Mobility Data

The demonstration of implementing a Smart Mobility Platform (SMP) developed by UrbanLogiq aimed to measure the effectiveness and impact of mobility initiatives beyond ridership analysis to study a more holistic travel ecosystem. To achieve this, external datasets were leveraged to analyze in association with operations data and the ODX.

Objectives:

- Ingest structured and unstructured data in a variety of formats
- Store disaggregated and aggregated data to support analysis of historical and current conditions
- Allow for the development of automated data aggregation and analysis pipelines
- Generate dashboards, reports and other data visualizations
- Provide secure access to confidential data and centralized validated data

The exploration phase included the identification of mobility analysis benchmarks and supporting datasets. A core analysis identified in the TriMet MPMs was an inferred Origin-Destination-Transfer (ODX) analysis using anonymized Hop Fastpass™ fare data. Origin-Destination Transfer (ODX) Methodology was developed by UrbanLogiq and included rigorous validation methods and security protocols to protect personal information. The ODX source code and code documentation are available on UrbanLogiq's github page: https://github.com/urbanlogiq/odx.

Table 13. Mobility Performance Metrics

Mobility Performance Metric	Dataset	SMP Use Case
Hop™ ODX	Hop™ ODX	Mobility Analysis
Modal access to stations	Lime	Mobility Analysis
Total Journey Time	Hop™ ODX	Metrics Dashboard
Frequent Users	Hop™	Metrics Dashboard
Weekly Active Users	Hop™	Metrics Dashboard
Monthly Active Users	Hop™	Metrics Dashboard
Unique Number of Trips Requested or Planned	OTP	Metrics Dashboard
Trips Planned per Platform	OTP	Metrics Dashboard
Demand for Multimodal Trips	OTP	Metrics Dashboard
Number of Transfer Points	Hop™ ODX	Metrics Dashboard
Percent of transfers	Hop™ ODX	Metrics Dashboard
Trip Reliability for Communities of Concern	STOPS AVL, GTFS	Metrics Dashboard
Trip Availability for Communities of Concern	STOPS AVL, GTFS	Metrics Dashboard
Wait Times for ADA Transportation Options	LIFT	Metrics Dashboard
LIFT vehicles arriving in the target pickup window	LIFT	Metrics Dashboard
Dwell Times	STOPS AVL	Metrics Dashboard

Figure 22. Mobility Metrics Dashboard

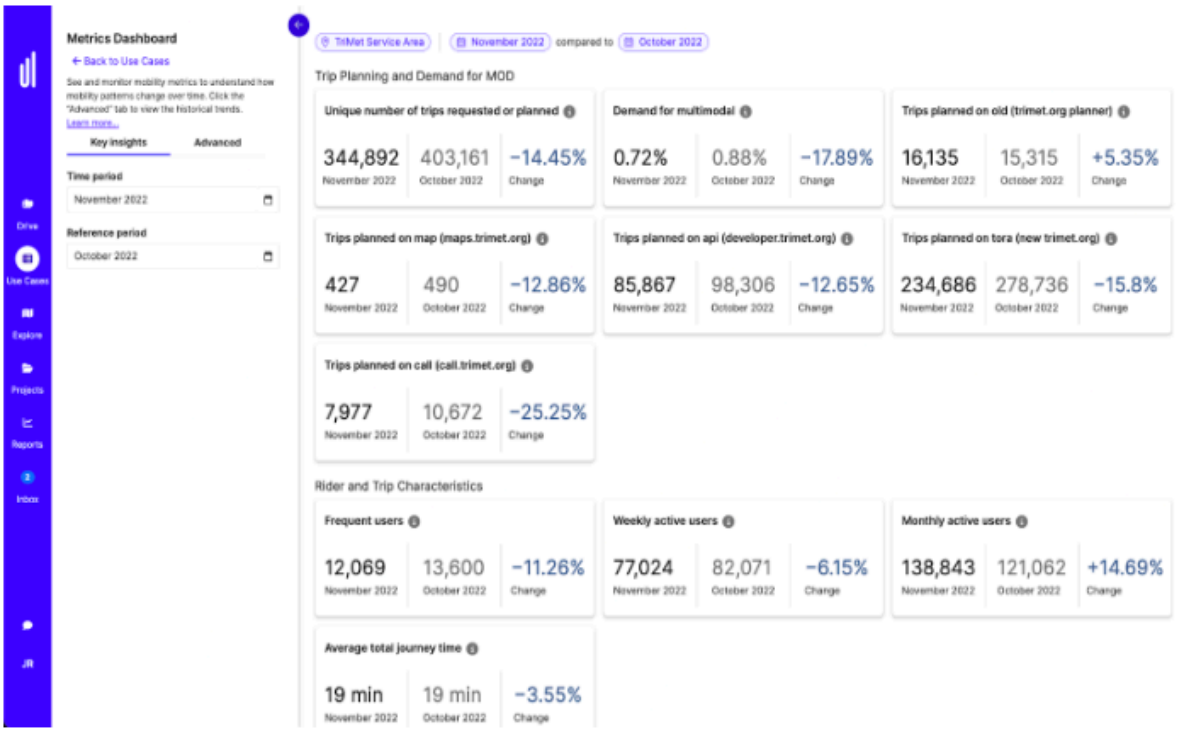
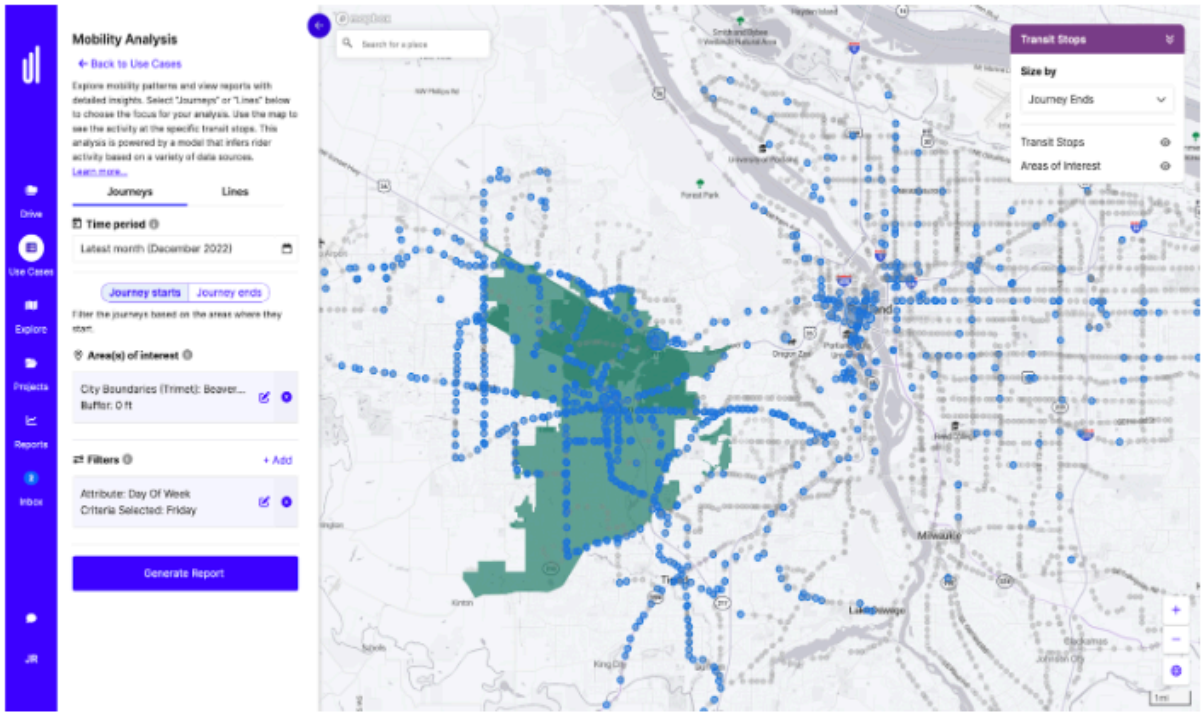


Figure 23. Mobility Analysis Dashboard



The success of the SMP demonstration led to full production of the system with a continuing budget to support additional use cases with supporting data and software enhancements.

For further information, please refer to the TriMet IMI Final Report, Task 3: Mobility Data.

Data Sources

List of data sources in SMP

Dataset Title	Description	Type / Scale	Collection Method	Data File Format(s)	Data Owner
American Community Survey (ACS) Census data	Socioeconomic data about riders in the TriMet service area.	Numerical data, multiple geographic scales.	See Census documentation	CSVs / API	U.S. Census Bureau
Existing Hop Fastpass System Data ("HOP")	Data created and/or logged by the Hop Fastpass fare collection system	Includes but not limited to user account data, transaction records, and other records of customer interaction with the Hop Fastpass System.	See Hop Fastpass System Documentation	CSVs	TriMet
CAD/AVL Data	Input vehicle location, on-time performance, etc data from TriMet's CAD/AVL system	Transit vehicle location data feed	INIT CAD/AVL system	STOPS text file (CSV)	TriMet
GTFS (static)	Data about TriMet's planned services and schedules	Static information about transit services	Generated/updated as needed based on TriMet scheduled services	GTFS Feed (API)	TriMet
Arrival/Departure Predictions	The time when a TriMet transit vehicle will arrive/depart from a stop	Real-time arrival/departure prediction datafeed	Existing TransitTracker prediction engine -TriMet-produced machine learning prediction engine	GTFS Realtime (GTFS-RT) Feed (APIs)	TriMet
Vehicle Locations	Real-time locations of TriMet transit vehicles	Real time vehicle location data feed	Existing TriMet traveler information system	GTFS Realtime (GTFS-RT) Feed (APIs)	TriMet
TriMet Automated Passenger Count (APC) Data	Data from TriMet vehicles about passenger boardings and alightings.	Numerical data, aggregated at the stop level.	Automatically collected from on-board sensors	CSV	TriMet
TriMet ADA/Paratransit Data	Data from TriMet about paratransit requests and dispatches.	Numerical data	Generated based on paratransit requests and dispatches	CSV	TriMet
Traffic Data (Waze for Cities)	Data about traffic congestion that impacts TriMet bus service reliability	Realtime traffic information via API	Probe data from public roads	API	Inrix
TriMet Trip Planner User Data	Data on users and usage of TriMet's Trip Planner; includes OD requests and mode options.	N/A	Data log file	CSV	TriMet
Uber Origin/Destination Dataset	Aggregated origin/destination (OD) data	Datatype TBD, 21 geofenced areas around TriMet stations, aggregation level under development	Internal Uber processing	CSV	Uber
Bikeshare Data (Historic)	Aggregated origin/destination (OD) data	Geospatial data	Real-time GBFS data	CSV	BIKETOWN
Lime Scootershare Data	Aggregated origin/destination OD data (point to point)	GIS data, Scale of TriMet service area	Real-time GBFS data	GBFS feed - API	Lime

Origin-Destination Transfer inference algorithm (ODX Methodology)

Depends on the following datasets, all sourced from TriMet's enterprise data warehouse:

- HOP transaction journal: A journal of all the boarding taps made by riders using any fare payment method besides cash. Included are the date, time, stop ID, line ID, and card ID that allows different transactions to be tied to an individual rider. Card IDs are rotated once a month, meaning that the movements of a particular rider can only be analyzed

within a calendar month. Also included are the fare classes (Adult, Honored Citizen, Youth, etc.) for each transaction.
- Automated Vehicle Location (AVL): The observed stop times and stop IDs across all times of in-service TriMet vehicles. Covers both buses and light rail. A trip ID associates a set of stop times and IDs across a service date.
- Static GTFS data: Attributes fields like the operating line ID to the AVL data.

Trimet Data Schemas

2023.11.29 Written by Irene Fabris

Schemas for the following data tables:

- raw HOP
- raw LIFT
- raw AVL
- raw OTP
- derived ODX

HOP

Header	**Description**	**Data Type**
card_id	ID of a rider's HOP card	VARCHAR
transaction_id	ID for the transaction	NUMBER
media_ticket_id	ID for the media ticket	NUMBER
media_ticket_description	Description of the media ticket (e.g., single-use ticket, transit assistance card, honored citizen card)	VARCHAR
media_type_id	ID for the media type	NUMBER
media_type_description	The type of media used for that tap (e.g., HOP physical, Google VC, Apple VC, open loop, closed loop)	VARCHAR
fare_category_id	ID for the fare category	NUMBER
fare_category_description	The fare category (e.g., honored citizen, adult, paratransit, youth)	VARCHAR
tap_time	Date and time of the tap event	TIMESTAMP

sales_channel_id	ID for the sales channel	NUMBER
sales_channel_descriptor	Where the ticket was purchased (e.g., validator, paratransit)	VARCHAR
transaction_type_id	ID for the transaction type	NUMBER
transaction_type_description	The type of transaction (e.g., pass use, transfer from a previous boarding)	VARCHAR
transaction_ticket_id	ID for the transaction ticket	FLOAT
transaction_ticket_description	The ticket for that transaction (e.g., TriMet Hop Bike & Ride Pass, Honored Citizen 1-Day Pass, TriMet Employee Pass)	VARCHAR
pursecredit	Purse credit associated with the transaction	FLOAT
location_id	ID for the location where the tap event occurred	NUMBER
location_description	The location where the tap event occurred (e.g., TriMet Platform, TriMet Bus, C-Tran Bus)	VARCHAR
operatedby_id	ID for the entity operating the service	NUMBER
operatedby_description	Description of the entity operating the service (e.g., TriMet, CTRAN, PSC)	VARCHAR
line_id	ID for the bus line	FLOAT
line_description	Descriptive name of the bus line	VARCHAR
stop_id	ID for the bus stop	FLOAT
stop_description	Descriptive name of the bus stop	VARCHAR
direction_id	ID for the bus direction of travel	FLOAT
direction_description	Description of the bus is headed to (e.g., EB, WB)	VARCHAR
geolocationlatitude	Latitude of the geolocation	FLOAT
geolocationlongitude	Longitude of the geolocation	FLOAT

map_link	Google Maps URL with the geolocation of that bus stop	VARCHAR

LIFT

Header	**Description**	**Data Type**
service_date	The Service Day Associated With the booking (the service day may extend past midnight)	NUMBER
scheduled_time	The scheduled pickup time provided to the customer	VARCHAR
actualarrivetime_origin	The vehicle arrival times at the booking origin	VARCHAR
actualdeparttime_origin	The vehicle departure time at the booking origin	VARCHAR
lat_origin	The latitude of the booking origin	NUMBER
lon_origin	The longitude of the booking origin	NUMBER
act_est_diff	Difference between actual and estimated times at the origin	VARCHAR
actualarrivetime_destination	The vehicle arrival times at the booking destination	NUMBER
actualdeparttime_destination	The vehicle departure times at the booking destination	NUMBER
lat_destination	The latitude of the booking destination	VARCHAR
lon_destination	The longitude of the booking destination	VARCHAR
clientid	Client ID (hashed) associated with the customer	VARCHAR
fare_type	Type of fare (e.g., hop fast pass, free fare, cash fare for companion, lift ticket)	VARCHAR
CLI	Sum of clients boarding associated with the trip (the value should always be 1)	VARCHAR
PCA	Sum of the “personal care assistance” associated with the trip	VARCHAR
COM	Sum of the “companions” associated with the trip	VARCHAR

AM	Count of AM Space types used for booking	VARCHAR
MN	Count of MN Space types used for booking	VARCHAR
MT	Count of MT Space types used for booking	VARCHAR
NX	Count of NX Space types used for booking	VARCHAR
AX	Count of TX Space types used for booking	VARCHAR
K	Count of K Mobility Aids used for booking	VARCHAR
CA	Count of CA Mobility Aids used for booking	VARCHAR
WC	Count of WC Mobility Aids used for booking	VARCHAR
L	Count of L Mobility Aids used for booking	VARCHAR
KN	Count of KN Mobility Aids used for booking	VARCHAR
SC	Count of SC Mobility Aids used for booking	VARCHAR
O	Count of O Mobility Aids used for booking	VARCHAR
H2H	Count of H2H Mobility Aids used for booking	VARCHAR
CR	Count of CR Mobility Aids used for booking	VARCHAR
PKN	Count of PKN Mobility Aids used for booking	VARCHAR
DV2	Count of DV2 Mobility Aids used for booking	VARCHAR
SA	Count of SA Mobility Aids used for booking	VARCHAR
PWC	Count of PWC Mobility Aids used for booking	VARCHAR

* Please consult the **Space Type Description Table** and the **Mobility Aid Description Table** in the Appendix for more info on the MOBAIDCODEs used as headers for LIFT data.

AVL

Header	**Description**	**Data Type**
service_date	Date of the service when the trip occurred	NUMBER
trip_id	ID for a specific bus trip	NUMBER
stop_id	ID for the bus stop	NUMBER

stop_sequence	Order of the stop in the trip	NUMBER
scheduled_arrive_time	Scheduled arrival time at the bus stop	VARCHAR
scheduled_departure_time	Scheduled departure time from the bus stop	VARCHAR
actual_arrive_time	Actual arrival time at the bus stop	VARCHAR
actual_departure_time	Actual departure time from the bus stop	VARCHAR
dwell_in_seconds	How long the bus was idle at the stop (in seconds)	NUMBER
vehicle_id	ID for the vehicle associated with the trip	NUMBER

OTP

Header	**Description**	**Data Type**
ip_hash	Hashed IP address of the user	VARCHAR
app_name	The Trimet application the request came from (e.g., trimet.org, call.trimet.org)	VARCHAR
date	Date and time when the user made the request	VARCHAR
url	URL of the GET request sent to OpenTripPlanner	VARCHAR
modes	Modes of transportation chosen by the user (e.g., bus, rail, walk only, bike only, scooter_share)	VARCHAR
companies	Companies associated with the search (e.g., lime, uber)	VARCHAR
from_lat	Latitude of the starting location	FLOAT
from_lon	Longitude of the starting location	FLOAT
to_lat	Latitude of the destination location	FLOAT
to_lon	Longitude of the destination location	FLOAT
brand	Brand of the user's device used to plan the trip (e.g., Apple, generic_android, Samsung, Nokia, Amazon, LG, Google)	VARCHAR
device	Type of device used by the user (e.g., Smartphone, iPhone, Mac, Kindle)	VARCHAR

os	Operating system of the device	VARCHAR
os_version	Version of the operating system	VARCHAR
browser	Web browser used by the user	VARCHAR
browser_version	Version of the web browser	VARCHAR

ODX

Header	**Description**	**Data Type**
journey_id	The ID of a journey	VARCHAR
timestamp	UTC timestamp of the event for that journey	TIMESTAMP
line_id	ID of the bus line of the event. A line_id is identical to what GTFS calls route_id	NUMBER
stop_id	The stop ID of the event	NUMBER
event	The type of event (e.g., origin boarded, mid-journey alighted, destination alighted, mid-journey boarded, interline started, and interline ended)	NUMBER
fare_category	The fare class of that journey (e.g., youth, adult, honored citizen, paratransit, and unknown)	NUMBER
hour	The start hour of the journey in 24-hour format	NUMBER
number_of_transfers	The number of transfers for that journey	NUMBER
day_of_week	The day of the week when the journey started	NUMBER

Appendix

Space Type Description Table

MOBAIDCODE	**Description**
AX	AMBULATORY

AX	AMBULATORY LARGE
MN	MOBAID, NO TRANSFER
MT	MOBAID, TRANSFER
NX	MOBAID NO XFER, LARGE
TX	MOBAID, XFER LARGE
XL	LARGE MOBAID

Mobility Aid Description Table

MOBAIDCODE	**Description**
CA	CANE
CR	CRUTCHES
DV2	SECOND MOBILITY DEVICE
K	WALKER/CART, FOLDING
KN	WALKER/CART, NON FOLDING
L	LIFT FOR BOARDING
O	OXYGEN TANK
PKN	WALKER, NON-FOLD, ATTENDANT
PSC	SCOOTER, ATTENDANT
PSW	SEGWAY, ATTENDANT
PWC	WHEELCHAIR, ATTENDANT
SA	SERVICE ANIMAL
SB	SEPARATE BOARDING FROM DEVICE
SC	SCOOTER
SW	SEGWAY
WC	WHEELCHAIR