OTP SUM: OTP Integration of Transit with Shared-Use Mobility Real-Time and Data Enhancements

Mobility on Demand Sandbox Program
Quarterly Report Q2 2018
04/01/18 - 06/31/18

Published August 20, 2018

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Project Summary

A project dashboard is available at www.trimet.org/mod. It provides more comprehensive information about the project and up-to-date status reports.

Challenges Addressed by Project

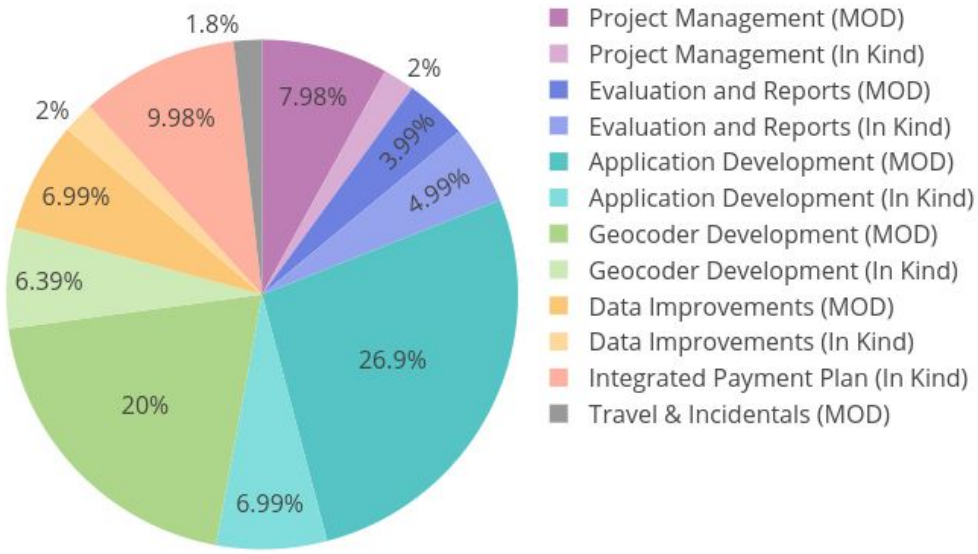
- OpenTripPlanner (OTP) does not currently incorporate shared-use modes.
- Address location for trip origins and destinations are a main requirement for trip planning, however, existing options are inadequate or cost prohibitive for government.
- Accessible trips are a challenge due to the lack of data available on the accessibility of pedestrian infrastructure and the absence of these features in a trip planner.

Anticipated Outcomes, Benefits, Impacts

- Extend the OpenTripPlanner code base to support the integration of transit trip planning with shared-use mobility modes, such as bike share and transportation network companies (TNCs), as well as updated real-time transit information.
- Implement a fully functional and comprehensive open geocoder built off the existing Mapzen Pelias geocoder. A non-proprietary and non-restrictive option for address locating would substantially lower the barrier to entry for many transit systems to offer trip planning and can achieve significant cost savings for transit agencies, government agencies, and the public.
- TriMet, in collaboration with the OpenStreetMap community, established best practices for representing accessibility information and will build out this accessibility information in the OSM network and provide a model for replicating this work in other regions.

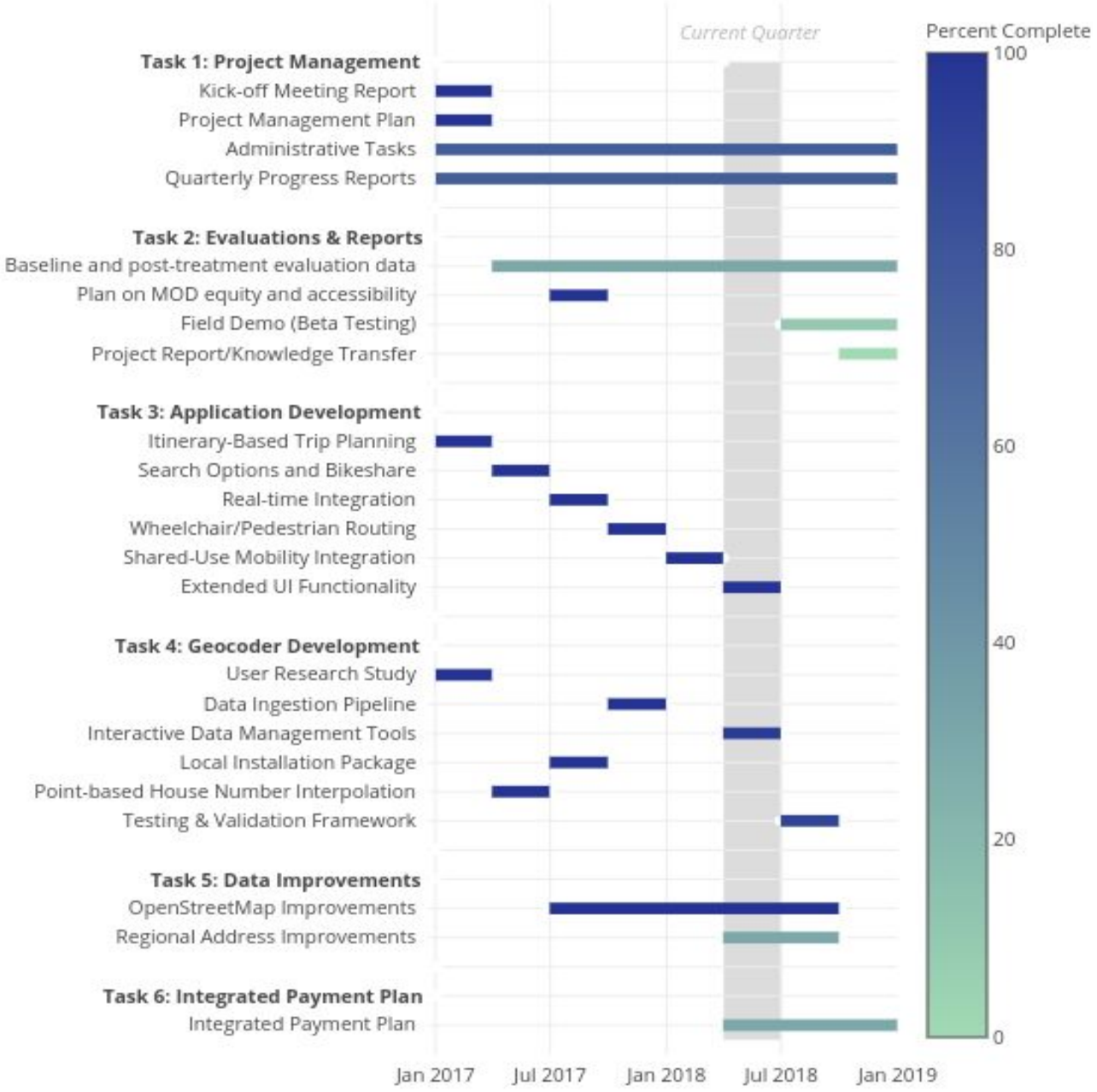
Grant Budget Allocations

TriMet's funding allocation from the FTA of $678,000 is matched with 32% of in-kind contributions, totaling over $1 million.



Project Scope and Budget Status

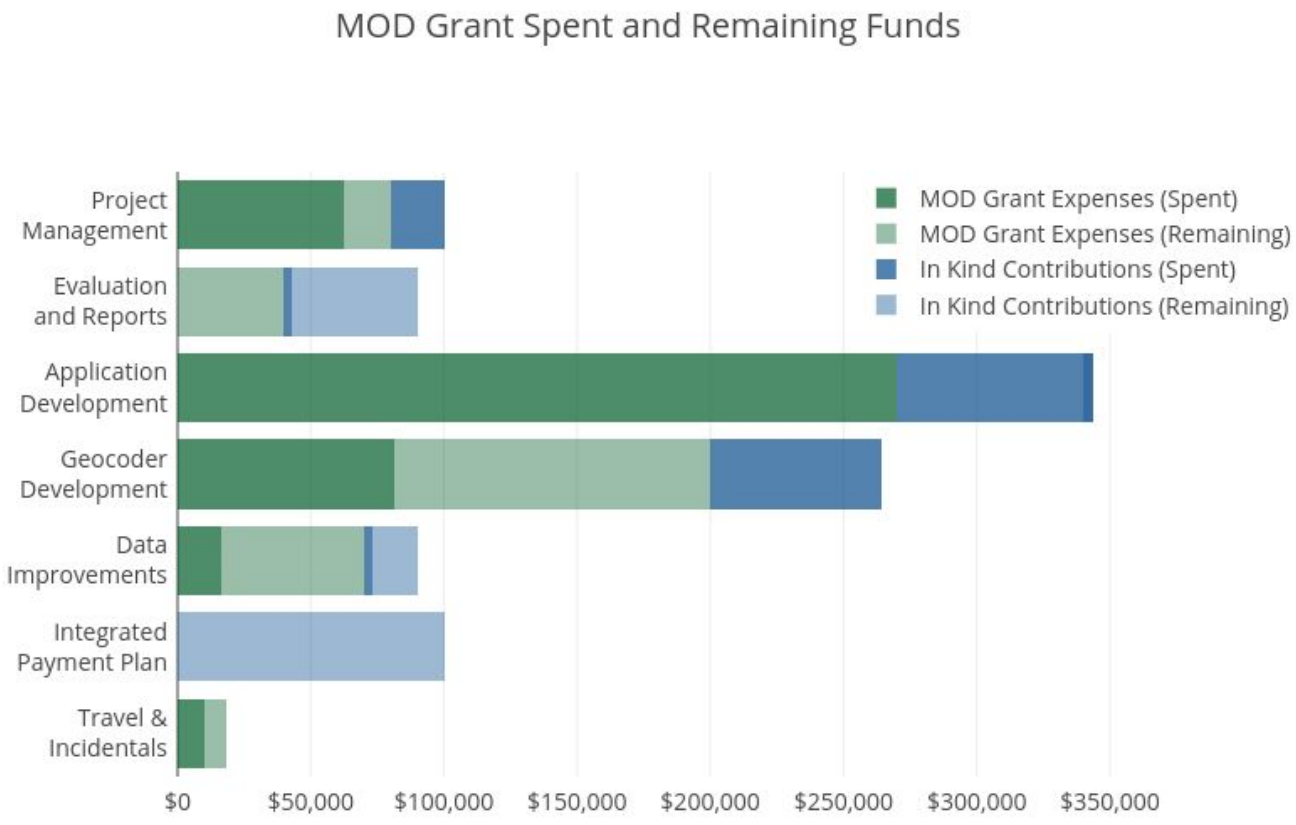
The MOD Sandbox project is divided into six main tasks: Project Management, Evaluations & Reports, Application Development, Geocoder Development, Data Improvements and an Integrated Payment Plan. The project is on schedule and in budget. Progress is as follows:



The above Gantt chart illustrates the tasks and status of deliverables in Quarter 2 2018.

Of the $678,000 that TriMet received, $440,170.37 (65% of allocated grant funds) has been spent thus far. The cleared expenditures through Q2 2018 are as follows:

$62,721 (78% of allocated grant funds) spent toward Project Management;
$162,000 (100% of allocated grant funds) spent toward Application Development;
$81,300 (41% of allocated grant funds) spent toward Geocoder Development;
$16,122 (23% of allocated grant funds) spent toward Data Improvements;
$9,900.37 (55% of allocated grant funds) spent toward Travel & Incidentals.



The above bar chart shows the current amount spent for each of the tasks in Quarter 2 2018.

Task 1: Project Management

TriMet's OTP Integration of Transit with Shared-Use Mobility Real-Time and Data Enhancements have been underway since January. All milestones and deliverables have been met and we are on schedule.

Quarterly Deliverables

Deliverables for this quarter are in the form of ongoing tasks that include scheduled weekly meetings and administrative tasks.

Quarterly Progress

Task progress includes:

- weekly scheduled meetings (slack or webinars) to ensure continued communications;
- use of Trello for project management;
- a dedicated and open TriMet MOD Project Google drive for project management;
- use of InVision for application interface development and review;
- continued update of the online project dashboard available to the public at TriMet.org/MOD to ensure transparency;
- and RealTime Board for live, remote whiteboarding sessions.

Task 2: Evaluations and Reports

Project evaluations and reports that are required by FTA for this project include:

1. Equity and Accessibility Plan - Completed
2. Evaluation Plan and Report - Under final review
3. Knowledge Transfer - Continuing
4. Field Demonstration - Public beta testing scheduled for Quarter 3 2018
5. Final Project Report - Development in Quarter 4 2018 and Finalized January 2019 at project close.

Recent modifications to this scope of the project include an Open-source Transit Software White Paper which is being prepared by the Center for Urban Transportation Research at the University of South Florida (CUTR) (**Appendix A - Open Source Transit Software White Paper**). The goal of the paper is to provide a review on how open-source software (OSS) in the transit industry has evolved from grant-funded or exploratory projects into production deployments at transit agencies with OSS projects supported by user communities, and the future of OSS along with advantages and disadvantages of its widespread deployment as an alternative to closed-source software and platforms. This white paper will be included in the Final Project Report.

Quarterly Deliverables

There were no scheduled deliverables for this task during this quarter.

Quarterly Progress

Contract has been awarded to PlusQA to perform a heuristic usability study Quarter 3 2018. Scope of the Open-source Transit Software White Paper was developed and approved.

Task 3: Application Development Status

A live demo of the application is available at https://trimet-mod-dev.conveyal.com/

Quarterly Deliverables

All five milestones have been completed and the application is ready for internal prototype testing. The last and final Milestone 5, after testing and review, was delivered on 4/25/18. This completes the $270,000 paid to Conveyal for the development of new features to the existing OpenTripPlanner (OTP) framework.

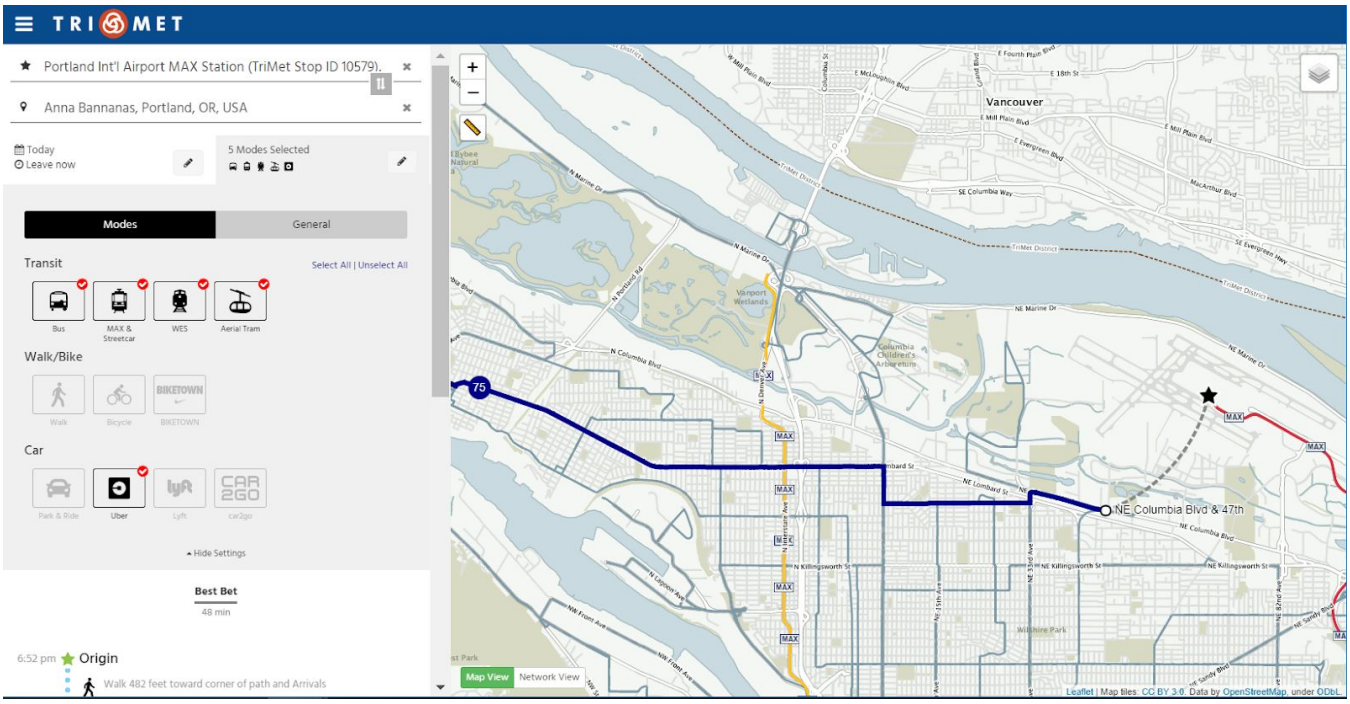
The enhancements to TriMet's existing OpenTripPlanner-based multimodal trip planning application include both the underlying multimodal routing engine and the user-facing web interface. Routing capabilities were extended to include the ability to incorporate shared-mobility services into multimodal trip planning including: TNCs; BIKETOWN; car2go; and driving to Park & Ride locations. Users can also select Zipcar locations on the map to quickly plan trips to or from there. Advances in the quality and availability of real time transit data are also incorporated, with enhancements to the routing engine's ability to consume real-time data and modify trip plans accordingly. Other enhancements include support for the General Bikeshare Feed Specification (GBFS).

In addition to the enhanced routing capabilities, a comprehensive new web-based user interface (UI) was developed. The new UI incorporates aspects from existing OTP front-end projects, including TriMet's existing interactive trip planner, the otp.js library, and Conveyal's Modeify project. The new UI is written using modern web development practices and frameworks, including the React framework and Redux architecture. This architecture emphasizes modularity and reusability of components in a variety of contexts: the library serves as the foundation for a comprehensive new OpenTripPlanner UI and also serves as a resource for developers working on complementary projects.

The prototype version with TNC integration was shared on April 18, 2018 at the MOD Workshop II. The latest version of the demo app is online at https://trimet-mod-dev.conveyal.com/ and the code for this deliverable is available at https://github.com/conveyal/trimet-mod-otp.

Quarterly Progress

Current internal review of the prototype continues this quarter to identify and log bugs in GitHub. Conveyal is providing fixes to these issues.



Screen capture of demo version of application.

Task 4: Geocoder Development

Pelias is a non-proprietary and non-restrictive option for address locating that is an important requirement for trip planning. This task includes the implementation of a reference framework for government agencies to auto-feed their authoritative address data into a publicly accessible geocoding service.

Following the closure of Mapzen on February 1, 2018, the Pelias team, at the former Mapzen/Samsung section, founded a new company "Cleared for Takeoff." A new contract and scope of services were signed in March, 2018. Cleared for Takeoff has established a new code repository and management system now referred to as geocode.earth https://geocode.earth/.

Quarterly Deliverables

The following milestones were completed this quarter:

Alias Table Functionality

The Contractor shall implement support within the Pelias geocoder for records to be searched for and returned using multiple names (also known as alternate names or aliases).

GitHub Issue: OpenTransitTools/trimet-mod-pelias/issues/3

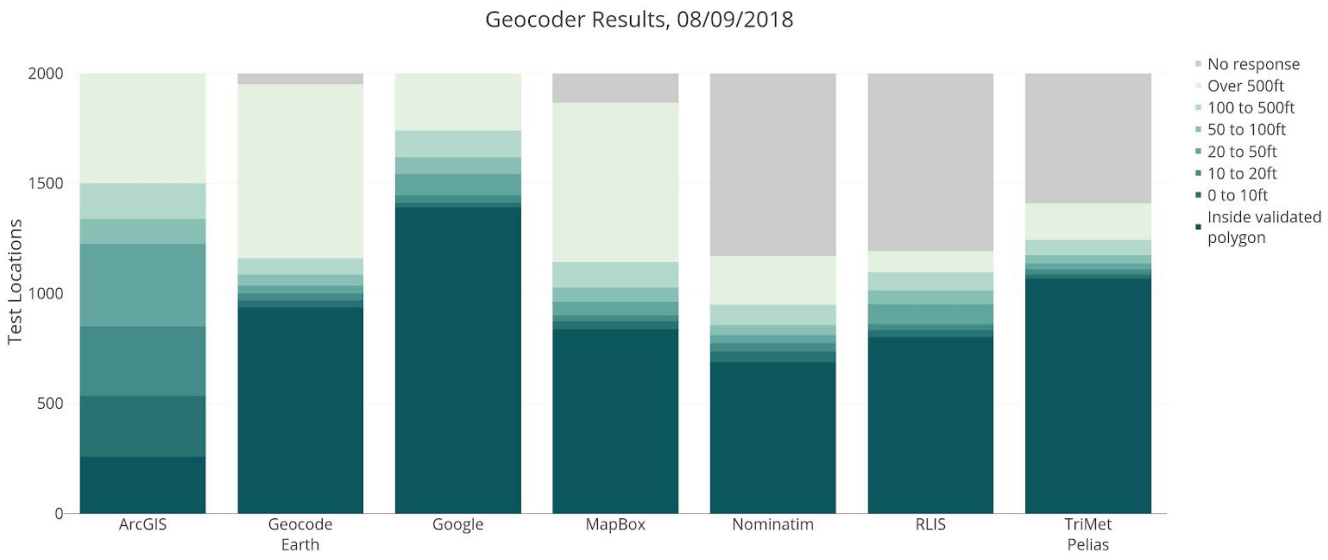
Query and Sorting Improvements

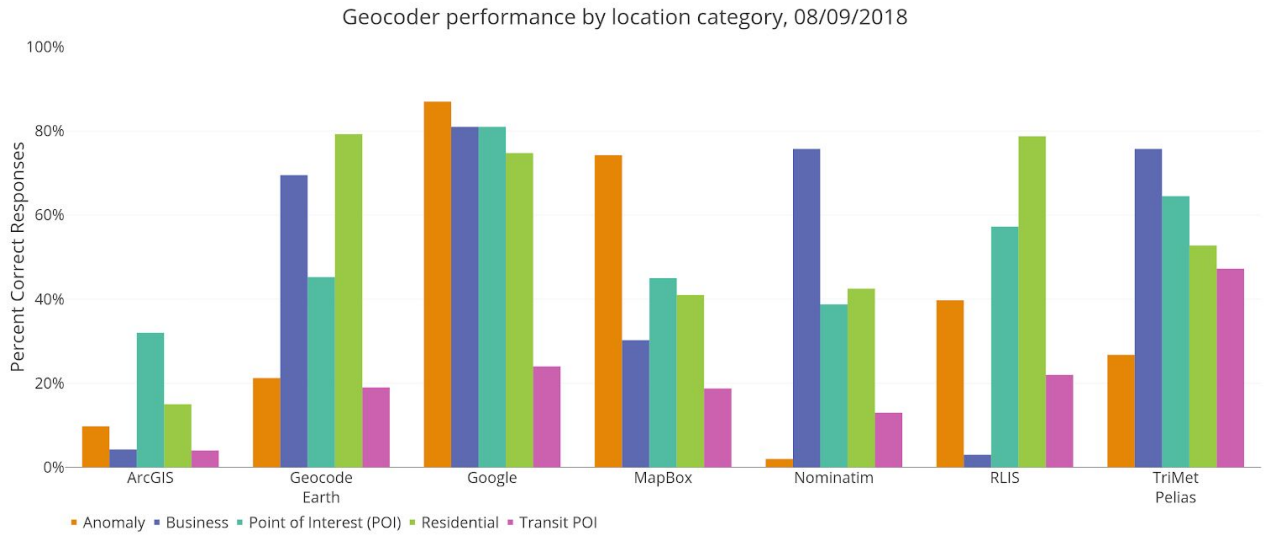
The Contractor shall implement improvements to the Pelias geocoder to improve the configurability and quality of search results in the following areas:

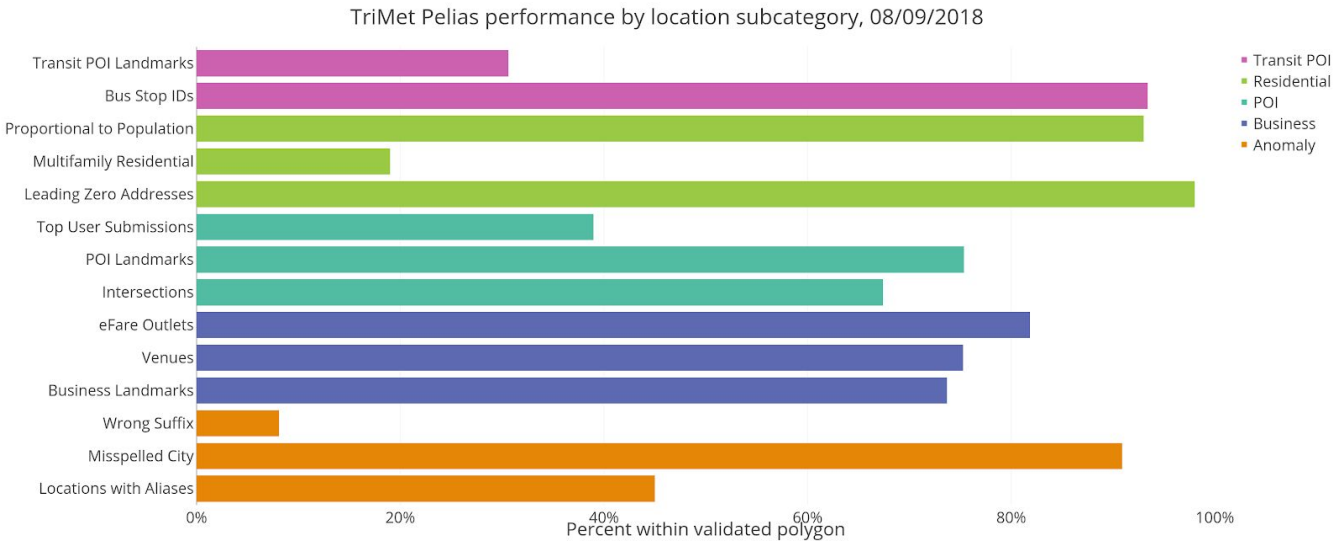
- Allow sources (referring to data sources included within the Pelias installation) and layers (referring to types of records included within the Pelias installation) to be configured, or detected automatically if possible.
  GitHub Issues:
  OpenTransitTools/trimet-mod-pelias/issues/9
  OpenTransitTools/trimet-mod-pelias/issues/10
- Allow the sorting of search results to be influenced for specified sources or layers
  GitHub issue: OpenTransitTools/trimet-mod-pelias/issues/7
- Allow search queries to return unique results based on unit numbers (for example, for apartments)
  GitHub issue: pelias/pelias/issues/618
- Ensure sorting rules related to focus point distance and confidence score are more consistent and accurate. Inconsistencies in how different geocoder modes of operation (e.g. search and autocomplete) sort results will be resolved where possible.
  GitHub Issue: OpenTransitTools/trimet-mod-pelias/issues/6

Quarterly Progress

The following chart demonstrates improvements benchmarked against other geocoders:







Task 5: Data Improvements

Improve OpenAddresses and OpenStreetMap (OSM) in support of comprehensive trip planning and geocoding (address matching).

Quarterly Deliverables

There were no scheduled deliverables for this task during this quarter.

Quarterly Progress

Updates to OSM continue as planned.

Task 6: Integrated Payment Plan

As a partner on this project, moovel will facilitate compatibility with their planned booking and payment features so customers can plan and pay for their trips in one app.

Quarterly Deliverables

There were no scheduled deliverables for this task during this quarter.

Quarterly Progress

moovel hosted the two-day MOD Grant Workshop on April 18-19, 2018. An integrated payment plan was one of the main objectives of the workshop. A subsequent draft was submitted by moovel.

Meetings and Events

Weekly Project Meetings

TriMet conducts weekly project meetings on the following rotating Slack channels every Thursday at 10am PST.

- Geocoder Meetings (https://trimet-mod-sandbox.slack.com/messages/geocoding/)
- Application Development Meetings (https://trimet-mod-sandbox.slack.com/messages/general/)

Conference Presentations:

April 5-6, 2018 TechFestNW , The New Mobility Framework
April 9-11, 2018 Fare Collection/Revenue Management & TransITech Conferences, MOD Update

April 18-19, 2018 TriMet MOD Grant Workshop II, moovel PDX

The second and final MOD Grant Workshop was held on April 18-19, 2018 at the moovel headquarters in downtown Portland. We welcomed nearly 70 participants representing 26 different private and public partners (22 of the 65 traveled in for the workshop). The agenda **(Appendix B -Workshop II Agenda)** provides links to further information and detailed session notes.

Appendix A - Open Source Transit Software White Paper

CUTR-2018-06

Open-source Transit Software

A White Paper

Prepared For

IBI Group, TriMet,

and Federal Transit Administration

IBI GROUP

TRIMET

Federal Transit Administration

June 2018

2018 CUTR CENTER FOR URBAN TRANSPORTATION RESEARCH USF UNIVERSITY OF SOUTH FLORIDA

CUTR.USF.EDU

Project Title:	Open-source Transit Software – A White Paper
Principal Investigator:	Sean J. Barbeau, Ph.D. Principal Mobile Software Architect for R&D National Center for Transit Research (NCTR) at the Center for Urban Transportation Research University of South Florida 4202 E. Fowler Avenue, CUT 100 Tampa, FL 33620-5375 barbeau@cutr.usf.edu 813-974-7208
Project Manager:	Bibiana McHugh IT Manager of GIS & Location-Based Services Public Affairs TriMet 4012 SE 17th Ave Portland, OR 97202 mchughb@trimet.org 503-962-7536

Goal

Provide a review on how open-source software (OSS) in the transit industry has evolved from grant-funded or exploratory projects into production deployments at transit agencies with OSS projects supported by user communities, and the future of OSS along with advantages and disadvantages of its widespread deployment as an alternative to closed-source software and platforms.

Task

Write a white paper approximately 10 pages long, covering the following topics:

- Introduction of potential OSS benefits and drawbacks and general applicability of OSS to the transit industry
    - Discuss the objectives of OSS (e.g., high level discussion of operations, integration, interoperation, as well as deficiencies, gaps, needs, etc. not met by closed-source)
    - Discuss the potential short and long-term advantages and disadvantages of open-source-based business model for transit agencies procuring services and how this addresses risk of innovation and partnerships
    - Discuss the potential role of OSS within the current (and near-term) mobility environments
    - Discuss OSS licensing options and how they can potentially affect company integration of OSS with closed source software
- Case Study – OneBusAway (https://onebusaway.org/)
    - Pros and cons
    - Costs and reliability as data is available
- Case Study – OpenTripPlanner (http://www.opentripplanner.org/)
    - Pros and cons
    - Costs and reliability as data is available
- TriMet and VTrans use of OSS in their FTA Mobility on Demand (MOD) Sandbox project (https://trimet.org/mod/), including OpenTripPlanner, Mapzen, and Pelias
    - Pros and cons
    - Costs and reliability as data is available
- Conclusions and possible future directions of OSS in the transit industry
    - Discuss possible governance model(s) and centralized funding for OpenTripPlanner and OneBusAway, along with advantages and disadvantages
    - Logical next steps and ideas to explore the feasibility of OSS (e.g., through demonstration/deployment, formation of a peer-exchange platform, establishing a community of practice/forum, a structured research and outreach program, fugure research tasks)

Budget

$38,489.79

Project Period

June 1st, 2018 to November 1st, 2018

Deliverables

1. Draft white paper – Due October 1st, 2018
2. Final white paper – Due November 1st, 2018

Appendix B -Workshop II Agenda

AGENDA TriMet Mobility On Demand Sandbox Workshop II April 18-19, 2018	**LOCATION** moovel 209 NW 4th Ave, #200 Portland, OR 97209

DAY 1 WEDNESDAY (April 18th)	
Day 1 webinar and call-in for remote participants: *PC, Mac, iOS or Android:* **https://meetings.ringcentral.com/j/1484649701** *Telephone*: **Call: +1 (773) 231 9226 Meeting ID: 148 464 9701** *Shared notes document:* https://bit.ly/2EY1yDm	
8:30 am	**CONTINENTAL BREAKFAST**
9:00 am	**Welcome and Opening Remarks** Doug Kelsey, General Manager, TriMet Tony Tom, Chief Business Development Officer, moovel Tim McHugh, CIO, TriMet
9:15 am	**Participant Introductions** Briefly state: name, organization, position, role/interest in project
9:35 am	**Workshop Objectives** Ritesh Warade, Director, IBI Group
9:45 am	**TriMet MOD Project - Progress to date and road ahead** Bibiana McHugh, IT-GIS Manager, TriMet
10:05 am	**Vision of Multimodal Payment Integration Program** Murat Omay, Senior Transportation Program Analyst, USDOT
10:20 am	**Open Source Transit Software White Paper** Sean Barbeau, Principal Mobile Software Architect for R&D, CUTR @ USF
10:30 am	**BREAK (15 minutes)**
10:45 am	**OpenTripPlanner Development Update and Demo** David Emory, Principal, Conveyal
11:15 am	**Pelias Geocoder** Julian Simioni, Founder, Cleared for Takeoff
11:30 am	**OpenStreetMap Data Improvements** Madeline Steele, GIS Data Analyst, TriMet

11:35 am	**OpenTripPlanner Project Briefings** New York MTA, presented by Sarah Anderson, Cambridge Systematics RTD Denver, presented by Brett McDavid, RTD Santa Clara Valley Transportation Authority (VTA), presented by Marshall Ballard, VTA Vermont Transit Authority (VTrans), presented by Thomas Craig, Trillium Solutions
12:15 pm	**LUNCH (provided - Thai buffet)**
1:00 pm	**Integrated Payment Plan and HOP Fastpass** Tim McHugh, CIO, TriMet Rhyan Schaub, Director of Revenue Operations & Electronic Fares, TriMet Narayan Siva, Product Manager, moovel
2:45 pm	**BREAK (15 minutes)**
3:00 pm	**Group Discussion - OTP Long-Range Vision and Business Strategies** Ritesh Warade, Director, IBI Group Aaron Antrim, Principal, Trillium Solutions David Emory, Principal, Conveyal Sarah Anderson, Senior Associate, Cambridge Systematics
4:30 pm	**Wrap-Up and Introduction to Technical Breakout Sessions** Jon Campbell, Transit Data Specialist, IBI Group Madeline Steele, GIS Data Analyst, TriMet
6:00 pm	**DINNER - See https://tinyurl.com/mod-dinner for information/sign-up.**

DAY 2 THURSDAY (April 19th)			
Note: Webinar/Call-in info for breakout sessions can be found on the notes page for each session (links below).			
8:30 am	**CONTINENTAL BREAKFAST**		
Breakout Sessions	**Track 1 - Technical** Orion (2nd Floor)	**Track 2 - Strategy** Hercules (3rd floor)	**Track 3 - Assessment** Chamaeleon (3rd Floor)
9:00 am	**OTP Tech Discussion - Part I** Facilitator: Jon Campbell Notetaker: Madeline Steele Link: https://bit.ly/2qwoSTw	**Mobility Management** Facilitator: Adrian Pearmine Notetaker: Marshall Ballard Link: https://bit.ly/2JGXNWu	**Evaluation Planning** Facilitator: Gustave Cordahi Notetaker: Meredith Rider Link: https://bit.ly/2EHx8F7
10:30 am	**BREAK (15 minutes)**		
10:45 am	**OTP Tech Discussion - Part II** Facilitator: Jon Campbell	**Fare Tech Discussion** Facilitator: Narayan Siva	**Equity & Accessibility** Facilitator: Prashanth Gururaja

	Notetaker: Madeline Steele Link: https://bit.ly/2GWx1HM	Notetaker: Meredith Rider Link: https://bit.ly/2GVFUBf	Notetaker: Cassadi Willey Link: https://bit.ly/2qt4jXL
12:00 pm	**Group Breakout Facilitators Report-Back**		
12:30 pm	**LUNCH (provided - burrito bar)**		
Note: Webinar/Call-in info for breakout sessions can be found on the notes page for each session (links below).			
Breakout Sessions	**Track 1 - Technical** Orion (2nd Floor)	**Track 2 - Strategy** Hercules (3rd Floor)	**Track 3 - Assessment** Chamaeleon (3rd Floor)
1:30 pm	**Pelias Geocoder Tech Session** Facilitator: Jon Campbell Notetaker: Madeline Steele Link: https://bit.ly/2HiUJkQ	**Mobility as a Service** Facilitator: Adrian Pearmine Notetaker: Marshall Ballard Link: https://bit.ly/2J46bOm	**UI/UX Design** Facilitator: Myleen Richardson Notetaker: Cassadi Willey Link: https://bit.ly/2EDUUSt
2:45 pm	**BREAK (15 minutes)**		
3:00 pm	**Pelias Geocoder Getting Started** Facilitator: Jon Campbell Notetaker: Cassadi Willey Link: https://bit.ly/2GTD8R9	**Open APIs** Facilitator: Tim McHugh Notetaker: Meredith Rider Link: https://bit.ly/2qrFCeo	**UI/UX Test Plan** Facilitator: Myleen Richardson Notetaker: Madeline Steele Link: https://bit.ly/2EGvbsG
4:00 pm	**Group Breakout Facilitators Report-Back** Join from PC, Mac, iOS or Android: https://meetings.ringcentral.com/j/1488977922 Or iPhone one-tap: +1(773)2319226,1488977922# Or Telephone: Dial: +1 (773) 231 9226 Meeting ID: 148 897 7922		
4:30 pm	**Workshop Wrap-Up** Ritesh Warade, Director, IBI Group		
5:00 pm	**FINISH**		

Breakfast and lunches provided courtesy of moovel!

Workshop Participants:

Booz Allen Hamilton Cambridge Systematics Cleared for Takeoff, Inc. Clevor Consulting Group CONNECTIVE DX Conveyal DKS Associates	Full Path Transit Technology IBI Group Interline Technologies Lane Transit District Lyft Metro	moovel ODOT PBOT ReachNow RTD Denver Shared-Use Mobility Center Trillium Solutions, Inc	TriMet FTA / U.S. DOT Uber University of South Florida (CUTR) VTA AECOM