APPENDIX J

Mobility Applications

METROPLAN
GREATER FLAGSTAFF

MOBILITY SMARTPHONE APPLICATIONS

SMARTPHONE APP REVIEW FOR MOBILITY SERVICES

MetroPlan

January 2023

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TERMS & DEFINITIONS

TERM	DEFINITION
Apps	Smartphone applications
Bikeshare locations/Inventory	Using real-time information, a bikeshare kiosk or dockless system, allows the app user to identify where a bike is available to rent.
Bikeshare Payments	Similar to Mobile Ticketing, the app user can reserve, pay, and unlock a bike for use through a bike rental specific app.
Carshare Locations/Inventory	Using real-time information, carsharing systems (e.g., ZipCar, Car2Go, etc.) allow the app user to identify where a car is available to rent.
Carshare Payment	Similar to Mobile Ticketing, the app user can reserve, pay, and unlock a car for use through a third-party app.
Crowd-sourced transit data	An app may use crowd-sourced transit tracking data in cities that do not have real-time transit data available. This means, the app is using the smartphone's location and speed (while on transit) to determine the approximate time of arrival to a stop. This data is then aggregated and used to inform the arrival time for other users of the same app.
Customer communications	This feature allows a public agency to communicate instantly with riders through the app. Communications can include "push notifications" or can be implemented "in-app". For example, an agency can customize a clickable banner within the app to direct user to online survey's, provide project updates, or provide alerts that may affect services.
Freemium	Freemium is a type of business model in which businesses provide their customers the basic features of their product/services for free and additional/special features for a premium.
Gamification	The use of game design elements in a non-game context
GDPR	The General Data Protection Regulation (GDPR) is the toughest privacy and security law in the world.
General Transit Feed Specification (GTFS)	A GTFS feed is a group of text files that contains infrequently changing transit data, like stops, routes, trips, and other schedule data. Transit agencies typically update their GTFS feed every few months.
GTFS Realtime	GTFS Realtime consists of three binary files that contain real-time vehicle positions, real-time arrival information, and service alerts. Transit agencies typically update these files every minute.
Incentives	A payment or concession provided to a mobile app user to encourage app use, retention, or some other type of behavior
Interoperability	The ability for any mobility technology component to exchange data in an open standard or scheme with other components in that mobility technology
MaaS	Mobility as a Service
Mobile Ticketing (Transit)	Mobile ticketing is mobile payment technology that allows riders to purchase transit fares from their phones. App users make payments through their smartphone using credit, debit, or other non-cash payments (e.g., Apple Pay, Venmo, etc.)
Mobility App	An application in a smartphone that provides multimodal real-time information, navigation, and payment options for transit, taxis, bikeshare, and ride-hailing.
Mobility Data	Data used by any mobility technology component to execute its core functions
MSPs	A managed service provider (MSP) is a third-party company that remotely manages a customer's information technology (IT) infrastructure and end-user systems.
Multimodal options	Mobile ticketing can be integrated into a multimodal transit system to provide greater efficiency. A combined ticket for a whole ride, no matter which type of transportation is selected, is a great way to incentivize riders to use public transit. What's more, mobile ticketing can also be integrated with trip planning to provide a single app that does it all – from beginning to end.
Navigation App/ Routing App	An application in a smartphone that provides navigational directions in real time.

Real-time arrivals / Live tracking	Live tracking or real-time information, broadly defined, means any information available to transit providers or customers about the status of vehicles, including approximate locations and predictive arrival times. Passenger's access real-time arrival and departure information through dynamic signs at stops and stations, or through the Internet at home or on smartphones.
Ride-Hailing	Ride-Hailing features are often connected to such service as Uber and Lyft. App user can often receive information such as locations of rides, and how many minutes a ride is away from the user's current location. This feature often connects to the service providers direct app. Therefore, a user must have a ridesharing/ride-hailing app and account already activated on their smartphone to use this feature seamlessly with other mobility apps.
Route Optimization	This feature allows the app user to make decisions based on the time it takes to get to/from their destination. Apps can show the travel time differences between modes (transit vs. bikeshare). In some cases, the app user can customize their routes, for example, minimizing the walking distance to a transit stop.
Scalable	The flexibility of mobile ticketing systems means public transit agencies can grow with the needs of the city. These needs can be monitored closely via the aggregated data the agency receives from the mobile ticketing app.
Transit Line Reports	Allows the transit agency to review service levels, operational efficiency and understand impacts of schedule or route changes on ridership. Data may include identification of first/last-mile barriers, typical load-factor and estimation of vehicle crowding, average boarding and alighting by the hour, additional descriptive statistics of line riders and their complete journeys.
Transit Station Reports	Provides data for planning functions to improve and optimize station use. Data may include, first/last-mile access to stations, average board and alighting per line, location, and time. Breakdown of common line transfers and wait times, origin/destination information.
Zone Reports	Displays travel patterns to and from a region, neighborhood, district, or even specific venues like a shopping mall or stadium. Data may include, journey origin and destination zones, modal split, popular transit lines and stations, and data to assess impact of network changes.

INTRODUCTION & OVERVIEW

Mobility and navigation technologies paired with smartphone applications (apps) impact how people choose their mode of travel. Whether walking, bicycling, driving, or taking transit, these improved mapping technologies, and wireless communications, paired with social concerns about congestion, the environment, and climate change, are changing the way we explore and travel through our communities and our region.

The purpose of this document is to review available mobility apps with a focus on identifying an app that is scalable to meet future demand and can engage customers with an environmentally conscious lens. Rather than undergoing the long and costly process of creating a new unique regionally specific app, reviewing existing apps was decided to be the most efficient approach. This document will review both the customers' user experiences and agency functionality through the review of *Moovit* , *Transit*, and *Citymapper* smartphone apps.

MetroPlan's research has determined that there is no strong advantage of one mobility app provider over another. The three apps reviewed offer similar services to customers and agencies with varying functionality based on cost and data access. These apps are further described in the following pages. ***Currently, MetroPlan recommends the continued use of the Transit App to meet the communities needs pending future investments in other travel options.***

While Flagstaff Region does not currently offer such transportation options as bike or scooter share, these apps can accommodate future multimodal options and investments. This will allow a customer to modularize their journey across all available transportation options in the future.

The Flagstaff region has applied several policy measures aimed at reducing carbon emissions and vehicle use. The most prominent policy to reduce single occupancy vehicle use is within the Flagstaff Carbon Neutrality Plan. This Plan aims to reduce greenhouse gas emissions by 44% by 2030. Leveraging smartphone applications to encourage multimodal travel represents a key opportunity for public agencies. However, to encourage the use of a multimodal system, making the process easy helps to reduce the barriers for individuals. One option to help move people out of their cars is by providing a smartphone app that allows users to identify the best bus, biking, walking, or carshare options and routes for their needs and allows for in-app passes to be purchased. Enhancing multimodal payment interfaces and enabling commuter benefit payment via smartphone apps are two ways public agencies can encourage multimodal trips.

Currently, the Flagstaff region does not offer transportation options outside of public transit. Transit information is provided by Mountain Line through its website, smartphone apps, and printed materials. Additionally, Mountain Line offers the following mobility tools for cellular phone users:

- ***Transit App*** – This smartphone app provides route information, bus stop locations, real-time transit, and the ability to purchase in-app transit passes.
- **SMS Texting** – This option is available to all customers with a cellular phone regardless if it's a smartphone or not. Customers can text to access real-time arrivals at their bus stop.

These resources help determine bus stop locations and route information. However, there is more that can be done to through Mobility-as-a-Service (MaaS) platforms such as the *Transit App*, *Moovit* , and *Citymapper* that can enhance and encourage the use of non-driver modes through apps that provide route optimization, customer communications, in-app pass purchases, and connections to other transportation options such as bikeshare or ride-hailing.

METHODOLOGY

Research and Literature Review

For this report, MetroPlan staff reviewed literature and research from 2016 – 2022, with a focus on resources in the last 2 years. This is because technology changes rapidly and in the initial research phase, staff identified that many case studies and findings from specific apps and platforms were no longer in existence or had been purchased by other mobility apps/tech companies. Because of this, MetroPlan will focus on the review of the current top three mobility apps: Transit, *Moovit*, and *Citymapper*.

Criteria Development

Based on research, local policies, and stakeholder guidance, MetroPlan reviewed the three mobility apps for the following:

- User experience and customer satisfaction
- App features for customers
- App features for the public agency
- Scalability
- Behavior change
- Branding/Marketing of the app

TECHNOLOGY BACKGROUND & INFORMATION

This section provides an overview of the current state of technology and smartphone apps. Information from this section will be built upon in further chapters.

Existing Mobility Apps in Flagstaff

Currently, Mountain Line is the only local agency providing a mobility app in the Flagstaff region. Mountain Line route information, real-time arrivals, and in-app pass purchasing are available through the *Transit App.* The *Transit App* was selected as the easiest option to deploy immediately following the expiration of the previous Mountain Line smartphone app. The *Transit App* integrated well with Mountain Line's existing technologies for both operations and IT and was easy to deploy within the community.

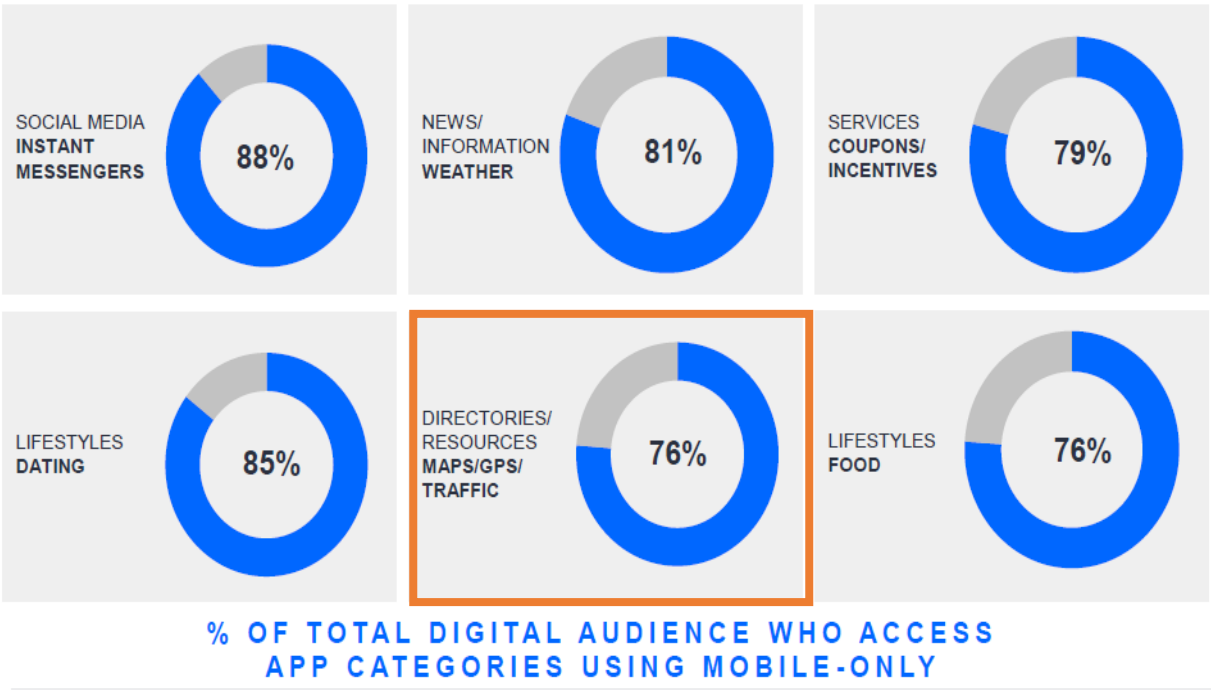
In addition to the *Transit App*, Mountain Line provides real-time arrival information through TransitFare to customers via a texting function. Texting allows customers that do not have a smartphone to receive arrival information at their bus stop by texting a bus stop's unique code for arrival updates. Customers can also find live route maps on Mountain Line's website.

Smartphone Usage Trends

Over the years, smartphones have become more versatile, handling everything from emails, video meetings, streaming, photo editing, and gaming just to name a few. As a result, many people are turning to their smartphones rather than their computers[i]. According to Comscore's 2019 "Global State of Mobile" Report, Americans now spend 70% of their digital media usage on smartphones.

Figure 1 shows app categories and their percentage of the digital audience who access those categories using mobile-only devices (smartphones). Under "Directories/Resources" **76% of people access maps, GPS, and traffic, only on their smartphones.**

Figure 1: Certain app categories worldwide skew toward mobile-only usage



Smartphone app usage does have limitations in terms of economics and demographics, this will be discussed further under Benefits and Challenges.

Mobility vs. Navigation Apps

There are nearly 500 transportation and mobility apps available worldwide. Apps such as *Transit App*, *Moovit,* and *Citymapper* can be viable options for many public agencies and their customers. They are existing platforms that allow for scalable features by both the customer and public agency and can be branded by local agencies. Other mobility apps may be localized, meaning they are custom-made for a specific agency and only usable within a certain geography.

Mobility apps differ from "navigation" apps, such as Google Maps, Waze, etc. While navigation apps such as Google Maps allows user to view bus routes, bus stop locations, bike lanes, and can optimize a trip based on customer preferences such as driving, walking, bicycling, or taking transit, navigation apps do not typically allow for real-time arrival information, in-app pass purchasing, or identifying carshare

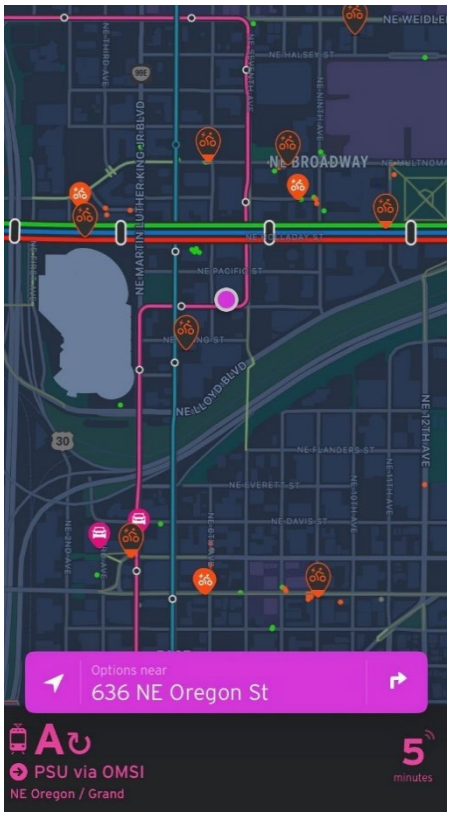
locations. The unique quality of mobility apps is that they can combine all mobility options into a single app for customers to access. These mobility options are primarily non-driver except for local car-share programs.

In addition to smartphone apps providing ease of access to information, both mobility and navigation apps help to alleviate the cognitive burdens associated finding directions and/or the best routes, regardless of mode.[ii] This is to say, mobility and navigation apps have a place in assisting current and future customers in identifying transportation options outside of a personal vehicle.

Example: Transit App

Transit App provides multimodal transportation planning and public transport information. The app enables users to plan point-to-point journeys by combining various transportation modes. In addition to providing transit stops and real-time arrivals, the app can be customizable by an agency to allow for bikeshare locations, reservations, and payments, show local bike routes, car share inventory and locations, and offers ride-hailing services through Uber and Lyft. Figure 2 provides an example of transit, bikeshare, and scooter share trip-planning from Portland, Oregon.

Figure 2: Transit App Costumer View w/multi-modes



Mountain Line launched the use of the *Transit App* for their customers as a pilot program in 2018 providing just trip planning and static bus schedules. Real-time location and arrival of buses started in 2020. It became Mountain Lines' primary app in the Fall of 2021 and now supports in-app bus pass purchases.

Example: Google Maps

Google Maps leads the navigation market for many users across the globe. Google Maps has 154.4 million monthly users. More than 50% of global Google Maps usage is on a mobile device such as a smartphone[iii].

Google Maps provides directions for driving, walking, biking, and transit. As part of Google Maps, Google provides "Google Transit" a public transportation tool that combines bus stops, routes, schedules, and fare information to make planning trips easy for users. Most public transit agencies can use Google Transit if they meet a few basic requirements (Google Transit). Transit information must be submitted by the local transit agency. Mountain Line submits real time arrival information to Google Maps so consumers can easily find arrival times of local transit but cannot purchase passes through Google Maps.

MOBILITY TECHNOLOGY COMPONENTS

Any hardware or software component that is used to:

- *Plan journeys/trips*
- *Provide mobility data to travelers (e.g., travel alerts, arrival predictions, LED signage, public address systems)*
- *Conduct transactions between mobility providers and travelers (e.g., reservation requests, ticketing, payments)*
- *Facilitate the duties of drivers, operators, or other on-board staff (e.g., communications hardware or software, Mobile Data Terminals, tablets, driver interface software),*
- *Facilitate the duties of dispatch, supervisory, or scheduling staff (e.g., scheduling software, CAD/AVL software, SCADA, APC), and*
- *Manage the mobility system (e.g., performance reporting, shift selection, non-revenue schedules), and*
- *Collect and/or compute traveler feedback (e.g., crowdsourcing of incidents, accidents, delays, onboard crowd levels, comfort, condition of stops and/or vehicles).*

Mobility Application Types

Mobility Apps vary based on function, technology, and features. Table 1 provides an overview of the various smartphone app types centered on travel and mobility. For the purposes of this report, MetroPlan staff will focus on Mobility as a Service (MaaS) platforms. MaaS platforms are the only smartphone applications that integrate and connect all forms of mobility such as public transportation, car sharing, ride-sourcing, and bike sharing within a single smartphone app. At the simplest level, MaaS brings together all available transport options.

Table 1: Mobility Apps by Types

TYPE OF APP	DESCRIPTION	EXAMPLE APP
Business-to-customer	Sell the use of shared vehicles from a business to an individual consumer, including one-way and roundtrip trip. This category also includes carsharing, bikesharing, and microtransit.	Zipcar, City Bike
Mobility Trackers	Tracks the speed, heading, and elapsed travel time of a traveler. These apps may include both wayfinding and fitness functions that may include metrics, such as caloric consumption while walking.	GPS Tracker Pro, Strava, Fitbit
Peer-to-Peer (P2P) Sharing Apps	Enable private owners of vehicles to share them peer-to-peer with others, generally for a rental fee.	Spinlister, Turo
Public Transit Apps	Enable the user to search public transit routes, schedules, near-term arrival predictions, and connections. These apps may also include a ticketing feature, thereby providing the traveler with easier booking and payment for public transit services.	Metro Paris, NYC Subway MTA

Real-Time Information Apps	Provide a platform for sourcing rides. This category is expansive in its definition to include "ridesplitting" services in which fares and rides are split among multiple strangers who are traveling in the same direction.	UberPool, Lyft, Lime
Trip Aggregator Apps	Route users by considering multiple modes of transportation and providing the user with travel times, connection information, and distance and trip cost.	Ridescout
Mobility-as-a-Service (MaaS)	Mobility as a Service (MaaS) is the integration of, and access to, different transport services (such as public transport, ride-sharing, car sharing, bike sharing, scooter sharing, taxi, car rental, ride-hailing, etc.) in one single digital mobility offer with active mobility and an efficient public transport system as its basis.	Transit, *Moovit* , *Citymapper*

Mobility-as-a-Service (MaaS)

The mobility apps reviewed in this document fall under the Mobility-as-a-Service (MaaS) category. MaaS platforms integrate public transportation with other mobility services, such as car sharing, ride-sourcing, and bike sharing. MaaS is a platform that connects all forms of mobility within a single app environment. The ability to find, book/reserve, and pay within a single app, along with constructing your entire journey door to door in a seamless manner, is a path that many providers and developers are currently undertaking [iv]. Investors and startups have recognized the previous ways of movement and mobility as no longer relevant, given rapid urbanization, personal and cultural changes, and environmental considerations[v].

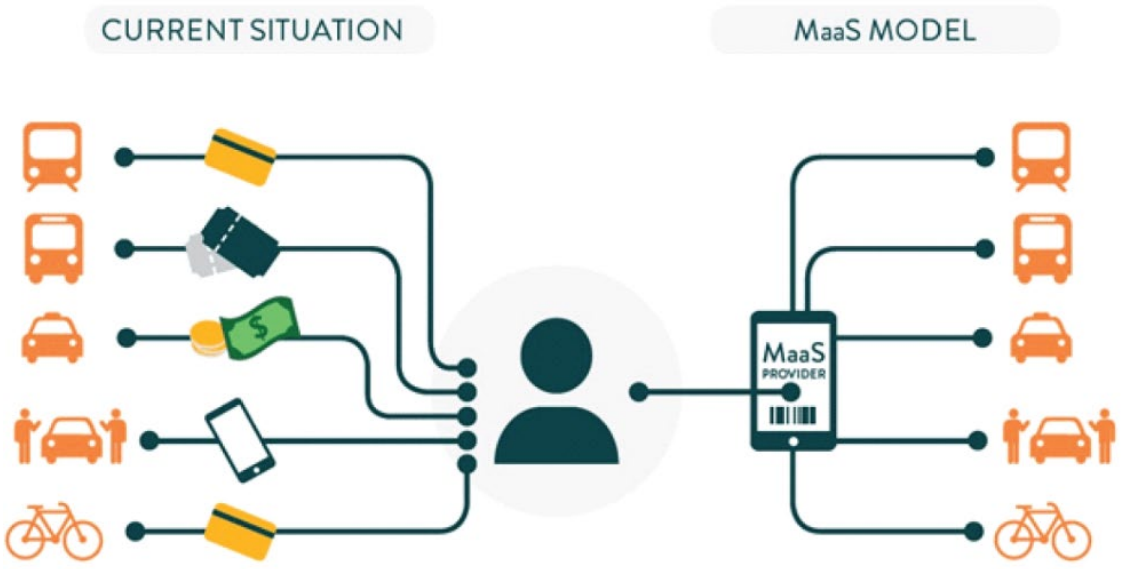


Image source: Mobility Innovators

MaaS Framework (Source: UITP)

MaaS platforms come on a spectrum. Transit, *Moovit* , and City Mapper fall into the *Open Mobility Marketplace* "which offers ubiquitous, decentralized, multi-city urban mobility" (Shepard, 2021). The marketplace provides a base infrastructure for any agency to provide mobility services or to offer those services directly to consumers via an app without investing in the costly development of a regionally specific mobility app. The Open Mobility Marketplace is often run on subscription-based (for the agency) or pay-as-you-go (for the customer) models.

MaaS can be broken down by stakeholder interests as demonstrated in Table 2. Components of a successful MaaS platform for customers include keeping passengers up to date with real-time information, intermodal ticketing, and booking/reservations. MaaS can not only enhance the travel experience of customers, but it also provides many benefits for transportation providers and agencies. The ability to access travel data and holistically understand customer behavior can help mobility service providers to optimize their services.

Table 2: Stakeholder Interests

AGENCY/ORGANIZATION	OPERATOR	CUSTOMERS/PUBLIC	NEW MOBILITY PROVIDERS
Public Mobility Strategy • Reducing Emissions • Improve Accessibility **Mobility Data Analytics** • Predict future mobility demand	**Access to all Passengers** • One interface **Single Point Payment** • Simple ticketing management **Mobility Data Analytics** • Understand passengers • Predict future passenger flows	**Compare** • Select transportation mode **Single Point Payment** • One payment process for all modes used **Incentives** • Loyalty/reward programs	**Access to all Passengers** • Integration in intermodal travel chains • One interface **Marketing** • Enabling a bigger customer base

MaaS is progressive and still evolving, like much smartphone technology new components will advance it even further in the future. Future speculations such as biometrics as a form of in-app pass payment, are just an example of how these technologies can respond to the changing world.

BENEFITS & CHALLENGES

When deciding on a mode of travel people prefer to have options. Research has found that users do not want to have only one mode available to them. Changing people's mobility preferences can be difficult because of economic and logistical challenges. However, mobility apps are a promising tool for influencing travel choices. Behavioral mechanisms from economics and psychology are already being deployed widely in mobility and navigation apps, with a variety of benefits[vi] such as those listed below:

- Alleviating cognitive burdens (the ability to easily find and use transportation options)
- Improving perceived and actual "control" over a user's journey
- Changing the norms around transportation, such as mobile ticketing
- Improving information availability and sharing service usage
- Generating new and desired travel behaviors (increase transit use, bike share, etc.)
- Changing perceptions of value across multiple modes

These economic and social-psychological mechanisms are driving both app usage and providing benefits to the consumers and the wider transportation system.

While smartphone transportation apps are prevalent, there are several challenges for app developers, mobility service providers, and public agencies[vii]. The following challenges have impacts on mobility apps:

- Privacy Concerns
- Open-data and interoperability among services and modes
- App authorization
- Accessibility concerns – not everyone owns a smartphone or has access to one
- Technical challenges – slow internet connection or cell phone reception

Information and Communications

85% of adults nationwide have access to smartphones. Still, that leaves 15% without access to smartphones and a "digital divide" is still present. While research shows the increased use and dependency on smartphones there is still the need for other mobility information and communications.

An example of addressing the customers' access to information is to provide materials through a variety of resources, such as a website or hard-copy versions of maps and schedules. Another option that is currently employed by Mountain Line is to provide informational texting. This function is usable on all cellular phones and is not dependent on downloading an app, usage of a cell phone's memory/capacity, or requiring personal information or permissions. In the last year Mountain Line receives between 11,646 and 61,460 SMS messages per month.

The benefits of promoting a mobility app are to provide an additional method of obtaining real-time mobility services such as transit arrival/departure times, locations of bikeshare, reservations of carshares, mobile ticketing, and often connects to other transportation services such as Uber and Lyft.

For the fully connected user, smartphone apps such as *Transit App*, *Moovit*, and *Citymapper* help with trip planning and alleviate the cognitive burden of finding and planning for mobility and transportation services. However, these smartphone applications are dependent on cellular coverage and/or wi-fi access which in the Flagstaff region can be challenging based on your location. For example, recently

Mountain Line has experienced a problem with supplying real-time information because of a connectivity issue due to Verizon Cellular services running out of bandwidth to support the *Transit App*. When this happens, the *Transit App* then defaults to the fixed schedule and does not provide real-time information to those customers.

Impacts on Travel Behavior

A literature review by Casquero, et.al (2022), identified the key elements of mobility apps that foster more sustainable travelers' choices. Their findings show that some persuasive strategies such as eco-feedback, rewards, or social challenges are effective because they are well-received by users[viii].

There are only a handful of studies that quantify the impact of MaaS on travel behavior using usage data collected from MaaS in-field trials or commercial offers. A recent study shows that through a formal modelling of bundle subscription (*pay a monthly or annual fee to access all modes at no additional costs*) and GPS-tracking car usage data, report that bundle subscribers reduced their private car kilometers (kms), with an average reduction of 29 kms (18.02 miles) per subscriber per month for a 10% increase in the probability of choosing a monthly bundle[ix]. Bundle subscriptions is a popular function of Mobility apps in other countries outside of the United States where the subscriber pays a flat rate monthly for unlimited accesses to multiple transportation options.

From the users' point of view, the perceived barriers (e.g., usability, privacy) relate negatively to app adoption, and it is considered useful to include functional needs such as real-time information, cost savings, comfort, or health. The research shows that multimodal travel packages based on financial incentives and environmental awareness, could help increase public transport patronage and reduce private car use[x].

Even though Mobility apps are not technically social media it is important that there be an element of cooperation or collaboration between users within the app. The app should encourage users to be active, provide information, and interact with other users and the transport operators. People's transportation decisions are oftentimes influenced by their friends, family, and other members of the community. For this reason, social influence can have a strong effect on the adoption of a mobility app. A good way for a mobility app to grow in popularity is through promotion by employers.

Incentives and Social Challenges

Well-designed apps reduce the cognitive burden of users trying to plan trips after considering transportation options and delays, as well as route preference and current traffic conditions. Another benefit of trip planning apps is giving additional decision control to the users, which may make them more satisfied with their trips regardless of whether there was an objective improvement in their comfort (FHWA, 2016). For example, several studies have shown that bus riders without real-time arrival data perceived wait times to be longer than was felt by riders with real-time data, suggesting that the presence of real-time information can increase the perceived trip satisfaction (Marczewski, 2015). The behavioral mechanisms employed by mobility apps are worth greater study as an increasing number of users consult travel applications before starting a trip. Findings of such studies could build on anecdotal evidence that suggests such applications are successful in affecting travel behavior (FHWA, 2016). Behavioral mechanisms from the disciplines of economics and psychology are being employed in mobility apps to benefit users.

Environment and Sustainability

For a Multimodal app to impact travel behavior decisions the benefits must outweigh the perceived barriers. To ensure app adoption and overcome these perceived barriers it is important that a multimodal app have functions such as real-time information, cost savings, and comfort/health information. A properly functioning mobility app that addresses these issues and focuses on financial incentives for users and environmental awareness could help increase public transport patronage and reduce private car use. Multimodal trip planning apps help users consider the menu of options available and can facilitate the use of modes that are not single-occupant vehicles. Reducing single-occupant vehicle trips can have significant impacts on the environment. It should be noted that there is a lack of studies that show quantitative data on the direct impacts of Maas platforms on environment and sustainability. Some studies show percentage of mode choice change but not direct carbon emissions or Vehicle Miles Traveled (VMT) impacts from mode choice change.

Safety and Privacy

Transit App structures their data so that it can never be used to identify individuals. This appears to be a common practice; however, methods may vary based on service providers. Location coordinates are generalized, and app usage information is stored separately from personal data. *Transit App* allows for one stop shopping for Mountain Line passes as well as other transportation options if they were available. The actual payment process for Mountain Line fares is done through TransitFare without redirection to another app. Riders sign up for Transit, enter their payment info once, and they're able to buy transit passes, bikeshare passes, and more. The rider can then go to any city and travel via any mode they would like with one tap given that *Transit App* operates in that area.

Almost unanimously, mobility apps use a third-party vendor for their payment services. This allows for secure and safe transactions for both the user and the provider. As discussed above this also helps to structure the data so that user data such as names, addresses, payment information, and app usage information is stored separately. The user is oftentimes unaware of this added security though because this is all processed behind the scenes without redirecting the user to another site or app.

MOBILITY APP REVIEW & CONSIDERATIONS

This section provides an overview of the mobility apps; *Moovit*, *Transit App*, and *Citymapper* for consideration in the Flagstaff Region. These apps fall into the MaaS category by providing integrated mobility services within a single smartphone application.

It should be noted that while some apps offer several functions, not all functions are available in the Flagstaff region as some services are not currently available (e.g., bikeshare) or would require contracting with a Mobility App provider to access the full functions of the app and its data. As these are existing apps each offers partnership opportunities to local public agencies for a fee, allowing agencies to offer in-app ticketing and purchasing, branding, customer communications, and to access travel data.

Tables 3 and 4 provide an overview of the functions for both the customer and the agency that can be implemented via the apps reviewed in this document.

Table 3: MaaS Platform Customer Features Comparison

PLATFORM	OPERATING SYSTEMS			CUSTOMER FEATURES											
	Android	iOS	Desktop	Mobile Ticketing	Real-time arrivals/tracking	Bikeshare locations/ Inventory	Bikeshare payments	Bike routes	Car share locations/ Inventory	Car share payments	Ride-hailing (Uber/Lyft)	Walkshed	Route optimization	Customer Fees[1]	Customer communication[2]
Moovit	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒
Transit App	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒
Citymapper [3]	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒

[1] Fees are dependent on if the local agency has sponsored a specific package. If not, customers may be responsible for fees associated with use of the app.

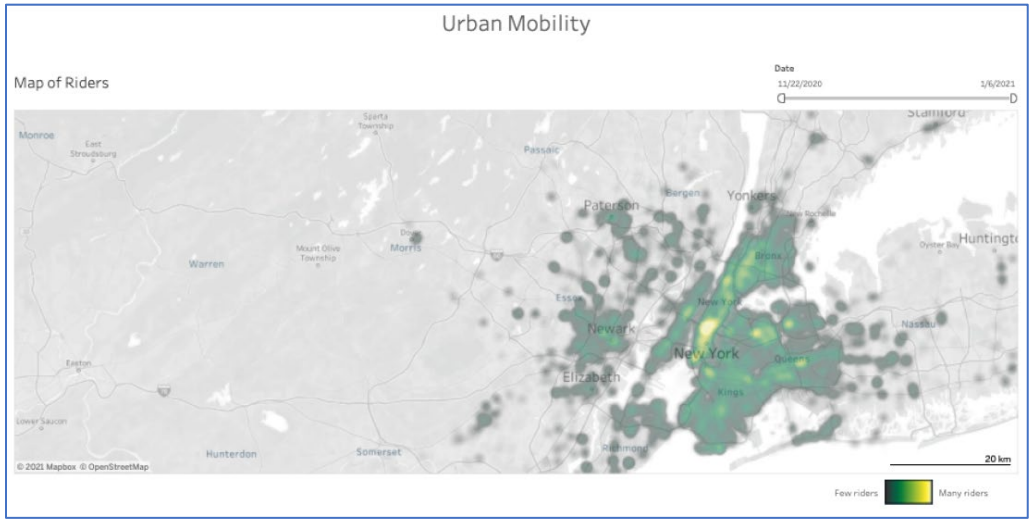
[2] Communications include route changes/delays, surveys, announcements, etc. that are provided through "push notifications" on the apps.

[3] Currently mobile ticketing, car share payments, and bike share payments are only available in London.

Table 4: MaaS Platform Agency Features Comparison

PLATFORM	AGENCY FEATURES									
	Compatible with other fare collection systems	Zone Reports/Mobility Heat Maps	Transit Line Reports	Transit Station Reports	Other modal reports (bikeshare)[4]	Scalable to new services	Custom Branding	Customer communications	Scalable	Est. Annual Cost
Moovit	☒	☒	☒	☒	☐	☒	☒	☒	☒	$10,000 - $50,000
Transit App	☒	☒	☒	☒	☐	☒	☒	☒	☒	$6,000 *(Royal Package)*
Citymapper[5]	☒	☐	☐	☐	☐	☒	☐	☐	☒	N/A

Figure 3: Moovit Urban Mobility Heat Map Example



Urban Mobility Heatmap (Moovit)

"The heatmap provides insight into where users are most concentrated, among other findings. A report can be generated to view the most popular destinations by their percentage of popularity as generated by trip plan results in the mobile app. The default view exposes data from the last 30 days with a filter to choose a custom period of time. This further adds to the city's mobility profiles for their users."

[4] *Undetermined but likely*

[5] *Agency information is not publicly available. A request for information (RFI) process may determine further features.*

Customer Functionality & Satisfaction

When considering a mobility app, customer ease to access and use, features that reduce cognitive burdens such as real-time arrival and in-app ticket purchasing are highly valuable. Many of these customer-based functions are ubiquitous and are effectively "baked into" the various mobility platforms with minimal differences.

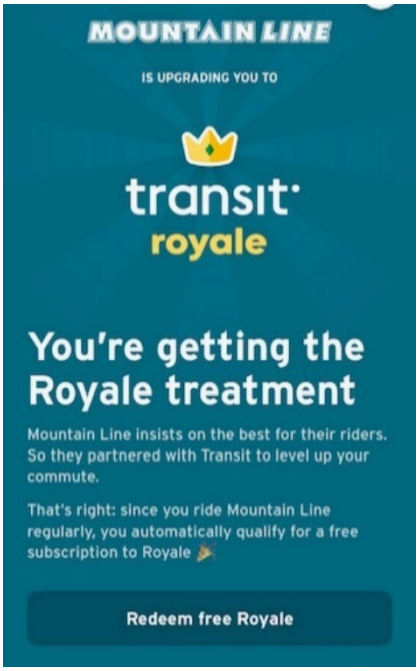
In urban settings, there is a shift within the mobility domain away from the desire for single-car ownership. "The explanations are many, but in a digitalized, shared, and on-demand society, the requirement of owning an automobile has diminished in the priorities of one's lifestyle." (Shepard, 2021). That shift may not be realized in the Flagstaff region yet. However, as more mobility options and infrastructure become available, mobility apps could support the policies found in the City of Flagstaff's Carbon Neutrality Plan and Active Transportation Master Plan, MetroPlan's Stride Forward (Regional Transportation Plan), and Mountain Line's Flagstaff in Motion A Community Transit Plan. While the mobility apps are fairly similar to one another, the decision to promote one of them is more about branding and awareness to meet and achieve local benefits.

All three apps are available for download at no cost to the consumer. However, the data to support the app and its functions must be provided in the region prior to downloading. For example, the *Transit App* is available in over 300 cities and 10 countries and is currently available in Flagstaff. When a consumer uses the app in Flagstaff, they have full access to all features on the app at no cost. This is because Mountain Line purchased the *Royal Package* that allows customers full functionality of the app.

If *Moovit* were downloaded in the Flagstaff region it will show the nearest transit stops and the static arrival information. Functions may be limited or temporary and may require future fees for continued use or improved access by the customer. *Citymapper* is not available in Flagstaff.

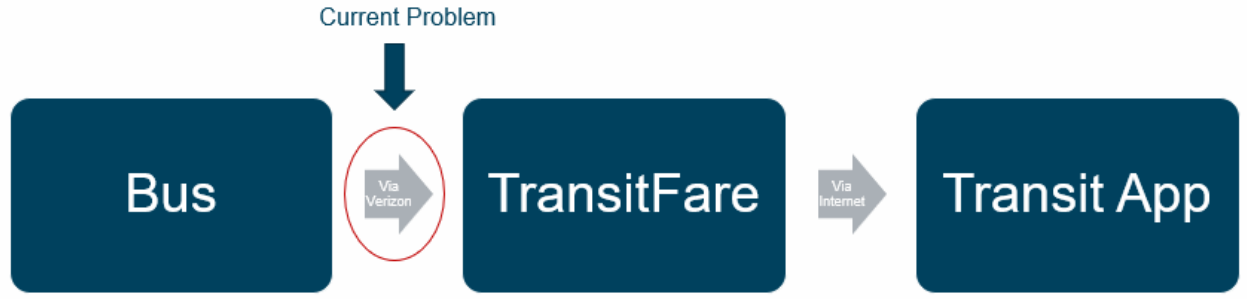
In terms of customer satisfaction and ratings, *Moovit* has an average rating of **4.6** with 26.8K consumer ratings which makes it the highest-rated mobility app. The second highest rated is *Citymapper* with an average customer rating of **4.5** from 39K consumers. Lastly, *Transit App* has an average customer rating of **4.4** from 103k consumers.

Figure 4: Royal Package for Customers



Mountain Line launched the use of the *Transit App* for their customers as a pilot program in 2018 with just trip planning and schedules. Real-time data in the *Transit App* started in 2020 and it became Mountain Lines' primary app in the Fall of 2021. The app provides real-time transit locations, bus stops, route optimization, and mobile ticketing. Since the launch in July 2021, Mountain Line has had 7,877 unique active users that signed up for the app. Just in the month of October 2022 users opened the app 128,662 times which is an average of 768 rides on a given weekday. The number of unique users per month varies, but the maximum number of users in one month was 2,407 in September of 2022. Those users completed 1,965 Go trips which was over 10% of Mountain Lines rides that month.

While these numbers are encouraging, the *Transit App* has been experiencing issues as of mid-May 2022 due to insufficient bandwidth from Verizon Wireless. To provide real-time transit information to the customer, the bus CAD VL System sends its real-time location via Verizon to *TransitFare* and then *TransitFare* forwards this data to *Transit App*. When the connection to *TransitFare* is interrupted it takes manual intervention to restore the flow of real time information to *TransitFare* and *Transit App*. With the lack of bandwidth to support communications between the bus and the app, customers are impacted substantially. Mountain Line staff has confirmed that the app does not always show when the bus is approaching or real-time tracking. The public has lodged complaints mostly about how this inconsistency in bus data/information is annoying. However, this hiccup in technology has not negatively impacted overall ridership.



It is undetermined if the bandwidth issues would affect the other mobility app options. If bandwidth is a continuous issue in Flagstaff, even if a popular app or a regionally branded app deployed with poor accuracy of the main functions would certainly impact the public's perception of using such technology and the potential use of alternative modes.

Agency Considerations

Based on the research, there are unique lessons learned with each MaaS deployment and implementation across the globe. Metro Magazine recently provided an overview of the lessons learned and benchmark experience that can be used in further identifying technical and functional requirements necessary to deliver MaaS platforms to consumers in a manner that is equitable, open, and accessible. Below are some of the highlights from that document:

App Stickiness

This is a term that is related to user growth such as app vitality, for instance, which is just an indicator that a mobility platform is acquiring customers at a faster rate than it is losing them. High adoption means a shared mobility platform keeps more of what it catches and is "stickier" and more vital.

Customer Experience is the key to the adoption and retention of new shared mobility services. By providing a seamless platform that integrates all primary functionalities, it has been proven that customers will more likely interact with and continually utilize such platforms.

Data Quality and Access

Many new MaaS digital platforms have been developed that collect shared mobility data and bundle it into intuitive dashboards, which agencies can utilize to monitor and enforce MSPs within MaaS. As such, MaaS data quality and access are imperative for such new opportunities to succeed in the long term. To enrich the environment that governments require with regard to understanding the mobility patterns on a city scale, GDPR-compliant, and anonymized historical and real-time data can empower regulators and data scientists with the insights required to understand the complete mobility picture.

An example of data that can be collected and used by an agency includes zone reports, transit line reports, and transit station reports (*see table 4*). Other reports may be generated based on available mobility/mode options. As part of Mountain Line's contract with *Transit*, they have access to various reports and data. Mountain Line intends to evaluate the data for quality and accuracy, determine how this data can influence future planning and operations, or determine how the data can be used to define key performance indicators.

Data practices of the mobility app options should also be considered. One of the trickiest aspects concerning the implementation of MaaS relates to the architecture and governance of the required data ecosystem. This pertains not only to the technological requirements for integrating the data systems of various actors, but also to the more fundamental questions of data ownership, data rights, and privacy issues[xi].

Integrated Payments

Research has identified that consumers appreciate the ability to make a one-click purchase of their entire door-to-door journey, simplifying the payment experience. The ability to enable a one-click door-to-door capability for travel experience is key to user adoption.

Modularized Journeys

Consumers like to discover, book, and pay for their mobility journey in advance. Users like the ability to book and pay for their tickets in advance (transit), then immediately book or plan their first and last mile trip (bikeshare).

Scalability

The mobility apps discussed are adaptive to the local market. They can respond to new or enhanced modal options, changes in services, and can be branded to reflect the local agency or community.

Costs

There are several pricing models for IT companies for software development outsourcing. Creating a regionally specific mobility app overseen by a local agency's initial start-up costs between $20,000 to $50,000 depending on the features an agency would like to provide for both the customer and the agency itself. This cost does not include regular maintenance or updates to the software. In 2020, the Los Angeles Metropolitan Transportation Authority contracted with *Transit App* which is expected to save the agency $240,000 per year in smartphone app maintenance and development costs[xii]. For this reason, the existing mobility apps are often more cost-effective and allow agencies to customize their needs based on both functionality and traveler data.

"Doubtful that an agency that size would be successful in the custom development of an app due to budget, but granted, Mountain Line is a supremely competent agency for its size."
– Heidi G. (mobilitydata.org)

Mountain Line currently pays $6,000 annually to use the *Transit App* with access to their Royal Package. *Transit* operates on a Freemium pricing model which is a type of business model where businesses provide their customers with the basic features of their products/services for free and additional/special features for a premium. Since Mountain Line pays for the Royal Package, this gives the public access to premium features at no additional cost to them.

Like the *Transit App*, *Moovit* offers levels of partnerships that vary in cost. In previous research conducted by MetroPlan staff in 2020, *Moovit* 's most costly package was $50,000 annually. The cost for *Citymapper* was not determined. Through communications with staff from Mobilitydata.org, "*Citymapper to my knowledge wouldn't consider (developing its app) for a community of 75,000 people*". *Citymapper* does appear to cater to major cities such as New York, London, Madrid, etc.

RECOMENDATIONS

Customer Experience is important in the adoption and retention of new shared mobility services. By providing a seamless platform that integrates all primary functionalities, it has been proven that customers will more likely interact with and continually utilize such platforms.

Local agencies hold the key to ensuring the success of mobility smartphone apps in Flagstaff's future. By understanding what works and what doesn't, local agencies can leverage best practices deployed across the globe, structure sustainable business models, and encourage MaaS platforms to develop apps and solutions that boost public transit ridership and promote mode shift away from personal vehicles.

Based on the research and information provided in this report, MetroPlan recommends the following:

1. Mountain Line should continue the use of the *Transit App* while determining and understanding the issues with local bandwidth (via Verizon Wireless) as it relates to communications from the bus CAD VL System to smartphone apps. This topic is planned for further research by Mountain Line staff.

2. MetroPlan will work with partner agencies in the investigation and procurement of a MaaS application. While the *Transit App* has been sufficient in replacing Mountain Line's previous smartphone app, the choice to continue with *Transit* still needs to be determined by Mountain Line.

   Additionally, as other agencies begin to offer mobility options, there will be a need to consolidate those options into a single MaaS platform that works for all agencies. A Request for Information (RFI) will be necessary in the future. An RFI will further impact this study and future studies as it relates to determining the host agency, evaluating the data for quality and accuracy, determining how mobility app data can influence future planning and operations, and developing and defining key performance indicators.

3. Ensure regular mobility updates are made on Google Maps and other relevant navigation and MaaS apps by all partners and agencies offering transportation and mobility services. As Mountain Line is the only mobility provider in Flagstaff, it is encouraged to continue providing real-time bus data to Google Maps. While Google Maps does not provide the same services as MaaS apps, it is the most used navigation app across many countries and modes. Therefore, it's important to ensure that all mobility options, transit stops, and routes, and any future mobility option (such as bike share stations) are easily accessible to the public. These updates provide an additional layer of mobility information to the public that may not be aware of existing mobility apps, or if app or communication technology fails, its becomes a secondary source of travel and mobility information.

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