to confirm you want to cancel the trip. 7. Verify that the scheduled trip has been canceled. <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. Tester can book and cancel a scheduled trip, and service provider is notified of the canceled trip. Tester should not receive an alert notifying them the trip is about to start.</p> <p><u>Post-condition:</u> Trip has been canceled; service provider has been notified of canceled trip.</p>	Traveler II	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
6.2.1	MMTPA/CPS-UN008-v02 MMTPA/CPS-UN011-v02	Metrics	The MMTPA should provide Travelers with access to summary statistics based on the individual travel history.	MMTPA-TRB023-V01	System	Demonstration	To demonstrate trip metrics in the Metrics section of the Pivot app.	Trip metrics are updated in the Metrics section of the Pivot app.	<p><u>Pre-condition:</u> Pivot is open; tester has completed the steps above to complete a trip; 24 hours have elapsed since the completed trip.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Click on the menu button (three bars icon) at the top left of the screen and click "Test Metrics". 2. Review updates to the bus and ride-hail trip metrics. <p><u>Pass criteria:</u> Trip metrics have updated in the past 24 hours for the trip taken.</p> <p><u>Post-condition:</u> Tester will only see gallons saved, exercise, and bus metrics if modes other than car are selected.</p>	Traveler II	Planned	

Source: City of Columbus

5.1.7. Gohio Commute (GOH)

This section contains test procedures for Gohio Commute.

Table 20: Gohio Commute Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
5.7.1	MMTPA/CPS-UN005-v02	Planning and Booking	The MMTPA shall provide the ability to book/reserve trips in accordance with the policies of individual Mobility Providers and to receive confirmation that trips have been processed and accepted.	MMTPA-GOH001-V01	System	Demonstration	To demonstrate the ability to book trips in accordance with the policies of the Gohio Commute app.	User can book a carpool trip in accordance with the policies of the Gohio Commute app.	<p><u>Pre-condition:</u> Pivot is open and the tester is logged in; Gohio account not setup.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. User goes to gohiocommute.com on his or her computer or smartphone. 2. User clicks register to begin account setup and completes the necessary information to complete the setup. 3. Once account is setup, User needs to enter commute information (origin and destination, working hours, etc.) and preferences (driver, passengers, etc.) in the app. 4. User opens Pivot app. 5. User clicks on menu button (three lines in upper left) and click 'Connect Accounts'. 	Traveler II – Gohio		

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
									<p>6. User clicks Gohio and enters username and password to connect account with Pivot.</p> <p>7. User clicks the Scheduled Trips icon (calendar in upper right) to access planned trips.</p> <p>8. To initiate an upcoming trip, the User clicks the 'Thumbs Up' button and selects if the User will be Solo, Driver, or Rider. For the test, one User will select Rider and on User will select Driver.</p> <p>9. The User that is a Rider needs to select 'Thumbs Up' as well to initiate the pickup.</p> <p>10. Pivot will alert the Driver when it is time to depart. The User will click on the notification to launch navigation to see the trip plan, in order of passenger pickup.</p> <p>11. Pivot will alert the Rider when the Driver is arriving.</p> <p>12. The navigation will take the Driver to the Rider's pickup location and to the destination.</p> <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices.</p> <p><u>Post-condition:</u> Rider and Driver successfully arrive at their destination.</p>			
4.2.6.2	MMTPA/CPS-UN001-v02 MMTPA/CPS-UN015-v02 MMTPA/CPS-UN033-v02 MMTPA/CPS-UN039-v02	Ridesharing Providers	The MMTPA shall be configured such that it will be capable of determining the scheduling and order in which the driver needs to pick up all members of the team.	MMTPA-GOH002-V01	System	Demonstration	To demonstrate the connection to the Gohio Commute application for carpool	User can see turn by turn directions based on passenger response with quickest route available.	<p><u>Pre-condition:</u> User has an active Gohio Commute account and is a part of an active carpool. User is logged in to Gohio Commute through connected accounts into Pivot. For this test, other travelers in the same carpool must notify the "driver" if they are participating in the carpool through the Pivot app.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. User can see carpool trips and travelers in the Scheduled Trips section. 2. User will specify that he/she is the driver. 3. User will record that he/she is participating in the carpool by clicking the thumbs up. 4. User will see notification of selection. 5. User will launch navigation to see the trip plan, in order of passenger pick up. 	Traveler II – Gohio	Planned	

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status	Comments
									<p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. User can see turn by turn directions based on passenger response with quickest route available.</p> <p><u>Post-condition:</u> Driver will have picked up passengers in order that is presented, and that order is optimal for the overall drive.</p>			
4.2.6.4	MMTPA/CPS-UN001-v02, MMTPA/CPS-UN015-v02, MMTPA/CPS-UN033-v02, MMTPA/CPS-UN039-v02	Ridesharing Providers	The MMTPA shall be configured such that it will be capable of reporting and calculating the route based upon the origin at the driver's specified location and terminating at the driver's specified location.	MMTPA-GOH003-V01	System	Demonstration	To demonstrate the connection to the Gohio Commute application for carpool	-	<p><u>Pre-condition:</u> User has active Gohio Commute account and is a part of an active carpool. User is logged in to Gohio Commute through connected accounts into Pivot. For this test, other users in the same carpool must notify the "driver" if they are participating in the carpool through the Pivot app.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. User can see carpool trips and travelers in the Scheduled Trips section. 2. User will specify that she is the driver. 3. User will record that she is participating in the carpool by clicking the thumbs up. 4. User will see notification of selection. 5. User will launch navigation to see the trip plan, in order of passenger pick up. <p><u>Pass criteria:</u> Verification by two independent testers on Android and iOS devices. User can see turn by turn directions based on passenger response with quickest route available.</p> <p><u>Post-condition:</u></p>	Traveler II – Gohio		

Source: City of Columbus

5.1.8. Smart Mobility Hub Integration (SMH)

This section includes requirements and test procedures from the Smart Mobility Hubs project for MMTPA integration at kiosks.

Table 21: Smart Mobility Hub Integration Test Procedures

Feature No.	User Needs	Feature	Req Description	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status
NEW	MMTPA/CPSUN016-v02	Smart Mobility Hubs	The MMTPA shall allow kiosk users to plan a trip and receive a trip plan by text or email in order to execute a trip on smartphone by launching MMTPA.	MMTPA-SMH001-V01	System	Demonstration	To demonstrate trip planning at a SMH kiosk using pivot app and receive the trip planning by text or email	Travelers can plan a trip at a Smart Columbus kiosk.	<p><u>Pre-condition:</u> Tester has a smart phone and access to the Pivot app through the IK.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Open Pivot app on the IK. 2. Click 'Where to' to enter destination. 3. Select a trip option from displayed options and click 'Book'. 4. Enter email or phone number to access trip information on the smart phone. 5. Enter the confirmation code sent to the smartphone (phone or text). 6. A link is sent to the smartphone either as a text or email based on the option chosen. 7. Click on the link to access trip information selected on the IK. 8. Tester will be prompted to download the Pivot from the app or play store (if not downloaded) OR Pivot is launched with the trip plan. <p><u>Pass criteria:</u> Verification by two independent testers at two different SMH kiosks: User can launch the Pivot app and selected trip plan is shown on the app using the link</p> <p><u>Post-condition:</u> N/A</p>	Traveler II – Kiosk	Planned
SMH-FN2343-V02	MMTPA/CPSUN016-v02	Smart Mobility Hubs	The IK system shall send SMH location, trip mode, and timestamp data to OS for all trips generated at the respective IK.	MMTPA-SMH002-V01	System	Inspection	To demonstrate SMH location, trip data and timestamp data are sent to OS.	SMH location, trip data and timestamp data are sent to OS for each IK.	<p><u>Pre-condition:</u> Tester has completed trip on the IK.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Open the data collection dashboard that OS receives from the IK-CMS. 2. Verify that data are present in the OS. <p><u>Pass criteria:</u> Data are sent to the OS for each IK.</p> <p><u>Post-condition:</u> N/A</p>	Technical	Planned

Source: City of Columbus

5.1.9. Load Testing

Scripts will be created to test Pivot APIs at high levels of demand to determine per-user scaling cost. Since the APIs are hosted in an auto-scaling environment across Amazon's Columbus data centers, limitations are determined by cost rather than by bandwidth or hardware availability. Load testing will be performed by writing scripts to call the APIs repeatedly independent of the hosting environment. Because the Pivot staging and production system is in the same hardware environment, it will be sufficient to test the staging system, which will avoid the need to reverse all of the test trips after the fact.

Table 22 contains all the server-side APIs used by Pivot. This covers the full range of communications that would be affected by the amount of user demand.

Table 22: Pivot Load Testing

API	Description	Endpoint	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status
Websocket	This API sends regular updates that pertain to each user, such as scooter availability changes near their GPS location. It needs to track each active trip.	N/A	MMTPA-API001-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned
Geocoding API	<p>This API looks up the coordinates of a place that the user types in or looks up the place name/address for a location the user chooses from the map.</p> <p>This API is called for every text change to perform the autocomplete every time the user is typing in a place search.</p>	https://mmapi.etch.app/geocode	MMTPA-API002-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned

API	Description	Endpoint	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status
OpenTripPlanner API	<p>This API calculates possible trip plans for a given origin, destination, and desired mode selection.</p> <p>This is expected to be the performance bottleneck given its high compute cost for searching the travel network.</p>	https://mmapi.etch.app/opentripplanner/otp/	MMTPA-API003-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned
TripBooking API	<p>This API is called when a user adds a trip in the itinerary.</p>	https://mmapi.etch.app/book	MMTPA-API004-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned

API	Description	Endpoint	Test ID	Test Type	Trace Method	Test Objective	Test Metric	Test Procedures	Test Group	Status
TripBooking API	This API is called when a user removes a trip in the itinerary.	https://mmapi.etch.app/book/cancel	MMTPA-API005-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned
Feedback API	<p>This API is call whenever a user submits comments to the Feedback screen or rates a trip after completing it. It is also called automatically when a trip can't be found for a given destination.</p> <p>Takes inputs: {type, comment, ratings, trip}</p>	https://mmapi.etch.app/feedback	MMTPA-API006-V01	API	Test	To test load at peak levels of demand to determine per-user scaling cost.	API can auto-scale to handle peak levels of demand and peak load capacity.	<p><u>Pre-condition:</u> Script are prepared to run in Pivot staging system.</p> <p><u>Steps:</u></p> <ol style="list-style-type: none"> 1. Execute script that runs hundreds of users simultaneously for an hour-long period and measures response time of requests. 2. Output report that summarizes the results and estimates a total scaling cost based on peak demand requirements and per-user cost. <p><u>Pass criteria:</u> Verification by MTech that API can auto-scale to meet demand.</p>	MTECH	Planned

Appendix A. Test Result Summary

This section defines the UAT Summary Report and test results, test metrics, outstanding issues, contractual requirements, exit criteria, and signoffs for the UAT process.

A.1 UAT SUMMARY REPORT

Test results for each test case will be documented in a UAT Summary Report. All functions will be tested under leadership of the system owner, test manager, and lead technical tester. Throughout this process, any bugs, inconsistencies, errors, and so forth detected will be captured in the defect tool and reported to the development team. The development team will follow the Change Control process to address any issues that arise during testing.

The following sections provide an overview of the UAT Summary Report format.

A.1.1 Test Results Matrix

Table 23: 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 Test Metrics

This section identifies the metrics to be used to evaluate execution of the test plan.

Table 24: Test Cases Planned versus Executed

App	Test Cases Planned	Test Cases Executed	Test Cases Passed	Test Cases Failed
MMTPA	0	0	0	0

Source: City of Columbus

Table 25: Defect Matrix Open versus Closed

App	Open	Closed	Canceled	Resolved	Deferred
MMTPA	0	0	0	0	0

Source: City of Columbus

Table 26: Defect Matrix – by Priority/Type

App	High	Medium	Low	Total
MMTPA	0	0	0	0

Source: City of Columbus

A.1.3 Outstanding Issues

This section lists any open defects the project is tracking along with the reason the defect remains open.

Table 27: Outstanding Issues

App	Defect ID	Defect Description	Severity	Defect Status	Notes
MMTPA					

Source: City of Columbus

A.1.4 Change Request Log

This section documents the change requests (CRs) that have been captured, evaluated, and implemented throughout the testing life cycle.

Table 28: Change Request Log

CR ID	Description	Justification	Defect ID	Requirement	Status

Source: City of Columbus

A.2 UAT EXIT CRITERIA

This section gives the conditions that were fulfilled to conclude user acceptance testing.

Table 29: Test Exit Criteria

Criteria	Met/Not Met
All planned test cases and scenarios in the RTM have been executed	
All contractual requirements indicated as needed to be met prior to deployment have been met	

Criteria	Met/Not Met
All planned test scenarios achieved 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	
A plan and schedule for resolution exist for outstanding issues	

Source: City of Columbus

A.3 UAT ACCEPTANCE

The information being reported in this UAT Summary Report is correct and grants permission for the project to move forward with production deployment.

Table 30: Test Signoffs

Role	Name	Date	Signature
Product owner	Andy Wolpert		
Test manager	Jeff Kupko		
Lead technical tester	Jared Olsen		

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:

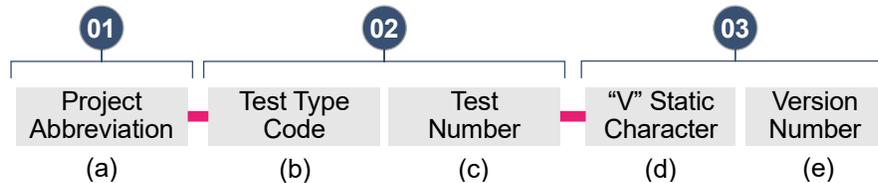


Figure 1: Numbering Convention

Source: City of Columbus

Table 31: Numbering Convention Definitions

Octet	Description	Data Type, Casing	Number of Characters or Digits
Project abbreviation	The designated Smart Columbus project acronym (e.g., MMTPA).	String, upper case	Variable
Test type code	Three-letter designation used for each test case based on the grouping (e.g., TRA: Traveler 1).	String, upper case	3
Test number	An integer incrementing by one, indicating the number of requirements established.	Integer	3
"V" static character	Static letter "V" represents the version for the test objective and procedure.	Character	1
Version number	An integer incrementing by one, indicating the number of revisions made to the test element.	Integer	2

Source: City of Columbus

For example, a test case for the MMTPA project would be MMTPA-TRA001-V01, where:

- "MMTPA" is the project abbreviation
- "TRA001" is the test type code coupled with the three-digit test number
- "V01" is the static "V" coupled with the two-digit version number

Appendix D. Acronyms and Definitions

Table 33 lists and defines acronyms used throughout this document.

Table 33: Acronyms and Definitions

Abbreviation/Acronym	Definition
API	application programming interface
AVS	Address Verification System
CDC	Center for Disease Control
CFMS	Central Fare Management System
CMS	Central Management System
ConOps	Concept of Operations
COTA	Central Ohio Transit Authority
CR	change request
DMP	Data Management Plan
DPP	Data Privacy Plan
EPM	Event Parking Management
GBFS	General Bikeshare Feed Specification
GTFS	General Transit Feed Specification
GUI	graphical user interface
HIPPA	Health Insurance Portability and Accountability Act
ID	test identifier
IDAM	Identity and Access Management
IEEE	Institute of Electrical and Electronics Engineers
IK	Interactive Kiosk
IVR	integrated voice response
MDS	Mobility Data Specification
ML	machine learning
MMTPA	Multimodal Trip Planning Application
NEMT	non-emergency medical transportation
NFC	near field communication
NIST	National Institute of Standards and Technology
OWASP	Open Web Application Security Project

Appendix D. Acronyms and Definitions

Abbreviation/Acronym	Definition
PHI	protected health information
PII	personally identifiable information
POS	point-of-sale
QR	quick response
RFP	request for proposal
RTM	Requirements Traceability Matrix
SyRS	System Requirements Specification
TNC	transportation network company
UAT [Test Plan]	User Acceptance Testing [Test Plan]

Source: City of Columbus

Appendix E. Glossary

Table 34: Glossary contains a list of terms used throughout this document.

Table 34: Glossary

Term	Definition
Agile	A method of project management characterized by division of tasks into short phases of work and frequent reassessment and adaptation of plans.
app	Software application.
banked users	Banked users have set up a user account with funds deposited in their account or credit card information saved.
travelers (end users)	The travelers (residents and visitors) in Columbus who will be interacting with the Event Parking Management Central System to view, plan, reserve, and navigate to desired parking.
COTA Central Fare Management System (CFMS)	System implemented through a recently executed contract with SPX/Genfare that will accept various forms of payment including cash, magnetic cards, smart cards, and mobile tickets.
data privacy	The reasonable expectation that data of a sensitive nature will be kept confidential, sanitized, and/or encrypted, and respectfully and responsibly maintained by all Users, managers, and collectors of the data.
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.
multimodal transportation	Travel using more than one mode of transportation.
open source	Software developed through open collaboration and voluntary contribution by developers who write and exchange programming code.
personally identifiable information (PII)	Information used in security and privacy laws that can be used to identify an individual, such as vehicle, traveler, and payment information.
push notification	A method used to alert users to relevant information pertaining to a route or selected mode of transportation, such as the approach of a transfer location, congestion or other impediment to travel, or pricing change.
quick response (QR) barcode	Commonly referred to as a QR code. A barcode that stores information that can be used for marketing or sharing information and can be read using a digital device such as a smartphone.
real-time data	Information delivered immediately after collection.
systems engineering approach	A linear and sequential product or software development model that includes Conception, Initiation, Analysis, Design, Construction, Testing, Production/Implementation and Maintenance phases.
third party	Organizations not affiliated with the Smart Columbus Program.

Appendix E. Glossary

Term	Definition
transportation network company (TNC)	Private businesses, non-profits, and quasi-governmental agencies that offer one or more types of transportation for use in exchange for payment.
trip data	Origin, destination, start time, end time, mode, transfer, transfer time, transfer location, disembarked location, embarked location.
unbanked users	Unbanked users are those who pay for each transaction separately at the time of the trip request.

Source: City of Columbus



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