

# Incorporation of the Roadify API in Ride and Bike Sharing Systems

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# Abstract

Ride and bike share companies have an interest in optimizing trips involving multi-modal transit. To make these services more user-friendly and efficient, we proposed that transit data should be integrated into them. Providing transit data to rideshare drivers in particular would increase their productivity and profits. To develop a plan for partnership between these companies and our sponsor, we developed pricing models and assessed how the APIs would work together. A tiered subscription model with a free trial base became the pricing structure of choice for a partnership with ridesharing company Uber, following research and discussions with our sponsor. Despite initial promise, we ruled out bike sharing as a possibility due to limited digital architecture and weaker financial incentives.

# Acknowledgements

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Roadify consultant Christopher Hamman also deserves to be thanked for his role in the initial stages of the project. He granted us access to many features of Roadify's API and other software tools such as RoadifyTV, which helped us learn more information about the company's API and its capabilities.

WPI research librarians Jessica O'Toole and Laura Robinson Hanlan provided us with guidelines for using library databases and strategies for formulating good research questions. The information they shared about using library resources and properly addressing copyright issues for images greatly influenced how the latter portion of project research took form.

We would finally like to thank our project advisor, Blake Currier. He spent a great deal of time meeting with us personally and coordinating with us both on and off-campus to discuss progress, help narrow the project scope, coordinate discussions with Roadify's CEO, and guide us on writing our final paper. His encouragement, positive attitude, and dedication to the project from start to finish were monumental in its success. For this, we thank him greatly.

All of these individuals contributed meaningfully during all stages of the project. Without them, this project would not have been possible. Thank you.

# Executive Summary

The project was focused on finding a solution to the first-last mile problem. The first-last mile problem is best defined as the extra time, cost and inconvenience commuters face when they are going from home to a transit station and then from the station at the other end of the trip to a final destination. The challenge is to make these multi modal transit options more reasonable than using the traditional option of a personal car.

The IQP team collaborated with Roadify, a company that provides transit information on signage, to develop a solution to socioeconomic problems related to transit. As a platform-as-a-service (PaaS), Roadify aggregates and distributes transit information from over 300 locations using its API. This information is then displayed through their mobile app, and their clients' kiosks, and public screens.

As potential solutions to the first-last mile problem, bike share and rideshare systems were explored.

## Rideshare

The concept of ridesharing is a broad term encompassing any system in which a rider provides a transportation service to a user. For this reason, ridesharing services such as Uber and Lyft were considered along with traditional taxi companies such as the New York City Yellow Cab and Green Boro Cabs.

Roadify transit data could be provided to rideshare drivers to let them know when transit would arrive at train and bus stations. Not only would this allow them to access a high concentration of riders, but it would also allow them to increase their productivity.

Through a survey that the IQP team conducted, it was realized that 27.3% drivers surveyed were waiting for 10 - 30 minutes on train and bus stations. Further, 81.8% of the drivers responded that they would use information about when trains and busses would arrive if it was available on Uber, Lyft or other rideshare apps. Using the data from the survey, it was realized that if wait times were completely eliminated at transit locations for drivers, then they could earn \$6.97 more per day on average.

It was also proposed that by synchronizing Roadify's transit data about "when would a train or bus arrive" with rideshare companies' location data of drivers, a reliable pre-booking system could be developed for transit areas to reduce the waiting time for riders as well as drivers. Pre-booking would allow someone to order a ride that would arrive when their train or bus arrives at the train or bus station.

Through the data collected by Taxi and Limousine Commission, Census Bureau, it was observed that rideshare is a popular solution among people who have money to spend and would like to save time on driving. However, there is a large population who could use Uber in combination with transit, as it would have reasonable cost benefits, and save time. It was statistically determined that a household could take about a third of its trips by Uber, filling in the rest with public transit, and it would still be cheaper than car ownership. The above proposed ideas would allow rideshare companies to access a population that could use Uber in combination with transit. The proposed applications would also help solve the socio-economic problem of first-last mile, by saving time, and making multimodal use of transit easier.

## Bike Share

Bike sharing refers to systems of bikes that are set up in cities or on college or corporate campuses to provide a quick and convenient method of transportation. Bike share enables someone who needs to travel a short distance to take a bike from a docking station, ride it for a short time, and return it to a docking station that is closer to the destination. College and corporate campus bike share provides a more efficient way to travel short distances on a campus than by walking or by car. City bike share provides people in cities with a way to travel short distances within a city. It is an alternative to walking and also has potential to help solve the first last mile problem.

One reason for someone to take advantage of bike share is that he can use it to travel from his apartment in a city to a train or bus station on the way to work. After arriving at a train or bus station closer to the destination, he could use bike share to ride to where he works.

A use case for the Roadify transit data that the IQP team considered was to provide public transportation information on signs at bike share stations. This information would support someone who would like to use bike share to travel a short distance to or from a train or bus station as in the first-last mile problem. The thinking was that the bike share company could profit from this setup through advertisements that would appear on the same signs as the transit information.

# Authorship

The IQP team members Sagar Mahurkar, Robert Vigeant, Alexander Wald, and Sean Watson all contributed to the research and writing of this IQP report. Specifics on what each person wrote about is as follows:

Sagar Mahurkar contributed towards the research on pricing models, market segmentation, consumer needs, development of the ridesharing use case, and write-ups of the abstract, executive summary, methodology and conclusion for the report.

Robert Vigeant researched traditional taxi services, the first-last mile problem, and case studies for pricing models. In addition, he aided in writing the literature review, methodology, findings and conclusions of the report.

Alexander Wald conducted research on market segmentation, and contributed to writing the introduction, literature review, methodology, executive summary, and conclusion. He also worked on determining and writing about key features of the Roadify API and designing survey questions.

Sean Watson drafted the acknowledgement section and contributed to the abstract and conclusion. He wrote sections of the literature review chapter pertaining to bike share and sections of the findings chapter associated with consumer needs and the first-last mile problem.

The paper was proofread for grammar, flow, and content by all group members.

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# Chapter 1: Introduction

Roadify is a company that aggregates and supplies public transportation information. Currently, this data is being displayed mainly through digital signage in cities, so that riders can visualize when their rides will arrive and how to reach their destination. One of the main objectives of this project was to find additional use cases for the API, which provides this transit information.

The IQP team proposed new use cases which would apply data from the API to address problems in public transportation. For example, people who use a public train or bus need a way of traveling from the station to their final destination. This short ride to one's final destination is known as the last mile problem, part of the greater first-last mile problem. People often use a private form of transit such as a taxi or an on-demand rideshare service to reach their final destination. In this scenario, there is a hurdle that has potential for improvement. Sometimes riders wait for long periods of time at the train or bus station for the private ride to arrive. Transit data from the Roadify API has the potential to solve this problem by reducing or eliminating this waiting time. After providing the transit data to rideshare drivers, they would be able to arrive at a train or bus station at approximately the same time that the rider's train arrives. Bicycles in bike sharing systems are also used to close this gap. Roadify's transit information was initially deemed valuable in assisting people who use these bikes to ride to or from a transit station. After taking on a specific direction, the major goals of the project became facilitating a partnership between Roadify and rideshare and bike share companies in order to help these groups develop solutions to the first-last mile problem.

Facilitating this partnership involved conducting research to answer relevant questions to develop new ideas. One of the first questions was how the market is divided among major rideshare and bike share companies. Answering this question marked the starting point to decide whom Roadify should partner with. The approach was to split market segmentation research into two parts: exploring how the market was structured for rideshare companies and the market for bike share companies. Research in this area answered specific questions such as how many rideshare or bike share companies there are, if any one company dominates the market, and how these various companies differ in their operations.

Following market segmentation, the IQP team developed a structure for the partnership. To begin this process, it was important to answer the question of how Roadify would formulate a deal for selling its API. Because the team was proposing a new application outside the scope of the API's major use case, signage, a new pricing method needed to be formulated. The approach taken to answer this question was to review existing case studies to find out what methods of pricing APIs have been used in the past. After comparing different pricing models, the goal was to identify which model or combination of models would fit the new use case of rideshare and bike share the best. Another goal was to decide on a "unit of consumption," or a way to gauge a partner's usage of the API for attaching a price to. Finally, an actual price for the deal was estimated using parameters from a dynamic Excel model as well as comparisons to other comparative API pricing plans.

Near the end of the project, the IQP team researched how much of a need there is for a solution to the problem with waiting time at a train or bus station. To gain a full

understanding of this wait period, the IQP team designed and sent out surveys to drivers, asking about how frequently and for how long a driver waits at a station to find a passenger. The survey also aimed to support a partnership between Roadify and rideshare companies by asking if drivers would use transit information if it were available in rideshare apps. The project was carried out with the motivation that facilitating the partnership between rideshare and bike share companies would have a positive impact on Roadify, its newly proposed partners, and riders alike.

## Chapter 2: Literature Review

This section details the basic background information and research that was used to formulate a plan for marketing the Roadify API to ride and bike sharing companies. Background information includes Roadify's corporate layout and the functionality of their API. Market segmentation on ride and bike sharing companies and a formulation of the first-last mile problem are also detailed.

### 2.1 Roadify

Founded in 2009 by Nick Nyhan, Roadify is a New York based company which aims to help people better understand transit. A platform-as-a-service (PaaS), Roadify aggregates and distributes open-source transit information from over 60 cities using its API. This information is then displayed through Roadify's mobile app, and kiosks and public screens of partners. The service is available in over 300 locations in the United States, Canada, the United Kingdom (London), and Germany (Berlin), according to the company's CEO (Kolber, 2015). Metrics are gathered from over 250 institutions on multiple forms of transit, including trains, buses, ferries, rails, Car2Go, and bike share stations ("Roadify - WPI API Initiative," 2015).

The services covered vary from city to city. Where it is available, live Twitter feeds from transit authorities such as the MBTA and real time tracking are also integrated into their mobile app (Roadify Transit, 2015). Approximately 60 million transit events are accounted for on a daily basis under their present scope ("Roadify - WPI API Initiative," 2015).

Roadify ultimately provides answers to three questions regarding daily transit from a consumer standpoint. As stated on their company website, these three questions are, “When will my ride be here?”, “Why is it late?”, and “How do I get there?” (Roadify Transit, 2015).

Roadify receives revenue from signage partnership subscriptions and by providing access to its API for a fee. Although it does have a free mobile app, the company focuses more on digital signage and marketing its API through various distribution channels. Transit Board is Roadify’s means of distributing digital signage through an accessible, easily customizable channel for displaying transit information (Roadify Transit, 2015). Less emphasis is put on their mobile app, which is free to use.

Digital signage subscription fees provide Roadify with its main revenue stream. Target distribution channels are divided into one of three categories, each potentially linked together depending on the structure of the partnership. The influencers are large organizations whose role is to provide an audience and a platform for signage agreements. These include sports organizations, technology companies, and academic institutions. Examples include the NBA, IBM, and MIT. Indirect Distribution consists of signage platforms, API platforms, and integrators of software, hardware, and marketing. Capital Networks, TouchSquare, and IBM are included in this channel. Direct Distribution includes the groups actively displaying the data using signage, apps, device features, or websites. Local governments, retail chains, and hotels fall under this category (“Roadify - WPI API Initiative,” 2015).

Under its current model, Roadify is penetrating the growing digital-out-of-home (DOOH) advertising market. DOOH frequency is measured in average minutes of



exposure per person per week. This number, according to PQ Media, was 14 minutes in 2013 and is expected to climb to 56 minutes per week by 2017 ("Exposure To Place-Based," 2014).

The actual size of the DOOH market is uncertain. Total market size estimates in 2010 ranged from a low of \$2.2 bil by MagnaGlobal to a high of \$5.06 bil by PQ Media (Platt, 2012). In any case, it is clear that the DOOH advertising industry is a growing, multi-billion dollar market.

Some examples of current uses of the Roadify API in digital signage are wearables and revenue displays. For wearables, Roadify has partnered with Samsung to provide its transit platform on their Gear S series of smart watches. For venue displays, the Barclays Center, a large indoor in Brooklyn, partnered with Roadify to broadcast transit data for Long Island Rail Road (LIRR) trains and subways on approximately 700 screens (Morales, 2015).

## 2.2 Functionality of the Roadify API

To better understand what features the Roadify's API provides to client software and the ability for the features to accommodate newly proposed use cases, the IQP team studied the API documentation. An API (Application Programming Interface) is a set of function calls or "features" that a software application can use to request information from or interact with an external service. In the case of the Roadify API, the function calls are ways to requests transit information. The functionality of the API can be divided into six features or API calls (Roadify API v2.9).

The first feature is called “List Nearby Transit.” A client can use this feature to request a list of nearby transportation that the Roadify API can supply information for. After providing the location and radius to the API, it will respond with a list of information describing each time that a transit option will depart from a stop. The API will reply with information about a particular stop for the vehicle in the trip including the stop where the departure is located, the name of the stop where the departure is located, the number of the stop in the sequence of stops that form the trip, the location (latitude / longitude) of the stop, and the time zone where the stop is located. The API will also reply with information specific to a departure, which describes the instance when the vehicle departs from the stop location. This information includes the service for the departure, the trip that the departure is a part of, how far the departure location is from the location provided to the API, how long from now the vehicle is scheduled to depart from this stop in the trip (provided only if real time data is available), how much time the vehicle will be delayed in the trip when this departure occurs (provided only if real time data is available), the time that the departure is scheduled to take place, and the zone where this departure will be. In addition, the API will respond with some extra information such as, the direction that the vehicle is heading in, the name of the destination of the trip, and the reporter that is supplying real-time data (Roadify API v2.9 · Apiary).

The API provides five other features. The second feature, called “List Zones,” provides a list of every transit system or zone that the Roadify API supports. Once a client application has this list of transit, it can use the “List Service Advisories for Zone” features to acquire a list of service advisories that affect a certain zone. Each service advisory in the list has a status value for the zone. The values given are Delays,

Suspended, Service Change, Planned Changes, Planned Work, Good Service, or Unknown. The client can also use the “List Routes for Zone” feature to obtain a list of all of the routes that are in a transit system (Roadify API v2.9 · Apiary).

After obtaining the routes in a transit system, the client can use the “List Trips for Route” feature to get information about the trip currently being serviced after being given a route and its zone. The information about the trip includes the arrival times for each stop in the route. Graphical client applications can also use the “List Shapes for Route” feature to acquire shapes that are defined by lists of points to create a map of a trip (Roadify API v2.9 · Apiary).

## 2.3 Rideshare Market Segmentation

Rideshare is a service that provides private transportation between different locations within a city. This includes both traditional taxi services as well as some modern services, which provide a smartphone app to request a ride. Two of the most popular rideshare services with a smartphone app are Uber and Lyft.

The concept of ridesharing is a broad term encompassing any system in which a rider provides a transportation service to a user. For this reason, ridesharing services such as Uber, Lyft, and Sidecar are considered along with traditional taxi companies such as the New York City Yellow Cab and Green Boro Cabs. Although car rental services such as Zipcar and Car2Go also fall into this category by their nature, the lack of a distinction between the driver and the rider makes them dissimilar enough to be disregarded in this instance. For the sake of this study, only services in which there is a driver and a rider separately are considered. These services will be referred to as peer-to-peer (P2P) transportation services.

In addition to Uber and Lyft, which are the best-known rideshare companies, there are other rideshare companies including Sidecar, Wingz, Carma, SideCar, Summon, Arro and Hailo. In Europe, there's also LeCar, SnapCar, BlaBlaCar, Djump, and Heetch.

Usually, the medium used by rideshare companies to reach users is a smartphone app. The passengers can pay through credit cards or PayPal accounts. Passengers use the smartphone apps to enter their pickup location and add a destination if they need a price estimate. The app then shows the nearest car, time to pickup, and real time tracking of the car. The passengers are allowed to rate the driver after the ride ends.

### 2.3.1 Uber

Uber is the rideshare transportation network company that develops, markets and operates the Uber App. The application allows passengers to submit a trip request, which is then routed to drivers who use their own cars. By May 28, 2015, the service was offered in 58 countries and 300 cities (Melham, 2015).

Uber needs quality drivers to sustain the frequency of requested rides. The secret to Uber's success has been a cause-effect relationship between the large number of drivers and large number of riders. Drivers like Uber because it provides a "busy" atmosphere, meaning they get high frequency of ride requests. Uber appeals to riders because the app is convenient to use, drivers are easily found in vicinity, and wait times are lower than that of Uber's competitors.

Uber's active driver base has grown from basically zero in mid-2012 to over 160,000 at the end of 2014. The number of new drivers has more than doubled every

six months for the last two years. Most of that exponential growth has come from the cheaper UberX service, which in most areas lets drivers use their own cars to pick up riders. UberBlack, the commercial-licensed black car service, has seen steady linear growth (Solomon, 2015).

The main incentives for Uber drivers are a higher pay compared to taxi drivers and flexible working hours. Hourly pay for drivers can differ based on location but is generally observed to be much higher than that of taxi drivers. The number of passengers using Uber has been increasing and keeping up with the expansion rate of riders. It is nowhere near a bottleneck. By July 9, 2014, there were 8 million Uber app users (Moss, 2014). By December 17, 2014, Uber was conducting a million rides daily (Huet, 2014).

| <b>Uber Earnings Per Hour or Hourly Wages</b> |   |   |
|---|---|---|
| <b>Cities</b>                                 | <b>Uber Driver-Partners<br/>(Earnings Per Hour)</b> | <b>OES Taxi Drivers and<br/>Chauffeurs (Hourly Wages)</b> |
| <b>Boston</b>                                 | \$20.29   | \$12.92   |
| <b>Chicago</b>                                | \$16.20   | \$11.87   |
| <b>Washington, D.C.</b>                       | \$17.79   | \$13.10   |
| <b>Los Angeles</b>                            | \$17.11   | \$13.12   |
| <b>New York City</b>                          | \$30.35   | \$15.17   |
| <b>San Francisco</b>                          | \$25.77   | \$13.72   |
| <b>Avg. BSG Survey Uber<br/>Markets</b>       | \$19.19   | \$12.90   |

Table 1: Comparison of median hourly earnings of Uber driver partners and hourly wages of taxi drivers and chauffeurs (Solomon, 2015).

Netbase provided a market analysis on social media sentiment in the Collaborative Economy in July 2013. The following figure shows the results:

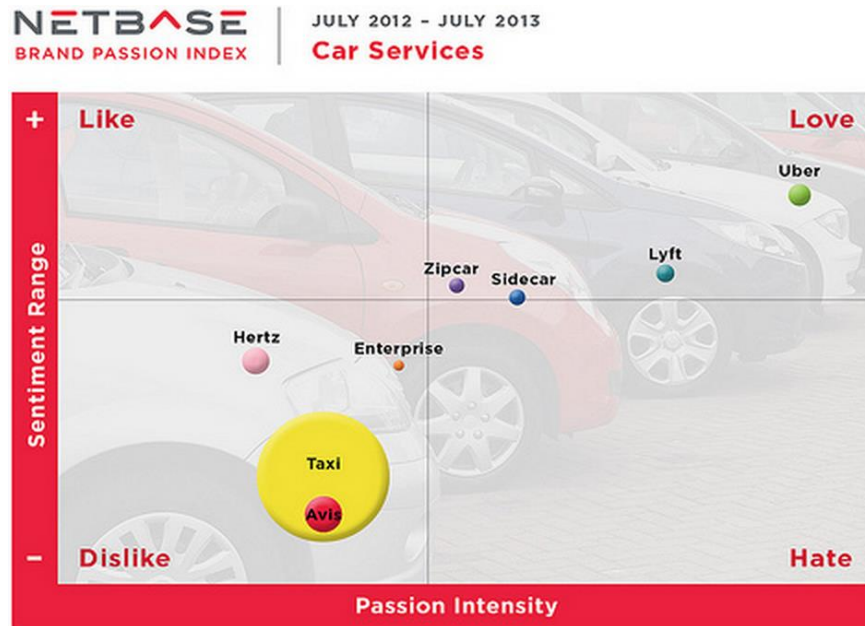


Figure 1: Brand Passion Index for Car Services (Owyang 2013).

Uber has been using an empathetic approach toward customers, leading to goodwill for them in the market. They have been using this as a base for their growth. The main reasons that customers of Uber appreciate the Uber App is that it provides cashless payment, rating systems to ensure a high quality of drivers, ETA for arrivals of drivers, ETA to destinations, and accurate fare estimates.

### 2.3.2 Traditional Taxi Services

City taxi services have been battling against newfound rideshare companies for years due to the pressure of competition and a shift in a long-held user base (Lazo, 2014). Although the two groups have not been getting along, they function very similarly. According to a UC Berkeley study of taxis and rideshare services in San

Francisco, taxi companies are adopting app-based dispatch more frequently, a service which until recently had been a distinguishing feature of new ridesharing services (Rayle, et al., 2014, pp. 2). For this reason, parallels can be drawn between taxi services and ridesharing companies. Roadify's intentions to partner with Uber, Lyft, and similar companies can easily translate to certain taxi companies.

According to Stiles, et al. (2014), the yellow cab system in New York City is the largest taxi service in the United States with over 50,000 drivers and 600,000 passengers per day, or about 236 million passengers annually (p. 1). Drivers for the Yellow Cab system operate almost solely in the Manhattan, with 90.3% of all pick-ups occurring in the borough (Stiles, et al., p. 5). This has spurred similar services such as livery programs and the green Boro Cabs, which will also be discussed in later sections.

There are three types of operation models used by yellow cab taxi drivers: fleets, driver-owned vehicles (DOV), and individual owner-operators (Stiles, et al. p. 2). In the fleet model, garages with several taxis are set up so that drivers can lease them on a daily or weekly basis for use. There is an associated fee which is determined based on regulations from the New York City Taxi and Limousine Commission (TLC). Driver-owned vehicles (DOV) are systems where the driver uses a car that he or she owns but which has a medallion leased from another party. A medallion is essentially a license from the TLC that allows a driver to operate a taxi in New York City. Finally, individual owner-operators own both the car they use and the medallion that allows them to operate a cab.

Yellow cab passengers in New York City are diverse, but two significant points discuss in detail are income levels and smartphone usage. Approximately 42% of users

have an annual household income at or exceeding \$100,000 annually (Stiles, et al., 2014, p.11). When one considers the financial demographics of Manhattan, where 90.3% of taxi pick-ups originate, this overrepresentation becomes clear. As of 2014, 38.7% of Manhattan residents have an annual income at or over \$100,000, whereas city-wide this number is only 25.7% of the population (US Census Bureau, Table S1901). In addition to having a higher-than-average annual income, riders are also notable for having a strong desire to streamline their rides by using their smartphones. According to data from a survey in the 2014 *Taxicab Fact Book* report, 67% of passengers owned a smartphone and 55% desire the option to locate taxis with their phone (Stiles, et al. p. 11).

Another increasingly popular taxi service in New York City is the green boro cabs. The demand for cab access in the city's other four boroughs led to its creation through the HAIL Act in 2013 (McCarthy & Metsch, 2013). Here, HAIL stands for Hail Accessible Inter-borough Licenses. The main restrictions written into this law are that boro cabs cannot pick-up passengers from lower Manhattan, also called the Manhattan Core, and are only allowed to pick up at Laganardia and JFK Airports for prearranged pick-ups ("2015 Hail Market Analysis," p. 2). This restricted area of pick-up operation is known formally as the HAIL Exclusionary Zone (HEZ), as shown in Figure 2.





Figure 2: Boro cab operations (green & grey) and HEZ (yellow) in NYC (“2015 HAIL Market Analysis,” p. 2)

Compared to the yellow cabs, Boro cabs deal with a much smaller set of passengers daily. As reported in the *2015 HAIL Market Analysis* from the NYC TLC, about 68,300 passengers use Boro taxis on a daily basis (p. 8). Since Boro cabs are restricted from operating in lower Manhattan, their prevalence is the opposite of what is reported for yellow cabs. About 98% of street hail trips originate outside of the Manhattan Core and the city’s two airports and only a minority of 19% end within the Core (p. 6).

In addition to the yellow and Boro cabs, there are other taxi services known as For-Hire Vehicles (FHVs). These are primarily liveries and community cars, black cars, and various services such as paratransit and luxury limousines which target a highly specific rider base.

| Service/Features                   | Vehicles | Providers         | Description                                      |
|------------------------------------|----------|-------------------|--|
| <b>Liveries and Community Cars</b> | 25,000   | 500 base stations | For-hire and pre-arranged services through bases |
| <b>Black Cars</b>                  | 10,000   | 80 base stations  | Serve corporate clients and various contracts    |
| <b>Luxury Limousines</b>           | 7,000    | > 200 companies   | Premium transportation for special occasions     |
| <b>Paratransit</b>                 | 2,000    | > 200 providers   | Serve healthcare facilities                      |
| <b>Fixed-Route Commuter Vans</b>   | 500      | 50 authorizations | Scheduled vans along fixed routes                |

Table 2: Alternative taxi services in New York City. (Stiles, et al., 2014, p. 2).

## 2.4 Bike Share Market Segmentation

Motivate offers a few different types of bike share. In this case, a bike share type is defined by the area in which it is implemented. Bike share systems can be classified as being either public or private. Public bike share refers to a bike share system used throughout a whole city. Such a system provides people with short distance transportation between locations within a city. There are many reasons for people to take advantage of bike share in a city. According to a study prepared by LDA Consulting (2015), bike share is used for social purposes by 85% of survey respondents making it the most frequent reason to use Capital Bikeshare bikes (p. 21).

The way that a public bike share system works is that someone can buy an access pass that grants use of the bikes any number of times for a certain time span. For example, Citi Bike provides 24-Hour and 7-Day access passes (“How It Works,” 2015). Each pass comes with an access code for taking a bike from a station. Citi Bike also provides an annual bike share membership. After someone takes a bike off of the

dock at a bike station, he or she can ride the bike for 30 minutes for a short term access pass or 45 minutes for an annual membership. Additional fees are charged for use beyond the time limit for a ride. The customer can then ride the bike to a different bike station in the city and put it onto the dock at the second station (“How It Works,” 2015). Motivate is responsible for managing many of these public systems (“Designing Bike Share,” 2015).

Private bike share refers to bike share systems that are within single college campuses or company campuses. Motivate also offers bike share to college and university campuses for transportation within a college campus. One goal of this is to provide sustainable transportation to college students (“Designing Bike Share,” 2015) . Private bike share is also used to enable employees to ride between buildings of a campus or corporation. It also provides a way for employees to ride a bicycle to work from public transportation to help solve the first-last mile problem (“Designing Bike Share,” 2015).

Zagster is a bike share company that provides private bike share to corporations. Their goal is to provide a convenient and fast way to travel between buildings on corporate campuses. For example, General Motors worked with Zagster to launch a bike share system on their campus. The employees of General Motors are now able to conveniently travel between buildings without having to wait for a shuttle bus. The employees also appreciate the environmentally friendly transportation and physical activity that the bikes provide (“Give Your Business,” 2015).

Motivate is a company that manages bike share systems around the world. The company provides a variety of bike share management services to client bike share

companies. Their goal is to “expand and mainstream bicycle ridership by designing, deploying, and managing world-class bicycle transit systems” (“About Motivate,” 2015). Each of Motivate’s clients provides bike share to one or more cities. Motivate helps its clients launch bike share systems using a thorough approach. They perform an analysis to determine feasibility and demand for bike share at city locations and then develop a business plan with the client (“Designing Bike Share,” 2015).

Before Motivate begins the process of launching a bike share system in a certain area, they evaluate certain properties of the area. For example, Motivate considers which types of other available transportation are in the area. The income level and employment in the area is also considered. After evaluating feasibility of an area as a whole, Motivate determines what the best locations in the area are for placing the bike stations. To do this, GIS based demand information is used. The next step that Motivate takes is to obtain permits to place the bike stations and to work with local agencies the requirements for each bike station site (“Deploying Bike Share,” 2015).

The company works with the property owners to obtain permits for each station. After which they hire and train workers to install the system in an area. If any issues prevent a station from being installed in a certain area, Motivate suggests alternate locations for the station. Motivate coordinates the ordering of all of the equipment and the assembling of the bikes and stations (“Deploying Bike Share,” 2015).

In order for a bike share system to continue running at its best, a lot of maintenance needs to be done. Motivate has IT employees that find trends in the use of bike share and provide feedback to the workers that maintain the systems. For example, the IT team may find that there are a large number of bikes in one area

creating congestion. To account for this, a street team will then use trucks to redistribute the bikes (“Managing Bike Share,” 2015). There are also other approaches to redistribute the bikes that are taken. For example, the system may encourage bikers to ride in a direction with less demand to keep the number of bikes at different stations balanced (“Managing Bike Share,” 2015). Below is a chart that shows each of Motivate’s client companies, the city that it serves, the number of stations it owns, and the number of bikes that it provides.

| Location   | Stations | Bikes  | Company                            |
|--|----------|--------|------------------------------------|
| Seattle, WA  | 50       | 500    | Pronto Cycle Share                 |
| Jersey City, NJ  | 35       | 350    | Citi Bike                          |
| Toronto Ontario  | 80       | 1000   | Bike Share Toronto                 |
| Columbus, OH   | 30       | 300    | COGO Bike Share                    |
| Bay Area (San Francisco, Redwood City, Palo Alto, Mountain View, San Jose), CA | 70       | 700    | Bay Area Bike Share                |
| Chicago, IL  | 400      | 4000   | Divvy                              |
| New York, NY   | 442      | > 7000 | Citi Bike                          |
| Chattanooga, TN  | 33       | 300    | Chattanooga Bicycle Transit System |
| Boston, MA   | 140      | 1301   | Hubway                             |
| Washington, DC   | 348      | 2800   | Capital Bikeshare                  |
| Melbourne Australia  | 51       | 600    | Melbourne Bike Share               |

Table 3: Client Companies of Motivate (“Ongoing Projects,” 2015).

As shown in the above Figure, Motivate has created and manages bike share systems in key cities in the US, including Boston, New York City, Chicago, and Washington, DC. This has contributed to why they are the leader of the market.

Other bike share companies operate similar to Motivate. The big difference however is the location of their systems that they have set up. As shown in the Figure

below, Bicycle Transit Systems has bike share systems in Philadelphia and Oklahoma City and further plans to set up a system in Los Angeles. However, Philadelphia appears to be their only sizable system and thus puts them far behind in the market share, while still allowing them to fulfill the need of a bike share in a still popular area.

| Location          | Stations | Bikes | Company |
|-------------------|----------|-------|---------|
| Philadelphia, PA  | 70       | 700   | Indego  |
| Oklahoma City, OK | 7        | 50    | Spokies |
| Los Angeles, CA   | ~        | ~     | ~       |

**Table 4: Bicycle Transit Systems locations including type, bike number, and partner company (Bicycle Transit Systems).**

Motivates’ second main competitor, Cycle Hop, has a competing amount of locations to that of the aforementioned company. These locations however are less attractive compared to the larger cities Motivate operates in. This does not prove to be completely negative since the cities listed still provide a strong market for a bike share company to exist.

| Location         | Type               | Bikes | Company            |
|------------------|--------------------|-------|--------------------|
| Phoenix, AZ      | City Public Sector | 500   | Grid Bike Share    |
| Tampa, FL        | City Public Sector | 300   | Coast Bike Share   |
| Orlando, FL      | City Public Sector | 400   | Juice Bike Share   |
| Santa Monica, CA | City Public Sector | 500   | Breeze Bike Share  |
| Atlanta, GA      | City Public Sector | 500   | Atlanta Bike Share |
| Ottawa, Canada   | City Public Sector | 500   | VeloGO Bike Share  |
| San Ramon, CA    | Corporate Campus   | ~     | BRite Bikes        |
| Louisville, KY   | ~                  | ~     | ~                  |

Table 5: Cycle Hop locations including type, bike number, and partner company (CycleHop).

## 2.5 First-Last Mile Problem

The first-last mile problem is defined in terms of the sections of a commuter’s trip in which another form of transportation is used to cover the gaps that exist between their home or workplace and a transit station (Cardoso, et al., 2014, p. 5). These gaps create added costs, inconvenience, and lag time during a trip, especially for those who commute on a regular basis and who do not own or regularly use a personal vehicle for their trips. The challenge is to make multi modal transit options which contain such gaps more convenient for users without forcing them to rely on a personal car.



Figure 3: A visual illustration of the first-last mile problem (Cardoso, 2014, p. 2).

In order to address this problem, several transit agencies in cities across the United States have attempted to create systems and partner with organizations and companies to provide options to users to close the gap (Jaffe, 2015). Uber, various taxi and shuttle services, and bike sharing systems all have a potential role to play and a financial interest in being a solution to this issue.

### 2.5.1 Uber and First-Last Mile

Though they can be costly for long-distance trips, ridesharing services' low per-mile costs, particularly for shared-ride services, make them reasonable for short journeys. A shared-ride option like UberPool could shuttle transit riders with an origin or destination as distant as four miles away from a station for under six dollars, disregarding surge fares, for a complete trip of eight dollars or less. By comparison, the average car ride in the United States costs around five dollars in gas and additional costs (Silver, 2014).. Additionally, unlike traditional forms of transit along fixed routes, taxi and shuttle services have the flexibility to reach user-specific destinations routinely.



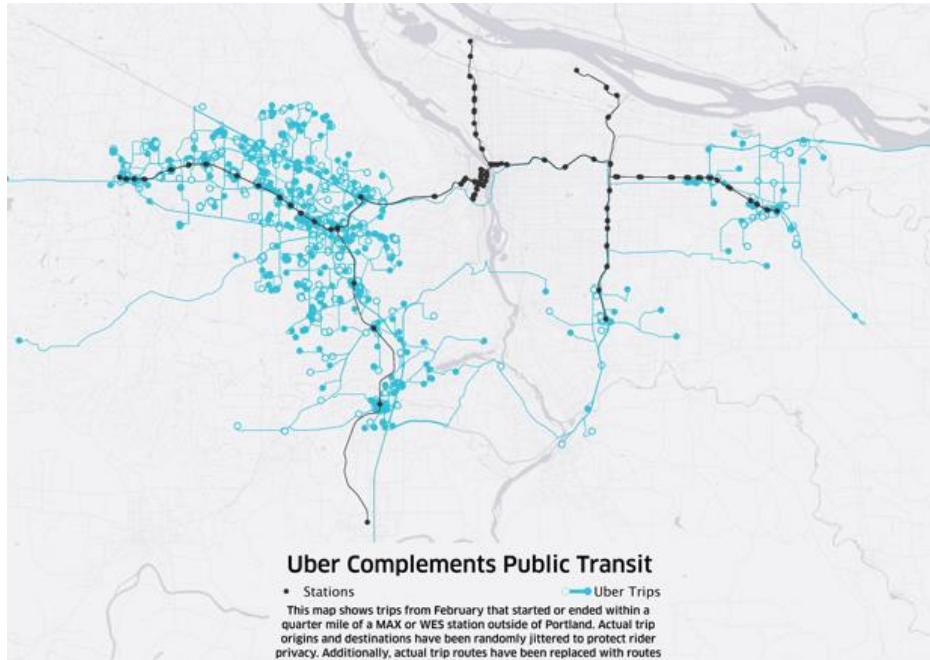
A commuter's home or destination would have to be along the fixed routes of trains or buses in order for such services to reach them at these locations. Since it functions as a taxi service, Uber can meet this commuter demand.

Uber is interested in playing the role of a first-last mile transit feeder. According to a study conducted in suburban Portland, Oregon, "1 in 4 Uber trips started or ended within a quarter mile of a public transit station" ("Uber and Portland," 2015). In that same report from the Uber Newsroom, the following was said about the company's role as a transit feeder:

"At Uber we are especially proud of our emerging role as a complementary service to existing public transportation. Here in Portland, we are helping make the Portland Metro Area more accessible to residents, commuters, and tourists."

A separate study of relationships between Uber and transit in New York City, conducted by renowned statistician Nate Silver (2014), showed a similar pattern:

"In census tracts that have no nearby subway lines, taxis are used only 27 percent as often, and Ubers 36 percent as often, as in New York overall. Use of taxis and Ubers is markedly higher in census tracts with even one nearby subway line, and it continues to increase until you get to the handful of census tracts saturated with 10 or more nearby subway lines"



**Figure 4: Map of Portland, Oregon with Uber pick-ups and drop offs (blue) within 1/8th mile proximity to MAX/WES stations (black) (Uber Newsroom, 2015).**

A similar study conducted in New Jersey revealed that of the 1.3 million rides taken in September 2015, 25% were to transit stations (Higgs, 2015).

It is clear that synchronicity between public transit and micro-transit services like Uber is extremely valuable. Integration of Roadify’s API into the Uber app accomplishes this by providing drivers with up to date information on intermediate forms of transportation before they reach their pickup destinations. This reduces driver wait time at train and bus stations and ultimately increase the frequency of rides.

## 2.5.2 Lyft and First-Last Mile

The second most popular ridesharing service in the United States, Lyft, has also been interested in being a transit feeder and makes similar claims about connecting riders to transit. In a 2015 Economic Impact report, Lyft claimed that 25% of its riders use the service to connect to transit systems (“Lyft’s Economic Impact,” 2015) .

Lyft has also been actively supporting a company campaign called “Friends With Transit,” in which they strive to bridge the gap commuters face while using transit. According to statistics from their website page on the subject, “33 percent of Lyft rides in Boston start or end near a transit station,” as well as 37% in New York City, 25% in Chicago, 20% in Washington, D.C., and 24% in San Francisco (Friends With Transit, 2015). These city-wide numbers are comparable to Uber, demonstrating that this trend is not exclusive to one company or one region.

## 2.5.3 Boro Cabs and First-Last Mile

In New York City, like in other large cities such as Boston and Chicago, car ownership is much lower than the national average (“Car Ownership,” 2014). For this reason, public reliance on transit is incredibly high. In relation to this, the *2015 Hail Market Analysis* paper states that 59% of Boro trips in the first half of 2015 began or ended within 1/8th of a mile from a subway station (p. 9). The study additionally shows that about 80% of Boro cab rides beginning within 1/8th mile of a subway station end in an area that is not within a convenient walking distance of the station, which suggests “that passengers use Boro Taxis to reach destinations that are less accessible by transit or as a way to complement transit for the ‘last mile’ of a trip” (p. 9).



**Figure 5: The most popular boro cab pick-up destinations from January to June 2015. Note also the HEZ highlighted in yellow. (“2015 HAIL Market Analysis,” p. 9).**

The relationship to the first-last mile problem is evident. A much higher frequency of riders in this time period used Boro cabs in proximity to transit than either Uber or Lyft. This could be due to two factors. First, the time frame was only for the first half of the year in 2015. A broader study covering more time would likely be more accurate, although the data from Uber was similarly limited (for example, a single month in the case of the Portland study). More likely, this data may be biased to New York City. Comparative data is not readily available for most cities smaller than New York City, since their taxi systems are more prominent and thus more heavily researched. Such high frequencies may not be common in other cities or, at least, cities without as high a population or as great a transit dependence as New York City.

While the Boro cabs clearly figure in as a bridge to solve the last mile problem, the first mile component is less established. There is not one station at which there were

more than 500 daily drop-offs within a 1/8th mile radius, whereas the top pick up location, the 125th Street stop on the Lexington Avenue Line, had around 1137 daily pick-ups on average within that same radius (“2015 HAIL Market Analysis, p. 9). This means that people are generally using these services to get to their destination rather than to get from their starting point to a transit location.

## 2.5.4 Bike Share and First-Last Mile

Along with ridesharing, bike sharing is also used to connect commuters to transit hubs during multi-modal trips. Three case studies are consulted to demonstrate this and to highlight key differences in how ridesharing and bike sharing function in this manner.

In their 2014 study on first-last mile planning, the Los Angeles County Metropolitan Transit Authority noted that a majority of their riders (64%) make at least one transfer during their trips to a single destination (Cardoso, et al., 2014, p. 9). This means that multi-modal transportation is prevalent among users in the Los Angeles area. A prominent sub component of these transfers is from or to is bike riding, specifically bike sharing (p. 48).

The Metro plan proposes creating a “Pathway,” which would accommodate several alternative modes of transportation along the normal transit path, including shared ride and taxi services as well as bike sharing and rental stations (p. 13). In the plan, several goals are outlined to implement this feature along the Pathway as a user option. Creating convenience for drop-off and pick-up and integrating systems with mobile technology for navigational improvement would also be a part of the plan to bring bike sharing into the fold of the Pathway (p. 48). Streamlining bike drop-off and pick-ups

would allow for bike sharing systems to work better in relation to multi-modal transit trips. The study also recommends that planners deploy signage at the stations (p. 48). Whether these are digital or static platforms is not specified. Directional signage also may take precedence over advertising-based systems.

According to research conducted in Vancouver by Quay Communications (2008), publicly shared bikes “fill an important niche in the urban transportation system in terms of trip length and costs” (p. 9).

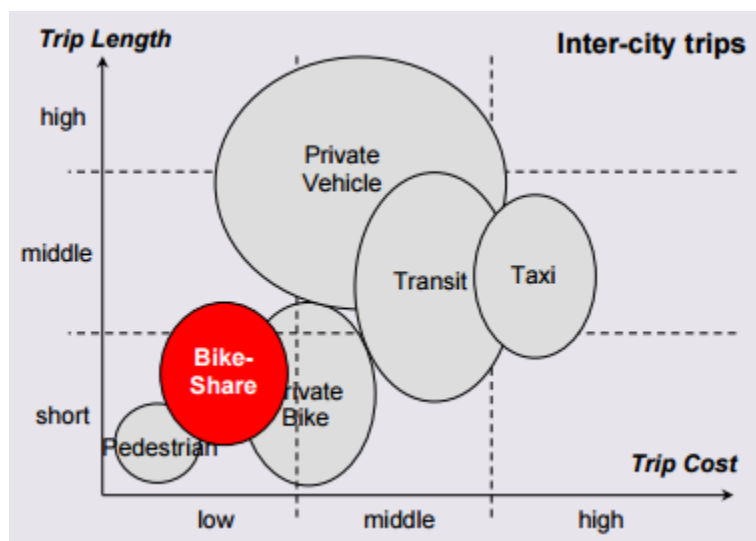


Figure 6: Bike-sharing, relative to other modes of transportation based on trip cost and length. Note also its relationship to transit and private biking (Quay Communications, 2008, p. 10).

In this diagram, it is shown that bike sharing is generally used for low-cost, short-length trips, compared to privately owned bikes which cover a wider range of cost and trip length variables. Studies cited in the report indicated that the average rider’s biking distance in the U.S. is approximately 2.2 miles (Quay Communications, 2008, p. 10). This niche described by the paper would essentially be the first or last mile of a user’s trip. Note that the average trip length is on average far less than a private vehicle or a transit ride. It is implied then that bicycle use, whether private or (for our purposes)

public, would suffice in filling the transit gap inherent in the first-last mile problem. Both private and public bike usage covers longer trips than walking.

Capital Bikeshare is a bike sharing program operated by Motivate International and sponsored by several cities and counties including Washington DC, Arlington County, Virginia, and Montgomery County, MD (LDA Consulting, 2015, p. i). In 2014 a user survey of over 4,000 members was conducted which showed that roughly 87% of Capital Bikeshare users live within a quarter mile of a station and 89% work within a half a mile from one (p. 7).

Given this information, it is clear that bike docking stations are within a favorable walking distance from both the homes and the workplaces of a majority of the program's users. This supports the potential for bike sharing to fill the gap in both the first and the last mile of travel in and out of cities. However, it is important to note in this same study, it is shown that bike share access actually resulted in an overall decrease in public transit use. More than half of respondents (58%) used the Metrorail subway less and a similar percentage (52%) used the bus less often (LDA Consulting, 2015, p. vi). For this sample, it appears that the close-proximity access to bike docking stations at the start and end of one's typical workday journey may not be complementing but substituting the intermediate transit rides which would normally take place.

One set of responses detail why riders used Capital Bikeshare for induced trips, those which would not have been made if the service was not present. A lack of a bus or train stop at the destination (37%), no bus or train running at all during the time of day the trip was made (23%), the affordability of biking over other methods (25%) and a desire to exercise (18%) were the main reasons people were encouraged to make a trip

in the first place (LDA Consulting, 2015, p. 36). Another explanation may be the distances traveled on average. If they are short enough, they may be achieved solely through biking, rather than needing to switch to another mode of transport for a longer portion of the journey.

Despite this, there is still a sizable amount of users who use the Capital Bikeshare program to access transit stops. A majority of respondents (64%) had at least one trip in the prior month that began or ended at a train station, with a smaller minority (21%) having biked for this purpose at least six times or more in that time (LDA Consulting, 2015, p. 26). Around 24% reported using the program to access buses in a similar fashion in the month before.

## 2.6 Additional Considerations for Partners

The following are major considerations for implementing a potential partnership between Roadify and transportation sharing services. These include pre-booking for ridesharing and a discussion on the signage and app considerations for using the Roadify API for bike sharing.

### 2.6.1 Pre-Booking and Driver Desires

Rideshare companies like Uber have a history of ensuring customer satisfaction, as shown by the customer appreciation chart displayed in Figure 2. A partnership with Roadify would encourage rideshare companies to implement a service such as pre-booking, where a user on a train could select which station they will be arriving at. The API could then take this booking, find a driver, and notify them of the time that the train will be arriving at the given station, allowing the driver to maximize efficiency. For



example, say that a rider on a train is going to arrive at the train station in 15 minutes. The API would then alert a driver of this and if they accepted the ride, they would know that they have time for a short ride in between that. They could also pick up someone who is trying to go to the same station, optimizing the amount of rides that they would have had as opposed to the time they spent waiting for the train to arrive at a time they guessed at.

This feature would only be implemented in a ridesharing application however, due to the nature of this service in contrast with bike sharing. Simply put, whereas there is a need for both driver and rider to synchronize at some point in the planning of a ride, there is no need for this in the case of bike sharing. The rider and driver are the same individual, and a biker at a bike sharing station would simply check availability at a given station and take a bike of their choice. Some services such as Social Bicycles allows for bike reservation in advance through either their website or at the station (Social Bicycles, 2015), but this still does not require interfacing between a separate driver and rider. Moreover, pre-booking would not optimize multi-modal trips since there is no additional lag time to overcome from simply finding a ride. Finally, signage options would likely be the ideal route for Roadfiy to pursue a partnership with a bike sharing company, which does not support an integrated pre-booking feature. Therefore, pre-booking is not considered for bike sharing implementations.

An aspect of the potential partnerships of Roadify with rideshare companies to implement transit info into the driver side of the rideshare app. Information such as train times could be used for informing drivers about the updated times of when trains are arriving at stations to minimize down-time and wasted time where they are just waiting

for a train to arrive ignorant of the schedule. As it will be shown from a small sample survey, rideshare drivers are overwhelmingly interested in using this data if it could be implemented. Ridesharing companies would also want to implement these functions due to the increased revenue that this wasted time could provide if optimized.

A driver might occasionally wait at a local train station for instance when he is not currently driving someone to their destination. He may have a basic understanding of the train station, but the train schedule often changes due to the route sometimes being delayed of times up to 30 minutes late. The Uber app that he is using on his phone notifies him that the train is running behind schedule and will be 25 minutes late that day. He then knows he can instead drive around to try to pull other rides in the time that he knows he has before the train will arrive at the station with prospective riders.

## 2.6.2 App and Signage Options for Bike Sharing

There are two possibilities for using data from the Roadify API in the context of bike sharing: signage at bike stations or incorporation into bike share mobile applications. The first way is to integrate the information into bike share apps. The second way is to display the transit information on signage at bike stations. Both bike share apps and signage have advantages for integrating transit information into bike share systems.

A large advantage to apps is that the number of people using smartphones in the United States is rapidly increasing. Currently, 64% of the United States population uses smartphones. This number has quickly increased from 35% in 2011 (Smith, 2015). According to data from Statistia (2015), the number of smartphone users in the United States has increased from 62.5 million in 2010 to 190.5 million in 2015. Other

advantages to smartphone apps is that they are interactive and personalizable (Smith, 2015). These advantages would enable someone to interact with the presentation of the transit information in the bike share app and personalize it to fit their own needs For example, someone could store “favorites” in the bike share apps that would enable the user to quickly display information for public transit stations that he or she commonly uses within a city.

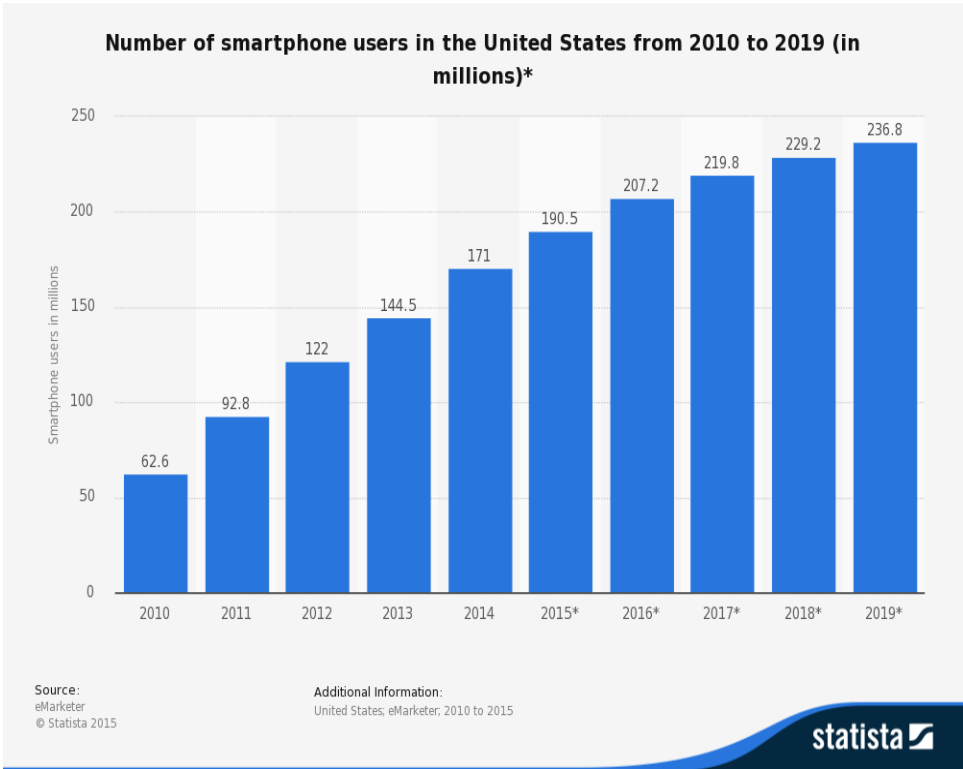


Figure 7: Number of Smartphone Users in the United States (Statista, 2015).

A large advantage to the signage approach to integrating transit information with bike share is that many people learn that a business exists because of its signage. According to The Benefits of Signage Infographic (2012), 35% of passerby would not be aware of a business at a certain location without a sign. Another advantage to signage is that it has a low per view cost at \$0.02 per one-thousand viewers (Benefits of

Signage Infographic, 2012). These advantages would enable both users of bike share and other people in cities to see the transit information that would be integrated with bike share systems. Roadify and the bike share companies could simultaneously earn revenue by using the transit information as a way of increasing viewers of advertisements on the same signs.

## 2.7 Pricing Model Case Studies

One significant portion of the project was determining the optimal pricing model to use in order to recommend a final pricing scheme for the API. The following section details numerous case studies in which API and other software pricing models were examined to analyze the strengths and potential fallbacks of the three major models: pay-as-you-go, tiered, and subscription fee. These would ultimately be the three models considered ideal for Roadify's situation. They were consulted in order to illustrate the nature of these pricing models. Note that pay-as-you-go is denoted "PAYG" in headings.

### 2.7.1 Pay-As-You-Go Case Studies

Evolved from their previously vague model, the Google Maps APIs now use a PAYG model for pricing. Google Maps Geocoding, Directions, Distance Matrix, Roads, Geolocation, Elevation, and Time Zone APIs are free for the first 2,500 requests per day. The cost is \$0.50 USD for each 1,000 additional requests up to 100,000 requests per API per day. Developers more than 100,000 requests per day should consider a premium license (Olanoff, 2015).

TraceLink Inc., a Massachusetts-based company “protects patients, enables health, grows profits and ensures compliance across the global Life Science supply network through its many-to-many business collaboration platform, the TraceLink Life Sciences Cloud” (Amazon, 2015).

The pay-as-you-go model of AWS has allowed TraceLink to develop their own customer model to be more attractive. "Using AWS lets us align our fee structure to the value created for our customers (Amazon, 2015)," according to Senior VP of Product and Cloud Engineering Peter Spellman. Using AWS results in huge cost savings increased business value for all of their partners. In one such example, “TraceLink can help a pharmaceutical company improve outsourced manufacturing performance by quickly integrating it to its 75 network partners through a single connection to the TraceLink Life Sciences Cloud, saving the company 4 years of time and more than \$9M in integration cost compared to traditional point-to-point methods. (Amazon, 2015)”

The API management company Apigee offers its management platform for free, up to a limit of 3.5 million API calls per month. Although this number is a reasonable amount of calls per month, it pales in comparison to other larger APIs such as Twitter’s, which averages around 13 billion API calls per day. Those using Apigee who exceed the cap of API calls have to use a pay-for service variant after the threshold is reached. The first tier in their rate structure is \$9,000 per month, based on traffic and storage capacity (API Marketing, 2012).

Models such as this - a freemium baseline and a pay-for tiered offer above a threshold - are common marketing techniques for products of all sorts, including software, APIs, and API management tools in the case of Apigee. Such a move is

especially common “in response to competition from open source alternatives” using the same model.

Twilio is a cloud-based communication service that follows a modified “pay-as-you-go” model. Customers pay \$0.02 per minute for outbound calls and \$0.01 cent per minute for inbound calls with a \$1 per month fee for the phone number itself. A similar model is used for SMS service pricing. Customers are able to easily monitor data usage and see how the service is benefiting their business. As usage is scaled up, the company provides larger volume discounts above 500,000 minutes per month, tied to usage benchmarks (Jung, 2013, p. 8).

Salesforce.com is a software company best known for its customer relationship management (CRM) software. It offers this CRM software through a bundled cloud-based offering with five pricing tiers ranging from \$5 to \$260 per user per month. Salesforce.com also has Force.com, an integrated platform featuring an API for developers to create their own apps. Access to functionality is divided into light use and enterprise level categories. By creating tiers on multiple product offerings, Salesforce.com provides flexibility based on varying customer needs, which is crucial for successful price tiers (Jung, 2013, p. 9).

## 2.7.2 Tiered Model Case Studies

Bundling tiered offers can result in offerings which are of low value to some customers. Since not all users may use all features of a higher tier equally, some users may feel that they are overpaying. This leads to a conflict between per-user pricing and tiered pricing. This issue was addressed by Assistly, which is now a part of Salesforce as desk.com. Assistly initially used a tiered pricing model for its clients. In 2011 the

company restructured its pricing model so customers would be assigned a full time customer service agent for \$0. A “flex agent” could be added for \$1/hour or a full-time agent for \$29/month (prepaid annually). This combination of consumption and tiered pricing “helped its customers better match seats to usage.” The perception of customers “growing” into their costs as opposed to having a higher price tier forced upon them again presents itself as an appealing element (Jung, 2013, p. 10).

Hubspot offers a number of applications for marketers through a SaaS platform. It actually uses a model that is a hybrid of the freemium, consumption, and tiered models. Firstly, the platform’s functionality is divided into three service levels (basic, pro, and enterprise) that offer progressively more features. Users can then select the number of contacts and leads that they want access to through the platform which are charged on a per month basis. This model together combines elements of the consumption and tiered models discussed above which allows the customer to select their optimal service level. Lastly, HubSpot allows for a 30-day free trial to take advantage of the benefits of a time-based freemium model (Jung, 2013, p. 10).

### 2.7.3 Subscription Fee Case Studies

Amazon Prime is a yearly subscription contract with consumers to allow them to purchase certain products through the retail website with free shipping. Throughout the years, Amazon has expanded the various deals and features associated with their Prime Membership, such as access to streaming through Prime Video.

The subscription service for Amazon Prime results in several benefits for consumers. Free delivery creates convenience, which in turn increases purchase

frequency. According to Wharton, shoppers spend 30% more per order when free shipping is included (Selz, 2014).

For businesses, predictability makes Amazon Prime easy to manage. It is easier to account for revenue loss from return for instance since item returns do not impact the guaranteed revenue from the yearly subscription. Retention rates are also extremely high for Prime users, upwards of 92% (Leary, 2014). This again makes revenue forecasting simpler since subscribers of valuable, useful services tend to stick with them for long periods of time.

The video streaming service Netflix currently employs a flat rate subscription fee for consumers to view content on their streaming platform. The current going rate for this fee is \$7.99/mo. One criticism of this method is that the flat rate subscription fee could fail to capture revenue from users who would pay more for greater access to content. One proposal to resolve this would be a tiered subscription fee, combining elements of a subscription fee and a tiered pricing model, dividing up offers based on consumer use or feature access (Chuck Culp, 2013, p. 17).

This model has been critically challenged as a viable pricing structure for content streaming, but in relation to a business-to-business API deal, it may prove useful to consider. Roadify may wish to create a tiered subscription offer for companies depending on how much they intend to use the Roadify API. For example, a larger company like Uber whose implementation of the API would be used in a higher volume, may be more willing to pay a higher subscription fee for more dedicated service and scalability from Roadify's end. In contrast, a lower priced subscription fee could appeal



to Motivate, whose implementation in signage at bike stations would be far more limited in deployment and would require less support from Roadify.

# Chapter 3: Methodology

This section details the major steps which were taken in order to both determine the project scope and pursue major objectives outlined in the initial proposal to Roadify. Along with the process of determining research objectives and goals, market segmentation research, pricing model determination, survey design, potential Uber revenue model formulation were determined.

## 3.1 Determining Objectives and Research Goals

To understand more about the Roadify API and its potential applications, extensive brainstorming was done at the start of the IQP. The following implementations were suggested:

**Airport Transit:** The idea proposed integration of the Roadify API to screens on airports. This could help collaboration between different airlines for local transit on airport (shuttles). These shuttles could travel between parking lots, boarding etc.

**Hotel Signage:** The idea proposed was to provide transit information to tourists that are new to an area. This information could be provided by hotels or tourism companies to their customers. The customers could use this data to find routes to tourist attractions.

**Local Recommendations:** Local companies like food chains would like to be recommended on billboards if there is time before transit will arrive. The idea proposed would allow Roadify to make profits through advertising.

Rideshare: The proposed idea was to integrate Roadify API with rideshare apps and inform riders when transit is arriving, so they could interact with higher concentration of riders.

Bike Share: The proposed idea was to implement Roadify API at biking docks to deliver the locations of open docks nearby and transit information to the users.

After implementing constraints like development required for the API, Return on Investment etc, on a higher level, the ideas related to rideshare and bike share were shortlisted and polished as discussed in the following sections.

### 3.1.1 Determining the Final Use Cases

The rideshare idea was refined to have two components: transit information for drivers and transit information for riders. Transit locations have a large concentration of Uber drivers and Uber riders. However, the concentration of riders is high only when a train/bus arrives. This leads to drivers waiting extensively for transit to arrive. If they would have access to transit information, they could spend the waiting time productively by picking rides at other locations, and expand their profits by arriving to the transit areas when a train/bus arrives.

Rideshare competition exists not only in price, but also in popularity. Netbase (see Literature Review) provided a market analysis on social media sentiment in the Collaborative Economy in July 2013. Uber has been using an empathetic approach toward customers, leading to goodwill for them in the market. To further increase the convenience of rideshare users, the feature proposed was to allow pre booking from transit. Roadify data could be used to estimate time of arrival, and synchronized Uber's data of drivers ETA to help riders save time.

### 3.1.2 Final Proposal Plan

The final proposed plan was focused around rideshare and bike share as core use cases. The research for these was divided into different sections.

**Market Segmentation:** Different rideshare and bike share companies were discussed. Competitive analysis was done between these, and international markets were explored. Further, information was found on case study basis for Uber, Yellow Cab, and Motivate.

**First-Last Mile Problem:** Rideshare and bike share were viewed in terms of solutions to the first-last mile problem to transit. These could be used in combination with transit to make the overall travel cheaper than the cost of owning a car.

**Pricing Models:** Various API pricing models were studied in depth. Models that were compatible with the Roadify API were further explored, and existing examples of implementation were studied. Based on these, a suitable model was proposed for both potential partnerships.

**Consumer Needs:** Current market needs for rideshare companies and their consumers were studied, and potential solutions in the scope of the Roadify API were proposed.

## 3.2 Research

In order to justify the proposed use cases, research was conducted on market segmentation and the first-last mile problem. A clear role was established with ride and bike sharing services as potential solutions to this problem. Moreover, a distinct

financial interest was identified for Uber and similar ridesharing companies in filling this role.

### 3.2.1 Market Segmentation

For both ridesharing and bike sharing services, market segmentation was conducted through research into the major players in each respective industry. Uber and Motivate were identified as the major companies of interest in the ride and bike sharing markets, respectively. For ridesharing market segmentation, two forms of ridesharing were determined in order to differentiate between peer-to-peer app-based ridesharing services and traditional taxi services. This was decided due to the common nature shared between the two different groups. Namely, both involve paid transportation in which the rider and driver are not the same individual.

Ride rental services such as Car2Go and Zipcar were initially considered but ultimately disregarded because the rider and driver in this scenario are not the same individual. It was also determined that these types of rides do not figure prominently in multi-modal trips involving transit, since they function temporarily as a private vehicle. These vehicles would not figure as prominently in multi-modal transportation since drivers would be more likely to take them from start to finish rather than switch off in between rides. Moreover, individual rental riders would have access to apps such as the Roadify mobile app to give themselves with more relevant transit information and therefore there would not necessarily be a benefit to providing this information in the cars themselves.

The main sources of this information were the company-owned websites of major companies of interest, various market research studies conducted by the companies or

affiliated agencies, city-based government documentation, and relevant articles of interest. Motivate was also contacted directly to determine their role in managing the mobile applications of their partner organizations.

### 3.2.2 Contacting Motivate

For collaboration between Roadify and bike share, the best potential partner had to be determined. To answer this question, it became necessary to determine whether Motivate has enough influence over its subsidiaries to incorporate Roadify's API into the bike share app for each of its subsidiaries. If this were the case then Roadify could propose a partnership with just Motivate to reach all bike share that Motivate manages, which is in many cities. Otherwise, Roadify would need to approach each subsidiary separately in order to reach as many cities. This question was answered by contacting Motivate via email.

A total of five questions were asked in the inquiry and a representative in the Business Development department responded with the answers. The first question that was asked was, "What aspects of your subsidiaries do you manage after their bike share systems have been launched?" The goal of this question was to understand Motivate's influence on its subsidiaries for already established bike share systems. The second question asked was, "Do you build your subsidiary's smart phone apps?". The third question was, "Do you manage the smart phone apps after you build them?". The purpose of this question was to find out whether Motivate could potentially modify their subsidiaries app's to incorporate the Roadify API. The next question for Motivate was, "How do you and your subsidiaries share profits from bike share systems?" The reason for this question was to determine whether Motivate could profit from incorporating the

Roadify API into its subsidiaries. If Motivate would not profit by making use of the Roadify API then it would not be worthwhile to prepare a proposal to approach Motivate with. The last question asked was, “Who are your main competitors?” The reason for this question was to obtain a better idea of the bike share market by knowing who is mainly competing with Motivate. After receiving a reply from a representative in the Business Development department, the results were interpreted. Refer to section 4.2 for the analysis of the responses.

### 3.3 Pricing Models

Following research into the ride and bike sharing markets as well as establishing a justification for the implementation of Roadify’s transit API for the ridesharing use case, a set of pricing models were considered to be used to shape the deal Roadify will ultimately attempt to make. Initial considerations included: freemium, pay-as-you-go, unit-based fees, software-as-a-service, content syndication, location based offers, query based offers, tiered pricing, all-you-can-eat, and subscription fees. All of these models are popularly used to price APIs or similar digital content. The focus of the discussions and research leading up to the shortlisted models was on the ridesharing partnership, but it was decided that all models considered could also be thought of in terms of a bike sharing deal except in the case of a digital signage agreement.

To determine which pricing models would be applicable in the case of the proposed partnerships with Roadify, research was conducted on the variants listed above. Results from this research, group considerations, and discussions with Roadify’s CEO helped to narrow down which models would be most applicable to the Roadify API use case, primarily for ridesharing. Except in the case of a signage-based platform, for

which Roadify already has an existing pricing method in place, the app-based bike sharing use case was determined to be functionally similar enough to the ridesharing use case to have the same pricing models considered for it as well.

Case studies and white papers were consulted in order to formulate a general understanding of how each model functioned, its pros and cons, and in which business scenarios it was most applicable. Further discussion both among the team and with Roadify's CEO refined the list and justifications were described for disregarding certain models, due to irrelevance, complexity, or potential weaknesses when applied in either the ride or bike sharing use cases.

Once a set of acceptable pricing schemes were found and mutually agreed upon both among the group and with Roadify's CEO, a final recommendation was drafted for Roadify to use in their partnership plans. Along with this, for the Uber use case specifically, an Excel-based pricing model was created using data from an Uber driver survey. This survey was distributed among a well-known Uber driver's forum. Results from this survey were used to estimate Uber's potential cost savings from using transit data from Roadify's API to reduce wait times to a negligible time frame. Furthermore, parameters and assumptions were specified based on available statistics, such as average driver shifts and frequency of interaction with transit users. In addition to the group's own model, Roadify CEO Scott Kolber also worked in conjunction with the team to develop a model using similar parameters. Assumptions and conditions from both models were integrated into a final model which would be used to determine how much potential revenue Uber could save by using data from Roadify's API.



## 3.4 Customer Needs and Survey

The main implementation of transit data for rideshare drivers, in this case Uber, and if they would be inclined to use this information to their advantage. Our estimated results are below on each above feature and while these are ideals, survey results will narrow down the exact statistics.

A simple four-question survey was distributed on an Uber drivers' forum known as Uberpeople.net. This website allows Uber and Lyft drivers from around the country to engage in discussions ranging from personal conversation to fares and technology. This forum was used as the major platform for gauging rider interest in the data the Roadify API would provide if it were incorporated into the Uber app.

In order to broaden the scope of drivers to be questioned, the survey was later expanded beyond the UberPeople forums and targeted at non-Uber drivers as well. The survey was distributed to Facebook groups for Rideshare drivers. Due to time constraints and a limited ability to conduct the surveys in a timely fashion, the sample size was only 11 drivers. Although the sample size was not large, it still offered a starting point for understanding driver interest. The IQP team strongly recommends that Roadify or Rideshare companies conduct this survey with drivers on a larger scale to gain a better understanding of driver interest in the technology.

The four questions were as follows:

1. In which city or cities do you operate?
2. How frequently do you find yourself waiting in close proximity to train and bus stops?

3. For how long do you wait at train and bus stops on average?
4. Would you use information about when trains and buses are scheduled to arrive if it was available in the Uber, Lyft, or other rideshare app?

The latter three sections were segmented into intervals of frequency and desirability based on the question at hand. Frequency of wait time in proximity to transit stops was inquired on a scale from never (0 times per day) to very frequently (10 or more times per day). Duration of average wait time at these stations ranged from less than five minutes to over half an hour. A simple yes or no question was posed as to whether or not drivers would information about train and bus arrival times if it was available in their respective employer mobile applications. The full survey questions can be found in Appendix A.

This survey was available to be filled out from the dates of November 9, 2015 to December 1, 2015. At that point, the team was notified that to officially send out a survey, we would need to have requested an exemption from the Institutional Review Board “before any human studies are begun” (Institutional Review Board, 2015). However, this was an oversight. The team learned about this when an attempt for a WPI campus wide survey was made through the IGSD office. At this point, the IQP team pulled the surveys and applied for IRB exemption. After acquiring the exemption, the IQP team realized that it would not cover surveys done at a previous date. Discussions with our faculty advisor and a member of the IRB determined that the survey was low-risk and that the discrepancy would not impact the integrity of the survey.

## 3.5 App and Signage Considerations for Bike Sharing

One of the considerations of transit information being integrated into bike share systems is the form of media that would be used to present the information. Two main ways to present the transit information were considered. The first way is to integrate the information into bike share apps. The second way is to display the transit information on signage at bike stations. Both bike share apps and signage have advantages for integrating transit information into bike share systems.

A large advantage to apps is that the number of people using smartphones in the United States is rapidly increasing. Currently, 64% of the United States population uses smartphones. This number has quickly increased from 35% in 2011 (Smith, 2015). According to Statista (2015), the number of smartphone users in the United States has increased from 62.5 million in 2010 to 190.5 million in 2015.

Other advantages to smartphone apps is that they are interactive and e (Smith, 2015). These advantages would enable someone to interact with the presentation of the transit information in the bike share app and personalize it to fit their own needs For example, someone could store “favorites” in the bike share apps that would enable the user to quickly display information for public transit stations that he or she commonly uses within a city.

A large advantage to the signage approach to integrating transit information with bike share is that many people learn that a business exists because of its signage. According to The Benefits of Signage Infographic (2012), 35% of passerby would not be aware of a business at a certain location without a sign. Another advantage to signage is that it has a low per view cost at \$0.02 per one-thousand viewers (Benefits of

Signage Infographic, 2012). These advantages would enable both users of bike share and other people in cities to see the transit information that would be integrated with bike share systems. Roadify and the bike share companies could earn revenue by using the transit information to increase advertisement viewer frequencies on the same signs.

# Chapter 4: Findings and Results

The following section details the major project findings. These findings include the nature of potential partner companies in question from market segmentation, the relationship of the first-last mile to Roadify's partnership with ride and bike sharing companies, various case studies of pricing models for comparative APIs, and a model for pricing and justifying the API transaction.

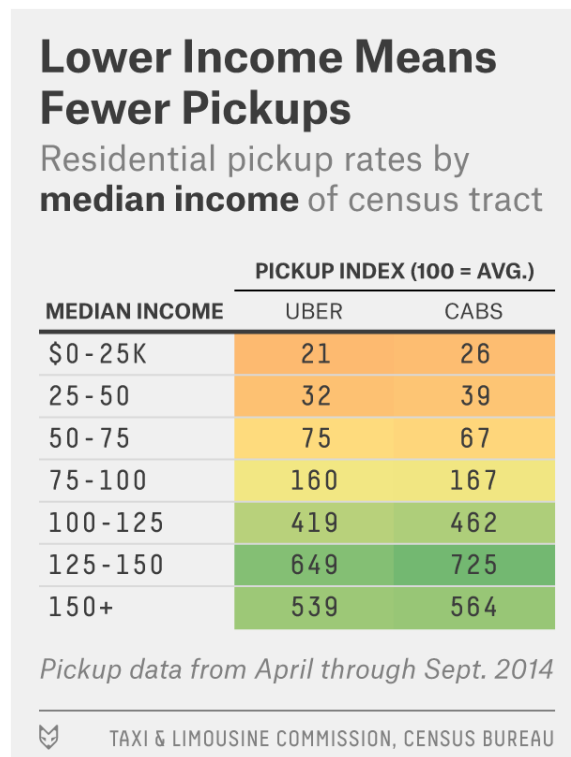
## 4.1 Consumer Needs

Using a case study and an online Uber driver survey, consumer needs for ridesharing services were explored. It was found that there is a considerable demand for ridesharing companies, to allow riders to pre-book rides that would be ready for them when they would. This service would increase the efficiency and applicability of the Roadify use case in addressing the first-last mile problem. Rider demographics as they relate to Uber and transit access were also explored. Finally, a survey of Rideshare drivers (see sections 5.2 and Appendix B.2) revealed a strong desire for the data Roadify provides through its API.

### 4.1.1 Uber Rider Consumer Needs

The average American household spends around \$8,500 on using and maintaining personal vehicles per year. That multiplied by 134 million households (U.S. Census Bureau, 2015) leads to there being a market worth in excess of \$1 trillion per year (Silver & Fischer-Baum, 2015). This untapped market could be targeted by Uber with the help of transit data provided by Roadify.

New York City is the biggest market for public transit in the country (Fischer-Baum, 2014) — around “40 percent of all public transit trips in the United States occur in the New York [City] metro area” (Silver & Fischer-Baum, 2015). According to data from New York City comprising 93 million taxi and Uber rides in a six month period in 2014, lower income riders use Uber and taxi services less (Silver & Fischer-Baum, 2015).



**Figure 8: Uber and Cab Pickups by Median Income (Silver & Fischer-Baum, 2015).**

According to Silver & Fischer-Baum (2015), “A 5-mile journey in a New York City taxi might cost \$20, including a reasonable tip and depending on traffic”. Uber is not much different, based on their low-cost service, UberX’s pricing. Other types of Uber rides (UberXL, UberSelect and UberBlack) run even higher than that which supports how expensive on-demand rides can cost and why there is less usage of such at lower income bracket. On the other hand, subway rides cost \$2.75 (Fares & MetroCard),

which becomes significantly cheaper to someone trying to live on \$50k or less per year while commuting to work on a daily basis. If ridesharing services save a passenger 15 minutes of time, then the passenger would have to have an annual income of about \$140,000 to justify using ridesharing as opposed to using a transit service to get to their destination (Silver & Fischer-Baum, 2015).

The average commuter however does not need to calculate this out, as statistics for New York City in 2014 show that there were 200 million rides taken by Uber, comparatively to the number of rides provided by transit services. Transit services tracked numbers such as 1.75 billion rides given by the New York subway and 800 million bus rides given by the MTA (Silver & Fischer-Baum, 2015).

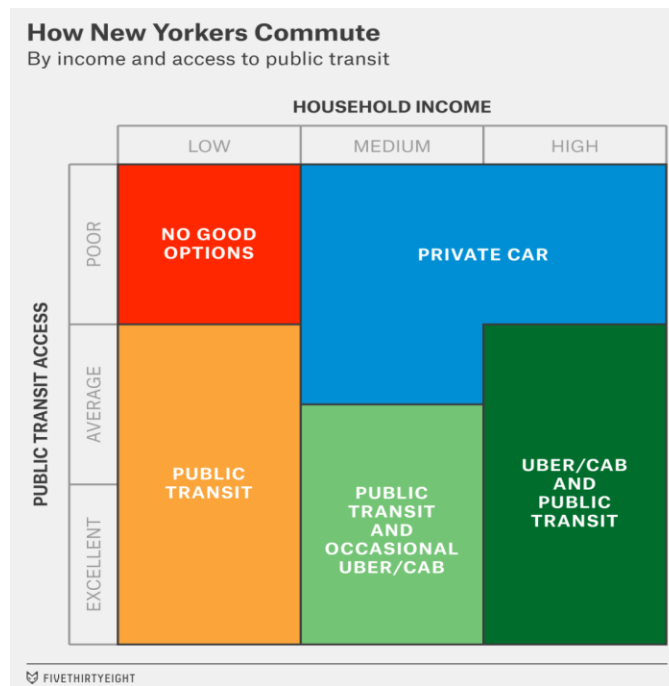


Figure 9 New York commuters by income and transit access (Silver & Fischer-Baum, 2015).

**Group 1 — Low income, poor public transit access:**

Families that have a low household income of \$35,000 per year in New York City (equivalent to an annual income of \$20,000 elsewhere) cannot afford to spend the aforementioned yearly \$8,500 to maintain a working car, much less own a parking space in the city (Silver & Fischer-Baum, 2015).

**Group 2 — Low income, better public transit access:**

Household incomes in the low median income bracket of \$35,000 with greater access to transit stations around them naturally use that for their daily commutes to work. This is quantifiable by the 2/3s of the group surveyed which reported similarly (Silver & Fischer-Baum, 2015).

**Group 3 — Middle to high income, poor public transit:**

Census results show that the majority (72%) of those whose median income of their household is increased to \$35,000 and there is no close transit hubs tend to own personal cars which they use to commute to work (Silver & Fischer-Baum, 2015).

**Group 4 — Middle income, average-or-better public transit:**

Although it might be counterintuitive, car ownership peaks in census tracts with median incomes of about \$75,000 per year rather than the highest tier of income. Part of this can be explained by the argument that neighborhoods with the worst public transit access in New York tend to be middle class, and people in those neighborhoods are more likely to need cars.

The national average for trips made by a household is around 2000 annually (Administration, U.S. Department of Transportation Federal Highway, 2009). It can either spend \$10,000 a year on car ownership (U.S. Bureau of Labor Statistics, 2015,



Table 1110), or it can use a combination of public transit (at a cost of \$2.50 per journey) plus Uber and taxis (Silver & Fischer-Baum, 2015).

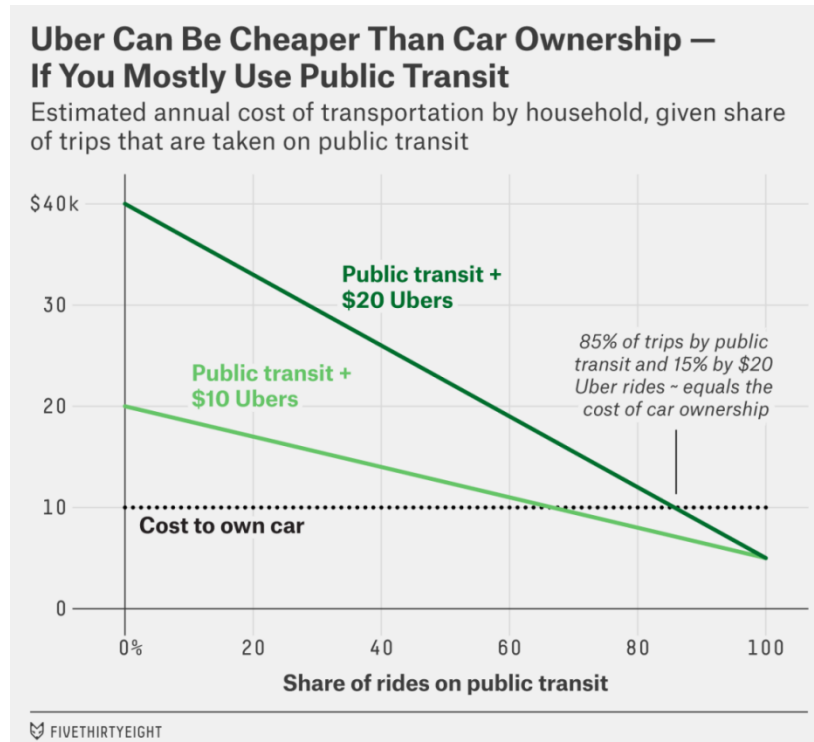


Figure 10:: Estimated annual cost of transportation by household (Silver & Fischer-Baum, 2015).

If Uber costs about \$20 per ride (5 mile trip in New York), then the household can make up to about 15 percent of its trips by Uber and the combination of Uber and public transit will remain cheaper than owning a car. Uber is also introducing some cheaper services, such as its carpooling service UberPool. Suppose that the price of an Uber ride could be halved, to \$10 per ride. In that case, this household could take about a third of its trips by Uber, filling in the rest with public transit, and it would still be cheaper than car ownership (Silver & Fischer-Baum, 2015).

**Group 5 — High income, average-or-better public transit**

For the time being, the principal consumers of both Uber and taxis in New York are upper-income passengers who value their time highly. Relatively few of them own cars, because it's more convenient for them to be driven around in a taxi or Uber than to drive themselves. However, it's likely that many of these customers also use public transit frequently, especially when (like during rush hour) the subway is potentially faster than an Uber or a cab (Silver & Fischer-Baum, 2015).

In conclusion, the above case study displays that rideshare services such as taxis and Uber is a popular solution for those that lived in the city with a median household income of medium or high. However, the majority of this group does not solely use ride share services to reach their destination. They use a combination with transit, and this is the market that we would be able to tap into for the potential it provides.

#### 4.1.2 Driver Surveys

Drivers responded to the survey in Appendix B from various cities including San Diego, Charlotte, Las Vegas, and Dallas. A majority (42.5%) claimed that they were infrequently waiting in close proximity to train and bus stops about one to three times per day. About a quarter (27.3%) waited moderately long, about three to six times per day, while 9.1% waited frequently, between six and ten times per day. Of the divers surveyed, 18.2% said they never find themselves waiting in this fashion. No respondents claimed to wait more than ten times per day at train and bus stations. Overall a vast majority (63.6%) of respondents said they wait for less than five minutes at train and bus stations on average, whereas 27.3% waited between ten and thirty minutes, and 9.1% waited between five and ten minutes on average. No respondents

reported waiting more than 30 minutes on average. Finally, 81.8% of drivers in the survey said that they would use information on arrival times for trains and buses if it were available in the Uber app. Only 18.2% said that they would not use this information.

Ultimately, these results show a promising, positive driver reception to the Rideshare app(s) containing information on transit schedules in real-time, which Roadify could supply using its API. It must be noted again that the sample size is quite small here (only eleven individuals) and is not contained to a single rideshare or taxi service. Therefore, the results may not be wholly accurate. For instance, the results may look different if only one type of ridesharing service were targeted, or if a more even distribution of respondents from different organizations and/or cities replied.

Additionally, both the city of operation and the nature of the driver may greatly influence willingness to use transit data as it would be incorporated in the app. Keeping track of transit arrival and departure times may be simpler and personally manageable in smaller cities where the systems are simpler and more predictable. The individual may also be tailored to a specific route or be more experienced and familiarized with a given area. If a driver has been employed for two full years and has lived in the city of operation for many years, he or she may not deem transit areas worthy of their time, since another concentration of users is both more well-understood and more profitable from their perspective.

## 4.2 Result of Contacting Motivate

After contacting Motivate to help determine the best possible partner for Roadify for bike share, a representative in the Business Development department of Motivate

responded with the answers to five questions. Refer to section 3.2.3 for the reasons behind each question that was asked.

In response to the first question, “What aspects of your subsidiaries do you manage after their bike share systems have been launched?,” Motivate replied with,

“In some markets, like New York City, Motivate develops our own version of the app based on the suppliers API. In other markets, we rely on the app from the supplier. It is highly dependent upon the market, for New York the digital app is apart of the sponsorship activation but in other markets which do not rely on sponsorship we use our supplier's app.”

This means that Motivate has a supplier that in some cases makes the app for them, and, in other cases, Motivate uses their supplier’s API to develop the app themselves.

The second question that was asked was, “Do you build your subsidiary’s smart phone apps?” Motivate’s answer was, “In most cases no, but in NYC's case yes.” The answer to this question provided the most important feedback. Motivate usually does not manage the smartphone apps for their subsidiaries. However, Motivate did develop the app for New York City’s bike share system, Citi Bike, which is the largest subsidiary of Motivate (see Fig).

The third inquiry was, “Do you manage the smart phone apps after you build them?” The purpose of this question was to find out whether Motivate could potentially modify their subsidiaries app’s to incorporate the Roadify API. Motivate gave the answer, “We have input on the development in an instance where our supplier builds

the app, and where we build the app we drive the development.” Motivate might be able to incorporate the Roadify API for apps that the supplier makes and probably could incorporate the API into apps that it develops itself.

The fourth query was, “How do you and your subsidiaries share profits from bike share systems?” The reason for this question was to determine whether Motivate could profit from incorporating the Roadify API into its subsidiaries. If Motivate would not profit by making use of the Roadify API then it would not be worthwhile to prepare a proposal to approach Motivate with. Motivate’s response was “Motivate typically shares revenue above certain percentage or dollar amount hurdles.” Therefore, Motivate may be able to profit from incorporating the Roadify API if each of its subsidiaries significantly profits from it.

The last question asked was, “Who are your main competitors?” The reason for this question was to obtain a better idea of the bike share market by knowing who is mainly competing with Motivate. Motivate’s reply was “The largest competitors in North America are Bicycle Transit Systems and CycleHop.” One advantage of this information is that after researching Bicycle Transit Systems and CycleHop, it could be speculated how much of an advantage the Roadify API would give to Motivate over its competitors.

From all of the information obtained through this questionnaire, it was determined that approaching Motivate with a proposal to incorporate the Roadify API into its subsidiary’s apps would likely have some success since Motivate controls Citi Bike’s app. However, Motivate mostly does not have control over bike share apps and pursuing incorporating the Roadify API into bike share would be indirect in most cases if done through Motivate.

## 4.3 Pricing Models

Of these, three were identified as being optimal given Roadify's situation and the nature of its potential partners: pay-as-you-go, tiered offers, and subscription fee. These three pricing structures were then used in conjunction with case studies, information about the Roadify API, and assumed parameters to construct a model in Excel for Roadify to use.

From this information, the final recommendation to price this offer was determined to be a city-based tiered subscription fee including a set of  $n\%$  price reduction for every  $m$  cities in which the service is implemented. A separate deal will also result if the partner implements the service in all of its cities. This can function for either a rideshare or a bike share company. In addition, Roadify's current approach to signage-based marketing would be appropriate for bike sharing companies if their information were to be displayed at stations through digital signs. However, due to the lack of infrastructure, it is not likely that the current signage model including ad revenue would be applicable in the near term.

### 4.3.1 Disregarded Models

The following pricing models were considered early in the formulation of the recommended pricing model but were declared as unfit for the use cases in question for both ride and bike sharing applications.

**Freemium** is a pricing model where a base product or service is provided free of cost, but premium (money) is charged for special or proprietary features for the product

or service. Usually, the product is a digital service i.e. application such as software, media, games or web services.

There are three requirements for successfully pricing a freemium service. First, the product in question must be of a high quality and able to be offered free of cost. Clearly if the service is not appealing or if it is too great a risk for the seller to provide it for free, the free baseline for a freemium model will neither attract customers nor generate revenue. Second, the product must easily be digitally duplicated for distribution. This is significant because the subset of free users who will apply for paid premium features is generally quite low. Therefore maintaining the free version must be cost-effective to avoid having to inflate the price of the premium service. Finally, the service must have a large user base. Again, if users of a paid version are low, the easiest way to increase revenue is to increase the user base (Froberg, 2009).<sup>1</sup>

Although a free baseline could work as a point of entry for use of Roadify's API, the standalone freemium model is not recommended. Roadify would not be appealing to a user base but rather a single corporate partner. Usage rates in terms of API calls could be viewed as similar to user rates in terms of individual software purchases. However, marketing the Roadify API would not translate well into a freemium strategy. The freemium model is more applicable to services such as mobile applications, and Roadify currently does not plan to incorporate premium features into its mobile app. The company also cannot run the risk of revenue loss as easily as larger companies and needs guaranteed revenue stream that the freemium model may not provide alone. Other models such as tiered offerings allow Roadify to reasonably expect revenue without running the risk of providing a free service with a significant revenue loss.

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Named after the real life concept of an all you can eat buffet, the **all-you-can-eat** business pricing model follows a similar logic applied to digital service offerings. Usually this pricing scheme is utilized within an interval of a fixed subscription rate. For example, Netflix has a subscription rate that users pay monthly. Within that month however, there are no restrictions on how much content can be viewed from their library.

The issue with all-you-can-eat is with revenue potential. Usually pricing with this model results in “a low profit potential and average revenue potential relative to other business models” (Noren, 2013), which is why it is often combined with a guaranteed periodic pricing model such as a subscription fee to decrease use over time. Roadify is seeking to maximize long-term profit and in the use case of ride and bike sharing implementation, API use would be expected to increase over time, not decrease. A subscription fee that is high enough may allow for a suitable combination, but other subscription fee combinations would generate more revenue than a pairing with all-you-can-eat pricing.

Both **unit** and **query-based pricing** were considered more or less equally as potential models for the Roadify API’s implementation in ride and bike sharing mobile applications. Essentially a unit of the API would be defined, such as a call. Under this model, Roadify would be paid per unit of usage. Roadify would then be compensated based on how often the defined units are used. For example, every time an API call is used by a driver in order to create a radius to pull in surrounding transit information.



### What's in an API Unit?

| Calls                 | API Usage                           |
|-----------------------|-------------------------------------|
| get_keywords          | Each of these calls are 1 API Unit. |
| get_keyword_volumes   |                                     |
| get_related_keywords  |                                     |
| get_question_keywords |                                     |
| get_keyword_niches    | 1 API Unit <i>per niche</i> .       |



Figure 11: Example of potential API ‘units’ from the unit-based WordStream API (Musser, 2013).

Although they are common API business models and were discussed at length during the project’s duration, both these models were rejected. The complex calculations and management that would be required from the partner company would not be attractive. Defining a unit of consumption relative to the API is also up for much discussion and may not yield the optimal revenue stream.

In a **content syndication model**, a single type of content is distributed and presented across multiple forums, such as websites and mobile applications. RSS feeds are an example of this. The goal of content syndication is to address a growing Internet user population that is spread out across several sites (ICSC, 2015, p. 10). All four major groups involved in this process - content creators, content publishers, advertisers, and users - are benefited through the facilitation of content creation across the many platforms.

This would not be applicable to Roadify because the platforms for distribution would not be diverse enough in either the ride or bike sharing cases. For example, in the case of Uber, it would only be deployed in the app and used by drivers. Even if both

signage and app-based deployment was incorporated into a bike sharing system, this would not be as beneficial to the content publisher (Motivate) unless coupled with advertising. This would however require Motivate to have partners reimagine their station infrastructure to be able to handle a digital signage display.

In the **location-based** payment structure, a user's physical location is the primary basis of offers. Mobile applications employ this judiciously for local recommendations and relevant advertising. One major advantage of this from a business standpoint is the ability to monitor consumer activity to make informed predictions about user trends (Brookins, 2011).

In the case of ridesharing, it would be the drivers however, not the end users, making use of the Roadify API feature implementation. Motivate and any other bike share company would likely have location-based capabilities in their apps, for example, to allow users to find bike stations in their area. Therefore, this pricing model would be of little value in this use case.

### 4.3.2 Considered Models

The three following pricing models were researched and determined to be the most relevant to the use cases that were considered for Roadify in relation to both ride and bike sharing partnerships. They are, in order: pay-as-you-go, tiered, and subscription fee offers.

Also referred to as activity-based pricing (Smith, 2012), **pay-as-you-go** involves pricing based on frequency of use rather than a flat rate. This structure allows API users to scale and modify resource components. The charges for use are then calculated

based on services used rather than on the entire cost of the software infrastructure (Technopedia, 2015).

This pricing model is increasingly attractive to small businesses. A survey of over 400 small and medium size businesses showed that about 28% were using this model to bill customers (Smith, 2012). Reasons for the prevalence of this model include supporting a growing consumer base, a way to diversify from companies offering traditional pricing methods, and a way to continually evolve business practices.

Larger businesses also apply this model to their APIs and cloud-based services. Amazon Web Services (AWS) has a pay-as-you-go plan in place for use. Options for pay-as-you-go were also recently added to Google Maps Web Service APIs (Robles, 2015). These APIs have a wide range of uses but previously vague flat rate pricing models limited the market for use. There is inherently less risk for companies who wish to use the API when the pricing model is scalable in a predictable manner.

One benefit of this model is that it is simple and transparent. Both parties understand clearly what type of deal they are making from the start. Earnings are both continuous and guaranteed. There is also a limited commitment needed in the long term from partners, since they are only paying for what they want to use. Difficulties include the struggle to make a profit for a smaller company if a baseline free service is offered with too many benefits. Since customer usage can be extremely variable, revenues are harder to accurately predict.

The way this model could work for Roadify is that a certain number of calls could be offered free for a unit of time, after which each unit of calls to the API would be offered at a certain cost. Such a hybrid between a freemium baseline offer and tiered

pricing after a certain data cap has been proposed previously. Roadify's ability to scale up service at a relatively flat rate would allow for higher order usage to be supplied without major imbalance between revenues from partner payments and server expansion and support costs. It would also be attractive to smaller organizations which, unlike Uber, would have to deeply consider financial impact from such a deal.

In a **tiered agreement**, developers pay for a specific level of pricing based on a set amount of requests in a given time. For instance, how many database calls are made per month. Pricing then progressively changes as volume increases (Zuora, 2015). For software-as-a-service (SaaS) businesses, Software Pricing Partners founder Jim Geisman discusses three features for structuring this type of model:

1. Determine frequency of use and value delivered in order to identify which features should go with which edition.
2. Evaluate the functional differences between editions.
3. Balance entry-level price with higher tiered editions at a higher price.

Having a reasonable 'step-size' between tiers is important so that the developers do not feel like they are being overcharged for upgrades to more premium options (Geisman, 2014). Since one simple way to make up for this is to have a high entry-level price, one must consider the balance between the cost of low-tier plans and the progressive increase between tiers.

Because pricing tiers allow many potential starting points for customers, tiers are usually constructed based on how much the developer will be "willing to accept

'overage' billing for work performed outside of the include services or service hours (CA Technologies, 2015, p. 7)." Hours and service offerings can be varied to optimize a plan which provides the least risk across the board for developers while providing the provider with the most financial gain for each level in the long term.

Sustaining a long-term relationship with the customer supports having a tiered model. As a business grows, the provider must demonstrate that the customer's needs can be met in the present and in the future through higher offer tiers that it can "graduate into" as time goes on. For a tiered model, it is important to segment appropriately using key metrics and intangibles such as the customer's expectations for quality service. It is important to maintain a sense of graduated relevance to avoid having the customer develop a feeling of being overcharged for a non-critical service.

The predictable revenue stream from a tiered model are especially attractive to larger companies who do not want to have to deal with unexpected costs or re-calculating finances at the year's end (Lemkin, 2015). Less discounts are needed to keep existing customers, so the average selling price is generally quite stable. However, for all of this to work, the customer must be provided for in the long term.

The way this model could work for Roadify is that a certain number of calls could be offered free for an unit of time, after which different quantities of calls to the API would be offered at different costs. Further, different features, and service levels could be applied to different tiers.

A **subscription** model strikes a good balance between consumer and business value. Consumers gain value through the model's convenience. The simplicity of subscriptions makes a purchasing decision easier. A subscriber does not need to worry

about reordering several times throughout the year and assuming that the cost remains fixed, it is always assured that the services needed will be present when they are needed. This flat rate also helps maintain a sensible budget. As with tiered offers, bundling can also enhance subscription fees from a customer standpoint by providing multiple services for a periodic, fixed cost.

For businesses, predictable revenue through recurring sales streamlines financial management. According to John Warrillow, creator of The Value Builder System, recurring revenue is one of the most compelling factors in a company valuation. "The more guaranteed revenue you can offer a potential acquirer, the more valuable your business is going to be," Warrillow says. "Because a high percentage of the revenue of a subscription-based business is recurring, its value will be up to eight times that of a comparable business with very little recurring revenue" (Loganecker, 2015).

Consistent revenue from recurring sales also makes it easier to determine the lifetime value of a customer, manage operations, and promote simpler pricing schemes. Convenience of purchase and a flat rate also add to this simplicity. Bundling offers can diversify options for consumers. Despite these benefits, long-term subscription packaging may still involve complex calculations, so the model is not entirely simplistic. Also, subscriber models for software companies tend to result in lower revenues in the near term since payments are spread over a longer period of time, rather than in a single sale (Dubey, 2007, p. 7).

Roadify could offer a subscription rate to companies. This could also be integrated with the tiered model. The model could operate as the subscription could be

for different types of use: signage, app, hardware (watch) etc. The model could also have subscriptions for different levels or specialized services.

### 4.3.3 Final Considered Models

There are two considered alternative methods which could be used to price out the data that Roadify would provide. The first takes into consideration the amount of transit data that Roadify has for a given city, alongside the size of Uber's operations inside of that said city. The city's size would be the main baseline for this analysis. A city such as New York would be the highest level of this tiered system, due to its extensive subway/bus system and also the amount of Uber drivers that operate in a city that large. A lower level city would be one such as New Haven, CT where there would not be as many drivers and a smaller transit system would exist.

The second of the two considered finalized models was a pay-as-you-go subscription model. Each city that Roadify had data for would have a flat cost price, and this amount would be paid yearly. An easy way to visualize this would be: Uber wants data for one city, so they pay \$500 (arbitrarily small for ease) for a year's worth of usage. Next year they decide they want to expand this to two other cities, so they pay \$500 for each additional city, making their cost for the year \$1500 for usage of all transit data in the API for those 3 cities. This model creates no incentive for the rideshare company to buy cities for data they do not intend on using unless they plan to expand their operations. This allows Uber to pick where they would want to roll out their pilot programs and expand with financial ease.

#### 4.3.4 Estimates from Pricing Model

Using data from a small sample survey of rideshare drivers, a model was constructed in Excel that was designed to roughly estimate the savings Uber could expect annually from implementing the Roadify API into its driver app. The full model is outlined and described in Appendix B.

From the survey questions on driver frequency of interacting with transit stops and duration of wait time in proximity to these stops, median frequency and wait time were calculated. This was done for frequency by taking the median value of the daily frequency values (0, 1-3, 3-6, etc.). For median wait times, the calculation was a result of taking the median value of the daily wait time values (0 minutes, under 5 minutes, 10-30 minutes, over 30 minutes).

With this information in mind, it was agreed that there should also be a flexible wait time gap to account for the fact that in reality, there would still be a small gap in connecting with transit users even with the Roadify data available to the driver. A two minute gap was considered reasonable and so subtracted from the median wait times to create an optimized waiting time.

Given this information, as well as parameters from other sources concerning Uber driver activity, average hourly salary and Uber makeup (commission and driver fleet size), a rough estimate of added annual revenue from reducing wait time was determined. This was found by multiplying the average wait period, average number of wait times, and average hourly salary and dividing by 60. From here a minor increase in daily salary was estimated, which allowed for an annual salary to be calculated.



Knowing that Uber takes a 25% commission from each ride, the final amount of revenue was calculated as this cut of the increased driver earnings.

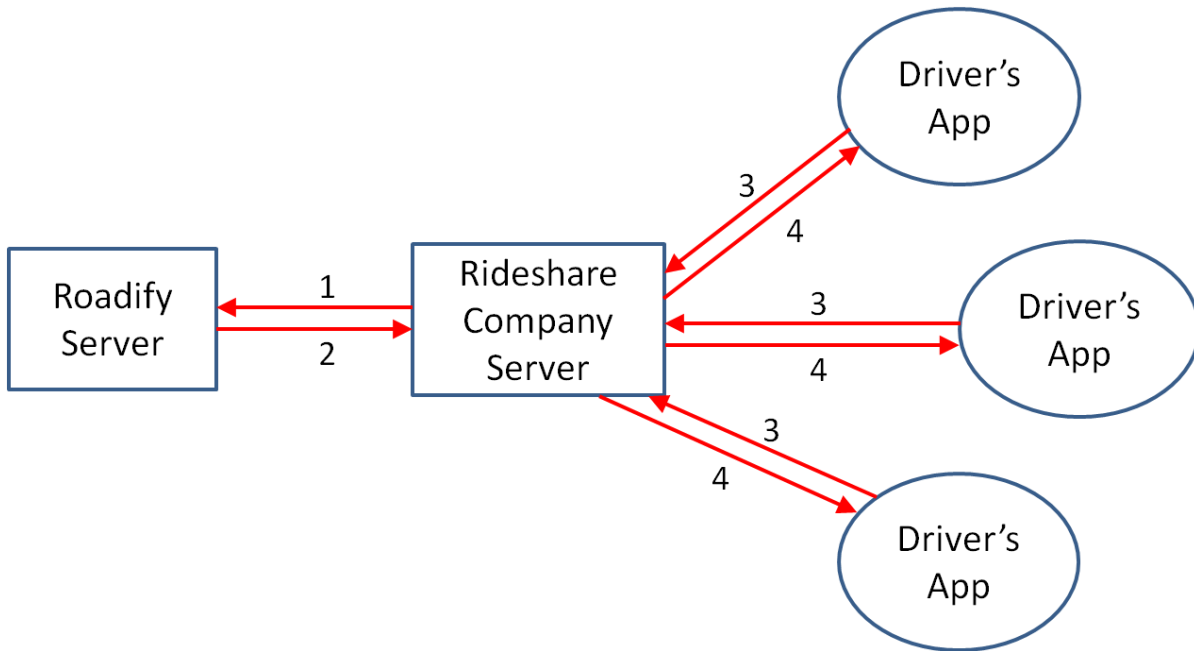
There are some clear limitations to this model. The small sample size of the surveys from which data on wait times and frequencies is derived can account for a significant amount of this. A larger sample could reveal different trends and more accurately reflect what these numbers are on average. Further still, because the data was collected from rideshare drivers, not exclusively Uber drivers, a direct correlation to increased revenue for Uber may not be entirely deducible.

In terms of assumptions, several are introduced, as described in Appendix C. The overall issue with developing this model was dealing with the nature of Uber and most other ridesharing services which allow large driver flexibility. User-dependent working hours and a lack of a clear minimum shift means that a large portion of active drivers do not work a full work week. On top of this, only about 25% of rides are in proximity to transit stations for Uber. While it might be intuitive to say that this would then apply to roughly 25% of drivers, this is not entirely true. The amount of rides does not necessarily equate to the number of drivers, as a single driver can serve multiple rides of the same type. In addition, the average amount of daily wait times (3) could be used to suggest that about 3-4 daily trips are of this nature. This assumption is built into the model, but this is based on average wait times, not average transit trips. Therefore it may not be entirely fair to assume that a transit trip always occurs from these waiting periods, or that it is only a single trip that may occur either.

## 4.4 Proposed Model to Deliver Information to Drivers

After establishing that there would be a benefit to supplying Roadify's transit information to the drivers of a rideshare company, the IQP team designed a model to propose for delivering the information. The model provides an overall structure for how the process would work and displays the roles of the Roadify Server, the rideshare company's server, and each of its drivers.

As the diagram below illustrates, the first step of the process for transferring the information to the drivers is that the rideshare company sends a request to the Roadify Server for transit data in a city (1). Next, the Roadify Server sends the transit data to the rideshare company (2). The rideshare company requests the transit information periodically at a certain time interval and, after obtaining all transit information that it needs, it can analyze or repackage the data, or incorporate the data into algorithms for dispatching drivers. Now any of the drivers' apps that is currently connected to the system can send a request to the Rideshare Company Server for transit information (4). The rideshare company then sends the information to the driver's app, and the driver can act on this information.



**Figure 12: How transit information will be delivered from Roadify's server to rideshare drivers.**

Reviewing the Roadify API documentation revealed that the API features or calls that would best serve this model would be the “List Zones”, “List Routes for Zone”, and the “List Trips for Route”. To obtain a list of all of the transit systems that the API supports, the Rideshare Company Server uses the “List Zones” feature. The Rideshare Company Server can then obtain a list of routes in certain transit systems using the “List Routes for Zone” call. For each route, the Rideshare Company Server can use the “List Trips for Route” feature to obtain a list of stops and their location, arrival, and delay data for a train or bus on the route.

Although this model satisfies the use case, there are alternatives that could be used to deliver the transit information to the drivers instead. For example, rather than the Rideshare Company Server requesting transit information periodically, drivers' apps could initiate the process and trigger the Rideshare Company Server to request information from the Roadify Server. However, this may result in latency issues because

the Rideshare Company Server would keep the drivers' apps waiting while it fetches and analyzes the information from the Roadify server. Another alternative is that the driver's app could contact the Roadify Server directly. However, this model takes away the freedom of the Rideshare Company Server to deliver the information to drivers' apps in any form that the company wants. A variation on the model that may need to be considered in the future is that instead of the Rideshare Company Server waiting for a request from the driver's app to deliver the transit data, the Rideshare Company Server could send the data at any time. This variation would be useful in cases where the data sent from the Rideshare Company Server to the drivers' apps is seamlessly integrated into the existing rideshare model, notifying drivers when a nearby rider orders a ride.

## 4.5 Bike Share Results

Research into the topic of the relation of bike share to transit revealed that there is a significant frequency of users that make multimodal trips (Los Angeles County Metropolitan Transportation Authority - Metro, 2014). Having established that, the prediction followed that many users would be in favor of implementing transit info into the app of their bike share. Another prediction was that the company would also display interest in implementing transit data in possibly two ways. They could either implement it in their app, as displayed in the use case below, or have it on a digital display that is on their bike docks so the users could see this data when docking their bikes. The reasoning behind the prediction that bike share companies such as Motivate would show interest in this feature is backed behind the idea of a source of financial revenue as, alongside transit information, there would be potential for interactive digital signage for advertisements, which would increase their overall revenue.

There exists a problem however with this idea for both implementation models. Bike sharing companies would have to spend significant amounts of money for developing either idea. First, for the signage option, the bike dock station would have to be retrofitted with digital displays that could display this and advertisements and that create the additional problem of providing enough energy to operate these screens. According to an analysis of Citi Bike's Solar Pole (2013), Citi Bike operates their bike dock stations using solar cells. These cells have issues with generating the required energy to run their mini-kiosk (Sauchelli, 2013). To implement the power needed to run a digital display, they would either have to change the way their stations generate power, or connect them to the main grid which both would require a large investment.

A user's commute to work in Boston may for example consist of getting a bike from a bike dock close to his home. While on his way to his normal subway station, he has the Hubway app open on his phone and sees that his train is running 10 minutes later than usual. He then decides to take a short detour to a coffee shop, picks up a quick coffee and then continues to his destination, arriving on time and not missing his train. Despite this potential benefit from this, Motivate only controls the Citi Bike app, according to a discussion with one of their representative. Their ability to upgrade even this app is limited and monetization through the app, though possible through advertising, is limited. Motivate therefore would not have as much initiative to implement Roadify transit data in a mobile application feature. Even if they could, they only manage a single app among the companies they manage.

# Chapter 5: Conclusions and Recommendations

Based on the findings, conclusions and recommendations were developed regarding market segmentation of bike share and rideshare companies, consumer needs, solutions to first-last mile problem, and ideal pricing model for rideshare and bike share companies.

## 5.1 Market Segmentation

To better understand which Rideshare companies would be best for Roadify to partner with, the IQP team determined how the market is divided among different rideshare companies. There are many Rideshare companies such as Uber, Lyft, Sidecar, Wingz, Carma, SideCar, Summon, Arro and Hailo. The two major companies are Uber and Lyft. One key finding from the research demonstrated that Uber has grown significantly since 2012. The piece of research stated that the number of Uber drivers has grown from about 0 in mid-2012 to over 160,000 by the end of 2014 (Solomon, 2015). Another important finding was that the Uber service was offered in 58 countries and 300 cities by May 28, 2015 (Melhem, 2015). Despite traditional taxis and other rideshare companies like Lyft being a good target, Uber was chosen as the best initial partner due to its size and high level of recent growth. The reason is that the improvements to rideshare that Roadify's transit data would provide would have the largest initial outreach.

As for bike sharing, it was deduced through market research and discussions with Roadify CEO Scott Kolber that Motivate, which manages several major bike sharing stations around the country, would be the primary target for partnership. Access

to major systems such as Citi Bike and Hubway would allow Roadify’s API to be implemented across a wide array of the nation’s largest and most successful bike sharing platforms in major cities.

## 5.2 Pricing Models

The pricing model we recommended that Roadify use is a tiered subscription model with an initial free trial period. The “unit of consumption” was decided to be a city of operation. The tiered model was divided into three stages: free, full cost, and tiered discounts. The offer would start with a free limited trial period of few cities, after which a price per city would be applied. A discount would then be offered on the subscription rate for each new city added after a certain number of city fleets had implemented the software. A mass discount was offered for the final tier, as shown in Table 6 below table shows the same. The commissions were under ten percent of Uber’s earnings (based on the potential Uber revenues model). According to the earnings model, where an annual revenue of \$70.106 mil was identified as the maximum bound for revenue increase, this would mean that no more than about \$7 mil could be expected in Roadify revenue annually.

| Number of Cities | Price per city per month |
|------------------|--------------------------|
| First 2 cities   | Free for a year          |
| less than 10     | \$2800                   |
| 10 - 19          | \$2600                   |
| 20 - 29          | \$2400                   |

|              |        |
|--------------|--------|
| 30 - 39      | \$2200 |
| 40 - 49      | \$2000 |
| more than 50 | \$1200 |

**Table 6: The final proposed pricing scheme for the Roadify API, as it would be sold to Uber.**

Therefore, in this model where Uber is considered as a primary partner, the per month pricing was decided so that the maximum potential revenue for Roadify would not exceed this yet be in a reasonable bound such as not to deprive the company of profits. Applying this pricing scheme to Uber with all its 300 cities of operation, Roadify’s direct annual revenue would be \$4.32 mil. This sits comfortably over half of 10% of the maximum expected value Uber would expect annually, while also accounting for a progressive discount as more cities are added. This tiered discounting model incentivizes purchasing data for a larger amount of cities, since each additional tier reached results in a steady, predictable decrease in prices.

This final proposed model is a hybrid of the shortlisted models described above. The model was tailored to the needs of rideshare companies. The most basic unit for rideshare companies is a city. All operations are conducted by city, and the most basic unit of management is the same. Thus the “unit of consumption” for the pricing model was decided to be a city. The tiered model would start with a free limited trial period of few cities, and then be converted to a paid model. Tiers were divided based on number of cities. After a certain amount of cities are added, a discount will be offered.

The biggest advantage of the model was simplicity and clarity. The trial period would provide a great evaluation platform for rideshare companies, and the tiered model with discounts would encourage rideshare companies to expand their use of the API.



Further, the model allows rideshare companies to use Roadify's services where required, and avoid expenditure on cities where the Roadify API's services would not be useful. For a large company like Uber especially, this model would be especially appealing for wide-scale application. Uber has both the capital and city distribution to support such a model, presented with reasonable discounts at regular intervals.

The tradeoff for the simplicity of this model is that larger and potentially more important cities are priced the same as normal cities. The data may be used more frequently for example in a city such as New York City or Los Angeles, where there are more drivers, greater transit activity, and more riders to interact with. Conversely, it could be that Roadify-based services are used less in these larger cities due to driver familiarity with the transit systems or inherent complexities in trying to optimize downtime with so many competing variables (large swathes of drivers, surge pricing, multiple transit routes overlapping, etc.). Another broader limitation of this model is that it might be better suited for larger more widely spread companies like Uber and Lyft. There is potential for smaller rideshare companies to want to use a similar feature to get an edge on their competitors. This model as it stands however would present a strong barrier for entry. A \$4.32 mil maximum contribution from Uber annually is not as significant given their high valuation as a company. A smaller rideshare service such as Arro or Hailo however might not be able to afford even a fraction of that annual sum. In these cases, the monthly prices would have to be dramatically adjusted to cater to these smaller companies or a different model would have to be considered. For instance, a pay-as-you-go model might serve a smaller company better since it puts more control in their hands and allows for greater long-term flexibility. Lower costs compared to

transaction or subscription fees may be outweighed by a partnership which would not otherwise exist with such a great barrier to entry.

## 5.3 Consumer Needs

Resonating with the first-last mile problem, a strong need for a reliable multimodal system was realized. It was noted that using both rideshare and bike share in combination with transit could be cheaper. A major inconvenience with multimodal transit was waiting time. It was observed in the survey for rideshare drivers conducted by the IQP team that the drivers spend significant amount of times (10 - 30 minutes in small cities like Worcester) waiting for passengers.

To reduce the waiting time during multimodal transit, it was recommended that Roadify's transit information be integrated with rideshare apps to provide drivers with information about train and bus schedules. A total of 81.8% drivers surveyed would like to use this data. Another recommendation was to allow pre booking for transit so that the waiting time for riders could be reduced. This could be done in real-time by synchronizing the arrival time of trains and busses from Roadify API and information about driver's location from rideshare companies.

## 5.4 First-Last Mile Problem

Across all types of ridesharing and traditional taxi services such as Uber, Lyft, yellow cab, and boro cabs, a significant amount of pick-ups and drop-offs occur within close proximity of a transit stop, especially a train station. The research presented in this paper clearly demonstrates that not only are many of the companies in question

openly admit that they can be or are actively being a solution to the first-last mile problem.

Roadify's transit data would be invaluable to be used as a component of solving this problem from a ridesharing standpoint. Reducing wait times for Uber, Lyft, and similar drivers at train and bus stops would simultaneously decrease lag time in a user's overall journey to and from their home. We recommend that because of the clear existence of this transit issue and the desire of rideshare companies to play a role in solving the problem, that Roadify pursue a partnership with these companies in which it provides its API for a structured fee (see 5.2 Pricing Models). Since it dominates as a leader in the ridesharing industry, Uber should be a model for future business deals and the first step in Roadify marketing its API for this purpose to ridesharing companies in the United States.

Although a similar percentage of bike share users interact with transit during their trips, one notable finding was that in one study 58% of bike share users decreased transit use due to access to bike sharing stations in close proximity to their homes. (LDA Consulting, 2015, p. ii) It is plausible that bike sharing services are being used to supplement transit rather than compliment it. That is, users are likely riding bikes from close to home to close to their destination, and vice versa, rather than switching to a transit option in the middle.

Additionally, through constant conversations with Roadify CEO Scott Kolber and after researching the technical limitations of most bike sharing stations, it was determined that these organizations are not at the stage of larger ridesharing companies where they can address the first-last mile issue using Roadify API

integration in the same manner. This is one strong reason for why we do not recommend that Roadify pursue partnerships with Motivate or individual bike share companies at this time.

## 5.5 Roadify's Initiative

Based on the IQP team's "go to market" strategy, Roadify CEO Scott Kober contacted a Rideshare company Uber and Bikeshare company Motivate. These companies were chosen to be contacted first as they were industry leaders.

The main revenue for Motivate from this deal would be from implementing advertisements on their docking stations, while using transit data to increase viewership. Unfortunately, the docking stations lack electrical power to implement this. Motivate also emphasized that the bike share market was still focused on developing their products i.e. bikes and docks. They weren't ready for additional costs associated with development of features not essential for functionality.

Scott's discussion with Uber gained reception. Uber was already interested in developing a solution for the first-last mile problem. They realized the potential revenue in solving that problem. Currently, Roadify and Uber are in concrete discussions on the potential collaboration.

## 5.6 Future Works

As with every project, there were areas that did not go as well as possible and other ventures that we just did not have time to pursue. Future works involving this project would be to build upon much of the research and proposed ideas including improvements for rideshare companies after initial progress to utilize the Roadify API.

The first area that would be beneficial to have expanded upon would be the idea of pre-booking rides which would be possible due to the integration of transit data into ride-share API's. We merely touched upon this in the paper, however if research into this could be found and used to justify this idea and how it would cut down on ride wait times/ increase overall revenue, it would help expand this idea.

Surveys were another area of the project that we would have enjoyed to have expanded. Due to issues with getting an exemption for the survey itself, it was distributed for a short amount of time and the sample size of the survey itself was under 20 people. As for the content of the survey, for the 11 that responded, it was a mix of drivers of Uber and normal cab drivers. Ideally, there would have been separate surveys for each separate company that we would want information from. Diversity in location for each select survey would be desired, to the point where each survey would be tailored to the city in which it is sent out.

For the last section of future work that we foresee that could be done. Further improvement on Roadify's API and app would be sought after. While we understood at this current time that it was not feasible in the short-term due to their resources being tied up in other company-related pursuits. Also even in the long-term when they would have the capacity to do so, the app is not as profitable or even easy to monetize. The API on the other hand, if improved, would be able to open up a whole new market of possibilities such as the one that we did for this project

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# Appendix A: Contacting Motivate

## **1. What aspects of your subsidiaries do you manage after their bike share systems have been launched?**

“In some markets, like New York City, Motivate develops our own version of the app based on the suppliers API. In other markets, we rely on the app from the supplier. It is highly dependent upon the market, for New York the digital app is apart of the sponsorship activation but in other markets which do not rely on sponsorship we use our supplier's app.”

## **2. Do you build your subsidiary's smart phone apps?**

“In most cases no, but in NYC's case yes.”

## **3. Do you manage the smart phone apps after you build them?**

“We have input on the development in an instance where our supplier builds the app, and where we build the app we drive the development.”

## **4. How do you and your subsidiaries share profits from bike share systems?**

“Motivate typically shares revenue above certain percentage or dollar amount hurdles.”

## **5. Who are your main competitors?**

“The largest competitors in North America are Bicycle Transit Systems and CycleHop.”

# Appendix B: Survey Questions and Results

## B.1 Rideshare Driver Survey

### Research Survey

A brief survey for Uber drivers about the use of transit information in daily operations.

**In which city or cities do you operate?**

Your answer

---

**How frequently do you find yourself waiting in close proximity to train and bus stops?**

- Never (0 times per day)
- Infrequently (1 to 3 times per day)
- Moderately (3 to 6 times per day)
- Frequently (6 to 10 times per day)
- Very Frequently (10 or more times per day)

For how long do you wait at train and bus stations on average?

- Less than 5 minutes
- 5-10 minutes
- 10-30 minutes
- Longer than 30 minutes

Would you use information about when trains and buses are scheduled to arrive if it was available in the Uber, Lyft, or other rideshare app?

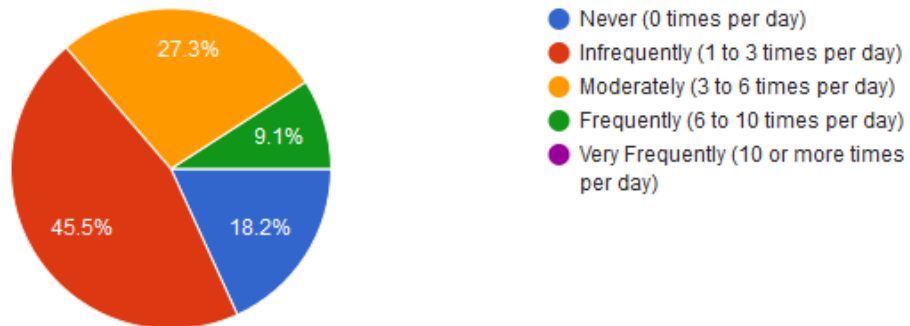
- Yes
- No

## B.2 Results

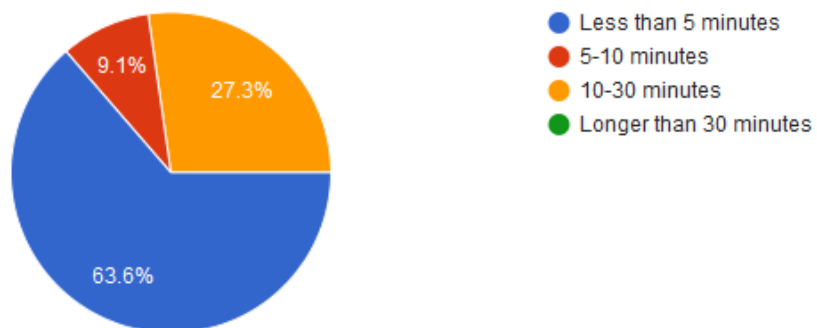
|              |
|--------------|
| Sandiego     |
| San Diego    |
| Las Vegas    |
| Nashville    |
| Worcester    |
| Dallas       |
| dallas       |
| Charlotte NC |
| Jersey Shore |

How frequently do you find yourself waiting in close proximity to train and bus stops?

(11 responses)

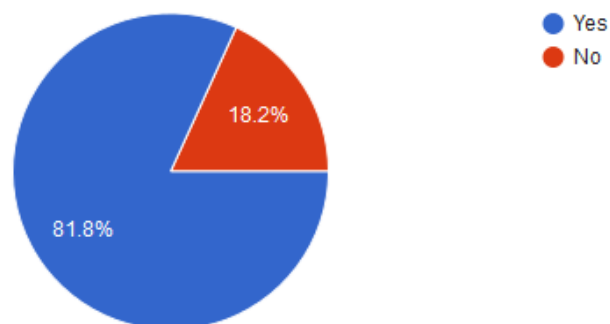


For how long do you wait at train and bus stations on average? (11 responses)



Would you use information about when trains and buses are scheduled to arrive if it was available in the Uber, Lyft, or other rideshare app?

(11 responses)





# Appendix C: Potential Uber Earnings

| Median Wait | Median wait frequency |  |                                   |
|-------------|-----------------------|--|-----------------------------------|
| 3           | 2                     | Average wait period (minutes)                                      | Uber's commission (%)             |
| 3           | 5                     | 6.091  | 25                                |
| 20          | 8                     | Average number of wait times                                       | Number of Uber Drivers (Dec 2014) |
| 3           | 5                     | 3.000  | 162,037                           |
| 8           | 2                     | Average Uber Driver Salary (USD)                                   | Increase in Uber's Annual Revenue |
| 3           | 0                     | 17.22  | 70,106,759                        |
| 3           | 0                     | Increase in Daily Salary (USD)                                     |                                   |
| 20          | 5                     | 5.24   |                                   |
| 3           | 2                     | Increase in Annual Salary (USD)                                    |                                   |
| 3           | 2                     | 1,731  |                                   |
| 20          | 2                     |  |                                   |
|             |                       |  |                                   |
|             |                       |  |                                   |
|             |                       |  |                                   |
|             |                       | <b>Assumptions</b>   |                                   |
|             |                       | Waiting time is reduced to negligible amounts on transit locations |                                   |
|             |                       | Drivers work 330 days  |                                   |
|             |                       | About 25% of rides are of this nature                              |                                   |
|             |                       | Assume about 45-50% of drivers are active daily                    |                                   |
|             |                       | Assume about 3-4 trips per day are transit related                 |                                   |
|             |                       |  |                                   |

# Appendix D: Presentation to Roadify

## Roadify IQP Presentation

A Marketing Strategy to Facilitate the Use of the Roadify API in Ridesharing Systems

### The Big Picture

- ❖ The Project in Summary
- ❖ Why Rideshare Companies Care
- ❖ How It Would Work
- ❖ The Benefits
- ❖ Pricing the API
- ❖ Potential Partners

## Summary of Project

### ❖ Rideshare

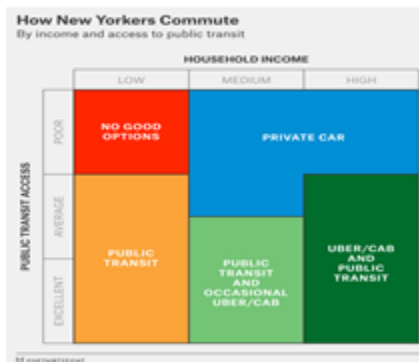
- Major use case for implementation
- Identified partner desire for information
- Constructed models (est. value and tiered pricing)

### ❖ Bike share

- Secondary potential use case
- Signage vs. App integration
- Lack of digital architecture, less app interest

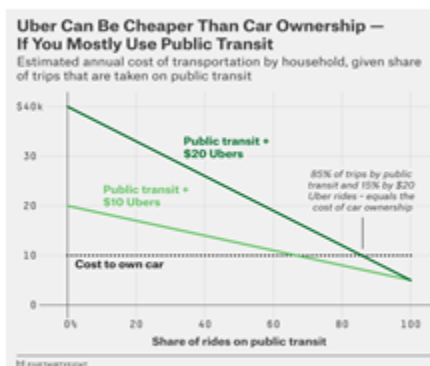
## Why Rideshare Companies Care

- Ridesharing is used by people who can afford to pay for their time
- A large potential exists for the population of car-owners



Source: [FiveThirtyEight Economics](#)

- If a 5 mile Uber ride in New York costs \$20 → 15% of trips can be made through Uber to keep transit cheaper than personal car
- If a 5 mile Uber ride in New York costs \$10 → 33% of trips can be made through Uber to keep transit cheaper than personal car



Source: [FiveThirtyEight Economics](#)

## Uber and Transit



Source: [Uber Newsroom](#)

Portland, Oregon study showing Uber rides (in blue) in proximity to MAX/WES stations (in black).



Source: [NJ.com](#)

New Jersey study showing Uber trips (in blue) originating or ending within 1/8th mile of NJ Transit rail line or station (in black).

## Lyft and Transit

- ✦ 33% of rides in Boston start or end near transit station
- ✦ 63% of rides in Chicago start or end in areas underserved by transit
- ✦ Union Station is the #2 destination in Washington, D.C.
- ✦ Of the 20 top San Francisco destinations, 7 are transit hubs

Source: [Lyft "Friends With Transit"](#)

## Driver Survey Results

How frequently do you find yourself waiting in close proximity to train and bus stops?

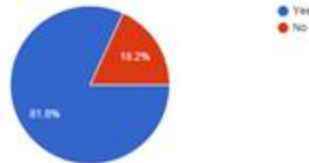
(11 responses)



For how long do you wait at train and bus stations on average? (11 responses)

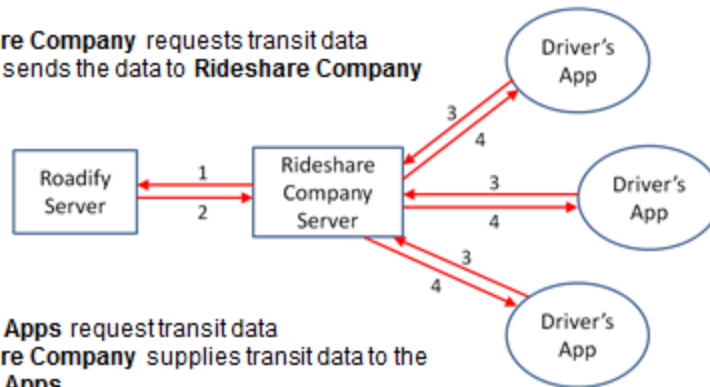


Would you use information about when trains and buses are scheduled to arrive if it was available in the Uber, Lyft, or other rideshare app? (11 responses)



## How It Would Work

1. Rideshare Company requests transit data
2. Roadify sends the data to Rideshare Company

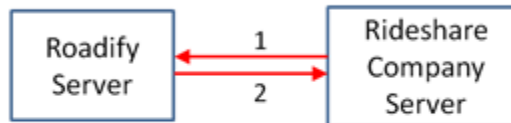


1. Drivers' Apps request transit data
2. Rideshare Company supplies transit data to the Drivers' Apps

## How It Would Work (Roadify's Role)

### Proposed Model

1. Transit data requested periodically at a certain interval



1. Roadify Server services the requests periodically

#### Key Questions for API Calls

- Obtain transit information for one or all cities at a time?
- For what modes of transportation will information be needed?

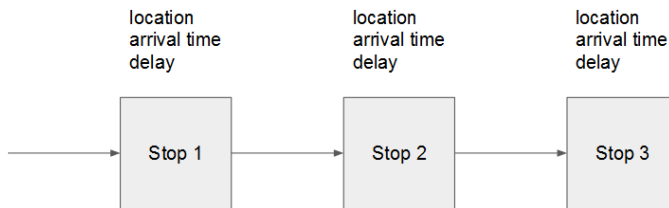
## How It Would Work (Roadify's Role)

Rideshare Company's Use of the Roadify API

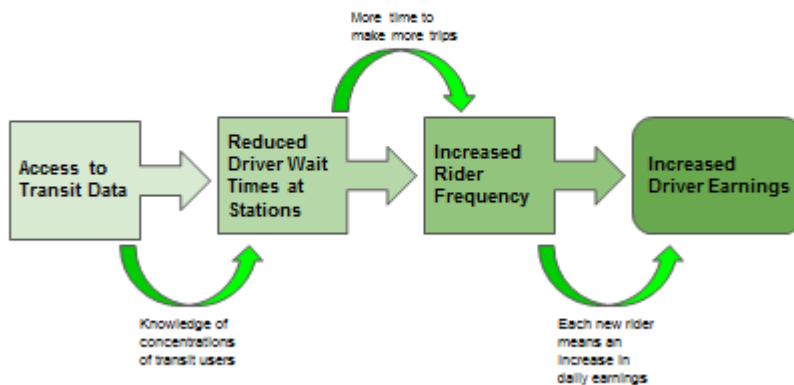
| API Feature          | Information obtained             |
|----------------------|----------------------------------|
| List Zones           | list of transit systems          |
| List Routes for Zone | transit routes for certain zones |
| List Trips for Route | list of stops for certain routes |

## How It Would Work (Rideshare Company's Role)

1. The locations, arrival times, and delays are extracted for each stop.
2. The Rideshare company analyzes the data and makes it available to its drivers.



## Benefits of Transit Data Access



## Recommended Unit of Pricing

We recommend that the unit of pricing be a **city of operation**

- Rideshare companies define their unit of expansion as a “city”
  
- Some cities may be more valuable than others but this is hard to determine, for example:
  - = Smaller cities have longer wait times, but less busy transit hubs
  - = Larger cities have larger transit networks, but shorter wait times

## Tiered Pricing Model

|                  |                        |
|------------------|------------------------|
| First 2 cities:  | <b>Free</b> for a year |
| Under 10 cities: | <b>\$2800/mo</b> each  |
| 10 - 19 cities:  | <b>\$2600/mo</b> each  |
| 20 - 30 cities:  | <b>\$2400/mo</b> each  |
| 30 - 40 cities:  | <b>\$2200/mo</b> each  |
| 40 - 50 cities:  | <b>\$2000/mo</b> each  |
| Over 50 cities:  | <b>\$1200/mo</b> each  |

## Pricing the API

**Real Estate Commissions:** 2-3% in Massachusetts

**Hospitality for Hotel Bookings:** 10 - 20%

**SaaS Sales Rep Commissions:**

8-10% base for enterprise-like sales

5-15% value of the contract

10-25% depending on incentives scheme

General range of commission: **Between 5-20%**

## Potential Partners



Source: [LightHouse](#)

## In Conclusion

- ❖ The Project in Summary
- ❖ Why Rideshare Companies Care
- ❖ How It Would Work
- ❖ The Benefits
- ❖ Pricing the API
- ❖ Potential Partners