U.S. Department of Transportation

Mobility on Demand

ITS Benefits, Costs, and Lessons Learned: 2018 Update Report

Mobility on Demand

Highlights

- Travel and mobility demands are evolving from an emphasis on private automobile ownership to more flexible, public and private options which incorporate shared-use and multimodal integration.
- A one-way carsharing impact study in the U.S and Canada found that participants were able to reduce GHG emissions by between 4 percent and 18 percent per household.
- Carsharing service Car2Go pays cities $1,009 to $2,644 per vehicle for parking and other operating costs.
- Arlington County, VA bikesharing service saves members an estimated $2 million dollars in transportation spending.
- New York City's app-based ride services provide increased mobility options but with a cost: over 600 million additional vehicle miles travelled over three years.
- Swedish start-up *UbiGo* offers subscribers everyday travel via public transport, car-sharing, rental car service, taxi and bicycle sharing, all integrated in one smartphone app and with a single invoice.

Photo source: USDOT

Introduction

This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: www.itskrs.its.dot.gov. The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.

Mobility on Demand (MOD) is a multimodal, integrated, accessible, and connected transportation system in which personalized mobility is a key objective. MOD enables the use of on demand information, real-time data, and predictive analysis to provide individual travelers with transportation choices that best serve their specific needs and circumstances. Modes facilitated through MOD providers can include: carsharing, bikesharing, ridesharing, ridesourcing, microtransit, shuttle services, public transportation, and other emerging transportation solutions.

A number of key trends are laying the foundation for MOD.[1] These include:

- **Increasing population**. Over the next 30 years, the U.S. population is expected to grow by about 70 million, with most of this growth occurring in cities. Growing urbanization will continue to put significant strain on city infrastructure and transportation networks.
- **Aging population.** By 2045, the number of Americans over the age of 65 will increase by 77 percent. Older Americans require mobility choices allowing them to age in place.

There is a renewed interest in demand-responsive operations largely driven by mobile technologies and the nearly ubiquitous smartphone.

- **1 in 5 Americans are disabled.** Persons with disabilities comprise nearly 20 percent of the U.S. population. About one-third of people over age 65 have a disability that limits mobility.
- **Rise of mobile devices.** Ninety (90) percent of American adults own a mobile phone allowing them to access everything from traffic data to transit schedules to inform travel choices. In addition, 20 percent of adults use their phones for up-to-the-minute traffic or transit data and smartphones are regularly used for turn-by-turn navigation.
- **Millennials waning interest in car ownership.** Millennials are becoming less and less reliant on car ownership compared to previous generations. By the end of the 2000's, they drove over 20 percent fewer miles than at the start of the decade. Millennials are the first generation to have access to internet during their formative years and are often early adopters of technology solutions including shared-use mobility services.
- **Growing popularity of shared mobility and modes.** There is growing popularity of shared mobility and shared modes, such as bikesharing and ridesourcing. The sharing economy and new transportation services are providing people with more options, helping to overcome barriers to the use of non-driving forms of transportation, and shifting individuals' travel choices.
- **Big Data era.** The transportation sector is increasingly relying on data to drive decisions. Data is projected to grow by 40 percent annually. Data enables innovative transportation options such as carsharing, ridesharing, and pop-up bus services.
- **Rise of connected vehicles and infrastructure**. Data derived from connected vehicles provide insights to transportation operators helping to understand demand and assist in predicting and responding to movements around a city.

The transportation landscape is changing, and research in new mobility options is necessary to document, evaluate, and adequately plan for growing mobility demands, new technologies, and changing demographics, amidst challenging financial realities. New business models and the demand for situational mobility choices offer new opportunities in shared-use mobility, such as car sharing, bike sharing, and ridesharing, and app-based ridesourcing provided by Transportation Network Companies (TNCs). Likewise, there is a renewed interest in demand-responsive operations largely driven by mobile technologies and the nearly ubiquitous smartphone. Along with traditional transportation options, these new trends provide real opportunities to develop an integrated system of mobility choices focused on meeting the needs of a diverse cross section of users while enhancing the safety of all travelers. MOD is poised to contribute to this new ecosystem with connected travelers, infrastructure, innovative operations and personal mobility needs.[1]

In 2016, the Federal Transit Administration (FTA) and Intelligent Transportation Systems Joint Program Office (ITS JPO) launched the MOD Sandbox Program that aims to provide a platform where integrated MOD concepts and solutions, supported through key local partnerships, are demonstrated in real-world settings. These projects will use smartphone apps, open data platforms, and other advanced technologies to better connect transit riders to their destinations, aided by private companies and research institutions in fields such as software development, ride-sharing, and bike-share. The 11 project selections receiving nearly $8 million in funding are described below.[2]

Table 1: MOD Sandbox Program Grantees and their Proposed Projects

Agency	Project Description
Regional Transportation Authority (Pima County, AZ)	Integrates fixed route, subscription based ride-sharing and social carpooling services into a platform to address first mile/last mile issues.
Valley Metro Rail (Phoenix, AZ)	Smart phone mobility platform that integrates mobile ticketing and multimodal trip planning, including ride-hailing, bike sharing, and car-sharing companies.
City of Palo Alto, CA	Commuter planning project incorporating trip reduction software, a multi-modal trip planning app, and workplace parking rebates.
Los Angeles County Metropolitan Transportation Authority	Mobility on demand partnership with the car-sharing company, Lyft. *This project, led by LA Metro, includes a companion project in Seattle, WA.
San Francisco Bay Area Rapid Transit	Integrated carpool-to-transit program.
Pinellas Suncoast Transit Authority (Pinellas County, FL)	On-demand paratransit using taxis and a car-sharing company to provide door-to-door service.
Chicago Transit Authority	Incorporates local bike-sharing company Divvy into CTA's transit trip planning app.

Agency	Project Description
Tri-County Metropolitan Transportation District of Oregon (Portland, OR)	Platform integrating transit and shared-use mobility options. By integrating data, the project will allow users to plan trips that address first/last mile issues while traveling by transit.
Dallas Area Rapid Transit	Integrates ride-sharing services into DART's GoPass ticketing app.
Vermont Agency of Transportation	Statewide transit trip planner incorporating flex-route, hail-a-ride, and other non-fixed-route services into mobility apps.
Pierce Transit (Pierce County, WA)	Limited Access Connections project connects service across two transit systems – local and regional – and ride-share companies to increase transit use across the Seattle region.

While the MOD Sandbox projects are still in the process of being deployed and evaluated, other pilot projects are demonstrating MOD concepts with the following benefits, costs and lessons learned.

Benefits

Carsharing

MOD enables smarter, more efficient, and safer mobility within a multimodal ecosystem that benefits individual travelers, transportation operators, and system managers alike. One such form of MOD, carsharing, is becoming increasingly popular due to its appeal as being personally convenient and more eco-friendly.

Car2go is currently the largest carsharing operator in the world, with a presence in nine countries and nearly 30 cities. It operates as a one-way instant access carsharing system within a pre-defined urban zone. The University of California Berkeley's Transportation Sustainability Research Center (TSRC) conducted a one-way carsharing impact study and found that car2go's flexible one-way carsharing model can work in tandem with existing mass transit options. The study gathered and analyzed car2go activity data from approximately 9,500 car2go members residing in Calgary, San Diego, Seattle, Vancouver and Washington, DC to determine the impacts on vehicle ownership, modal shift, vehicle miles traveled (VMT), and greenhouse gas (GHG) emissions.

Overall, the results of this study suggest that car2go one-way carsharing is substantively impacting travel behavior, miles driven, GHG emissions, and the number of vehicles on urban roads within operating regions (2016-01125).

Across the five study cities, it is estimated that:

- Car2go members sold (gave up ownership of) between 1 to 3 vehicles per car2go vehicle (on average)
- Car2go members suppressed the need for (reduced vehicle usage) for between 4 to 9 vehicles per car2go vehicle (on average)
- Overall, when considering both effects together, each car2go vehicle removed between 7 to 11 vehicles from the road of the five cities studied (on average)
- On balance car2go reduced VMT by 6 percent to 16 percent, per car2go household
- GHG emissions were reduced by 4 percent to 18 percent per car2go household

Bikesharing

Since 2010, the Capital Bikeshare service has connected a network of over 450 stations via 4,000 bicycles across several jurisdictions in the Washington, DC area including Arlington County, VA. Arlington County reported on progress on the service's performance measures in its FY2016-FY2021 Transit Development Plan Update & Progress Report (2018-01252).

Source: istockphoto

Results from 2013 to 2014 show increases in ridership, with slightly shorter trips as follows:

- Ridership grew by 24 percent between FY2013 and FY2014 as the system expanded service.
- The average annual number of trips per bicycle decreased slightly between 2013 and 2014 from 393 to 381. This decrease was expected as the system expanded to outside of Arlington's Metrorail corridors where the highest ridership is located.

- The service saved Arlington members a combined estimated $2 million dollars in transportation spending in 2014.
- Overall the total calories burned by users grew to 14,390,372 calories in 2014, reflecting higher ridership.
- Calories burned per trip decreased from 2013 to 2014, from 80 to 75 due to a decrease in average trip distance.
- The service improved its operating cost recovery ratio from 59 percent in FY013 to 63 percent in FY2014.

Arlington County intends to expand the bikesharing service, while working on increasing the diversity of the user base and reducing its dependency on Arlington County operating funds.

Costs

A limited number of ITS applications have been deployed to support MOD systems, with cost data not publically reported. However, costs to operate shared used services are starting to become available.

Carsharing

The primary concern of cities implementing a carsharing agreement involves issues of parking. Many carsharing programs have agreements with municipalities to allow for free on-street parking. The companies also have agreements with cities that provide a number of dedicated spaces, indicated by city signs, paint, or other markings. Typically the carsharing company pays the city a fee to cover these costs, which can generate significant revenues. Depending on the agreement the car company may also pay for other costs to operate that include insurance, pilot evaluation, car removal in cases of parking restriction violations. Information on payments made by Car2Go when launching its carsharing service is U.S. markets is shown below (2018-00395).

Table 2: Car2Go's Payment per Vehicle to Various U.S. Cities

City	Payment per Vehicle per Year	Year	Notes
Arlington County, VA	$1,645	2015	Includes payment for pilot program administration and evaluation costs. Car2Go also agreed to move cars that have remained parked for 24 hours in areas zoned for residential permit parking and parked for 36 hours elsewhere
Austin, TX	$1,449	2011	
Minneapolis, MN	$1,689 for first 250 vehicles $1,614 for each additional vehicle	2013	Includes administrative cost, meter revenue recovery, event revenue recovery, and residential permits
Portland, OR	$1,303	2015	
Washington, DC	$2,644	2012	Initially paid $578,000 for 200 cars; paid an additional $215,300 to add 100 vehicles

Bikesharing

Recently Arlington County reported its cost to operate the Capital Bikeshare service in its region. Bikesharing is a service in which bicycles are made available for shared use to individuals for a short time period for a fee. The rider reserves and pays for the bicycle rental with a smartphone applications although many services also allow credit card payments at the docking station. Operating costs for 70 stations with 493 bicycles were broken out by system operations and management and marketing. System costs were projected to increase in FY2015 due to expansion of the service by up to 22 stations (2018-00396).

Table 3: Arlington County's Capital Bikeshare Operating Expenditures

	FY2014 (Actual)	FY2015 (Projected)
Expenses		
System Operations	$1,246,000	$1,371,000
Management and Marketing	$185,000	$103,000
Total	$1,431,000	$1,474,000
Revenue		
User Revenue	$792,000	$972,000
Private Sponsorships	$102,000	$89,000
ACCS Commissions	$558,339	$65,000
Local Funding (TCF)	$0	$348,000
Total	$1,452,339	$1,474,000

The overall cost recovery ratio (the portion of operating expenses covered by user revenue and private sponsorships) in FY2014 was 63 percent. Arlington County has a goal to minimize operating costs while providing an effective service at the regional and local levels.

Lessons Learned

Ridesharing

In 2012, Santa Barbara County Association of Governments (SBCAG) Traffic Solutions and the Community Environmental Council in Santa Barbara County launched the Dynamic Rideshare project, an FHWA Value Pricing Pilot Program project. The project focused on increasing rideshare participation by implementing a dynamic ridesharing program using a smartphone application (branded as *Carma*) that provided near real time carpool matching for individual trips. The app also provided the ability to incentivize carpooling through micro payments from Traffic Solutions to the riders and drivers. Through GPS enabled mobile devices, actual trip data was tracked for all trips within the app.

Overall, the pilot was unsuccessful at launching Real Time Ridesharing in Santa Barbara County as the *Carma* application failed to garner as much of a user-base as hoped. In total, 274 trips were made which resulted in 3,325 miles of ridesharing. The failure of adoption of the Real Time Rideshare Program can be attributed to several factors, including the lengthy app development process, the steep learning curve using the app, and the lack of motivating forces and a culture for Real Time Ridesharing.

Key lessons for communities interested in launching a Real Time Rideshare community are as follows (2016-00751):

- Conduct internal testing of the technology before introducing it to the general public, and only introduce a technology that is stable and user-friendly.
- Target markets that have natural conditions that lend themselves to a Real Time Rideshare solution, such as toll lanes, HOV lanes, expensive parking, and a concentration of travel between select origins and destinations.
- Remember that offering a Real Time Rideshare app does not create its own demand.
- Do not underestimate the level of effort needed to build a critical mass of app users.
- Consider testing smaller Real Time Rideshare groups composed of 15 to 25 individuals that have similar commutes as an incremental approach to building a larger Real Time Rideshare community. Each group should have a champion that will conduct outreach and marketing to form the group.

Case Study – Mobility as a Service *UbiGo* (Gothenburg, Sweden)

UbiGo was a public 6-month trial of a Mobility-as-a-Service (MaaS) model, undertaken by project Go:smart, in the city of Gothenburg, Sweden. The project was developed as an attempt to create better conditions for sustainable travel by demonstrating how new business models and partnerships can reduce the need for private car ownership. The UbiGo model achieves this through a web-based smartphone application that combines public transport, car sharing, rental car service, taxi and bike-sharing services all into one application, all on one invoice. The application provides 24/7 technical support, an "improved" travel guarantee and even bonuses for sustainable travel choices.

The public trial operated from November 2013 to April 2014, and involved 195 users. For the study, trial users subscribed to prepaid monthly packages (similar to a mobile phone subscription) based on their travel needs, with the ability to charge additional trips and save unused trips for later use.

Source: UbiGo

An evaluation of the MaaS model was performed based on surveys, interviews, travel diaries and focus groups. The participant users were interviewed before, during and after the trial about their experience and their satisfaction with the service. After the initial six months of testing, no household stopped using UbiGo, and nearly 80 percent indicated that they would be interested in becoming an UbiGo customer if the pilot became a regular service. Regarding traveler behavior, half of the users changed their modes of travel, four out of ten changed the way they plan their trips, and one out of four changed their "travel-chains". In a follow-up survey, many participants stated that they had become less reliant on private cars and were more likely to use other forms of transportation such as public transit, walking and cycling after their participation in the pilot. Additionally, users stated UbiGo made it easier to pay for travel and gave them better control of expenditures.[3]

The total cost of the project was £1.5 million and overall perceived benefits of the project included greater efficiency to transportation services and a reduction in greenhouse gas emissions (2017-01197).

Case Study – Transportation Network Companies (New York, NY)

A recent report presents findings from a detailed analysis of the growth of app-based ride services in New York City, their impacts on traffic, travel patterns and vehicle mileage since 2013, and implications for policy makers. Results show the increases in trips, passengers and mileage generated by the growth of Uber, Lyft and other app-based ride services since 2013 as follows (2018-01245):

- TNCs provided 80 million trips in 2016, transporting 133 million passengers.
- After accounting for declines in yellow cab, black car and car service ridership, TNCs have generated net increases of 31 million trips and 52 million passengers over the past three years.
- TNCs also accounted for the addition of 600 million miles of vehicular travel over the past three years, after accounting for declines in yellow cab, black car and car service mileage and shifts from personal vehicles.
- Growth in trips, passengers and mileage was seen throughout the city. The majority of net growth occurred in northern Manhattan and the boroughs outside Manhattan. But there was also significant growth in the Manhattan core, all of it since mid-2015.
- Trip growth in Manhattan, after subtracting shifts between industry sectors, has been concentrated during the morning and evening peak periods, late evenings, and weekends.

While increasing mobility options, the growth in TNC trips and mileage has significant implications for New York City's ability to achieve its goals for sustainable population and economic growth. Potential impacts discussed included: travelers moving from transit to TNCs, potentially undermining the revenue base for transit; increased vehicle mileage from TNC increase traffic congestion delaying buses, taxis and other for-hire vehicles, driving up travel time and costs; and increased vehicle mileage from TNCs may reduce traffic safety and increase greenhouse gas emissions.

References

[1] *Mobility on Demand- Research Program Framework*. U.S. DOT Federal Transit Administration. September 2016.

[2] "U.S. Transportation Secretary Foxx Announces $8 Million in Groundbreaking Mobility on Demand Grants to Transform Public Transit." MOD Fact Sheet, U.S. DOT Federal Transit Administration, Website: https://cms.dot.gov/sites/dot.gov/files/docs/FactSheet_MOD_20161013.pdf. Accessed 12 January 2017.