On the Street Efficiency
Bikeshare Operations Compared

Report Written By Rebecca Reilly, Spring 2024

Introduction - Bike share and me

I came to bike share after a long involvement in the larger cycling community. I was attracted to the NYSERDA fellowship and the team spirit at Reddy Bikeshare. It seems this team believes, as I do, that bikes have the potential to solve a lot of problems.

Bike share was invented in the Netherlands in 1965 (EMBARQ@WRIcities, 2017). The first bike share in the U.S. appeared in Portland, Oregon in 1994 (Staff, 2010). The first major bike share in the U.S. opened in 2008 in Washington, DC. Leaders in the bike share space are the Netherlands, Copenhagen, Montreal and Portland. These cities are also leaders in bike infrastructure and bike friendliness. In determining good placement of bike share stations, responsible parties are keen to put them in places where they won't be burdening their users with an unreasonable risk. "Bikeable neighborhoods play a direct role in site placement of bikeshare stations. If municipalities do not invest in safe biking through its infrastructure, bike sharing companies have trouble providing service. Poor infrastructure discourages cycling and can be a major safety issue." Mike Galligano, Reddy Bikeshare, Executive Director.

In my research, I not only talked with people who also redistribute and fix bikes like I do, I also rode my bike in those cities. The environment that bike share is in plays an important role in operations efficiency.

If you have never ridden a bike in New York City, let me assure you it is stressful. I rode in NYC as a courier in 1999 before any real bike infrastructure. I returned to experience riding from the top of Manhattan to the bottom exclusively using bike infrastructure, and it was nerve wracking. Seoul, South Korea is a vastly more populated and dense city but I felt almost no anxiety riding my bike there. I feel the same about Europe.

When you have to negotiate a city with a van there are manifold difficulties that you will not encounter on a bike. Parking and being stuck in traffic are chief concerns. Smaller cities are easier to operate in with a van, but often growing the system means growing in disparate areas like in the case of Reddy Bikeshare and CDPHP Cycle around Albany. Then the challenge expands to coverage of those disparate areas even though it takes a long time to drive between them.



Bikeshare sign in Japan

Coming from a smaller bikeshare system than say, the Seoul bikeshare system at 45,000 bikes, I wanted to understand how different operators tackle these problems as efficiently as possible.

Method

I have a M.S. in Creative Studies which leads me to prefer to use a creative approach to my research. The specific focus of my report is understanding efficiency when comparing the different bike shares I have engaged. Ultimately, the goal is to bring best practices home. I would have liked to do deep ethnographic research, essentially riding around with other Fleet Techs like myself in all the different cities I visited, there simply wasn't time to do it and in some cases I wasn't granted that kind of access.

As an observer it appears that there is a standardized and digitized method for managing fleet, and there is a ground up attitude. Basically, large systems lean on software programs and smaller ones tend to rely on people who are doing the job on the ground level.

So I interviewed, visited and researched as much as I could about several different bikeshare systems. In comparing and contrasting the systems, from an operational

standpoint, it was my aim to find out what efficiencies other bikeshare systems got out of their systems, the challenges they were faced with and how they were overcoming those challenges.



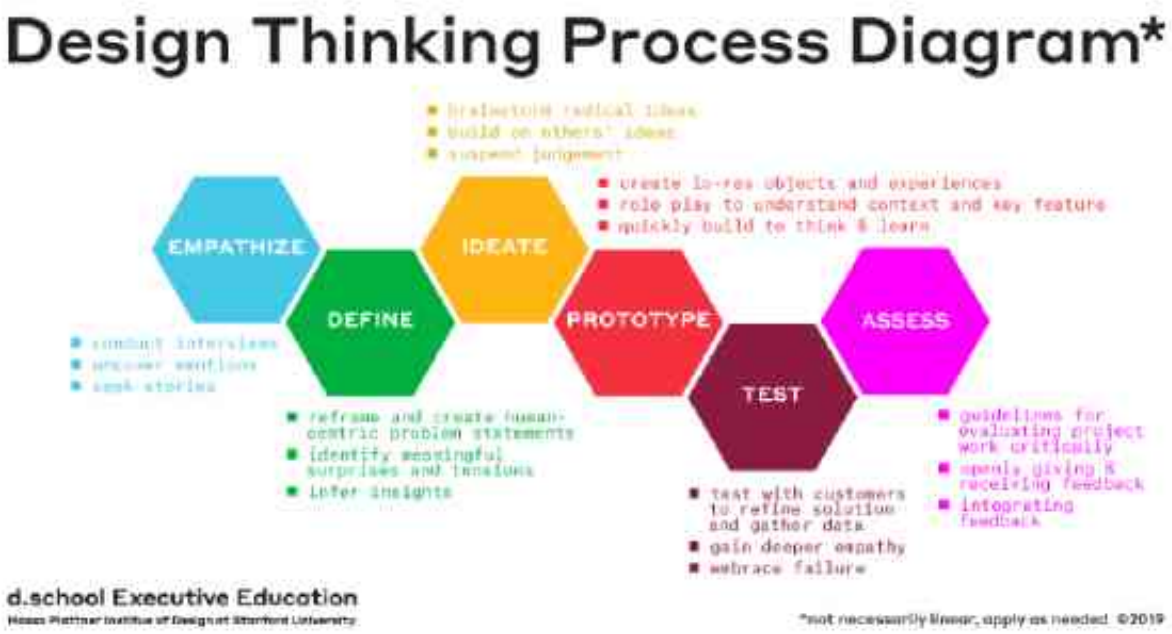
Bikeshare station in Yokohama



Typical “Salaryman” bike share user in downtown Yokohama

Research

Research was conducted through online discovery, interview questions, and ethnography. Using a Design Thinking construct (see graphic below) a hypothesis was determined creating the framework for the information that was collected.



Design Thinking Process

Systems (by city)

In exploring the bikeshares for this report, consideration for the environment in which they operate is an important factor. Cities have their own rhythms, tempo and human geography. For this reason, any analysis of a bike share will be made in light of the context within which it operates.

Analysis of each city/company bike share will have the following inputs:

- Human geography of a city
- Bike advocacy/infrastructure
- Generalized operations standard operating procedures
- Comparison of bike shares and best practices

Buffalo, Niagara Falls, University of Buffalo Campus North (Reddy Bikeshare)

Buffalo is a city of 276,000 inhabitants. It is a mid-sized city by American standards. It is not particularly dense and there is not a high demand for bike solutions as most people in Buffalo do not consider riding a bike due to historically harsh winters. US most bike friendly cities list of 1676 cities, assembled by the industry advocate, People for Bikes website, Buffalo ranks 1387th. In New York State, Buffalo is ranked 35th even though it is the second largest city in New York State (People for Bikes, 2022). Another list from a real estate statistics provider puts Buffalo at 22nd (Staff, 2022).

Video: Part I E bike + trailer prototype ops

Reddy Bikeshare has been in operation for 9 years and has had a nearly 12% growth rate in fleet size year on year. A snapshot of operations staff in 2023 comprises three cross trained Fleet Technicians who both perform rebalancing functions as well as fixing bikes in the off season. The team currently uses two gas powered trucks but has plans to purchase one Electric Vehicle and will test the intermittent use of an electric bike and trailer for battery changes and station inspections.

The Reddy Bikeshare system comprises Buffalo, Niagara Falls and the University of Buffalo North Campus. With a current fleet size of around 450 bikes, Reddy Bikeshare plans to expand its fleet to have 600 bikes by 2026. There is one warehouse/mechanic workshop but there have been remote workshops and warehouses in Niagara Falls. Consolidation was needed to defray the expense of moving bikes in the off season.

Currently, Reddy pulls up all stations for the winter. This is mostly a requirement of the City of Buffalo and Niagara Falls. This is a process that takes approximately one month to complete.



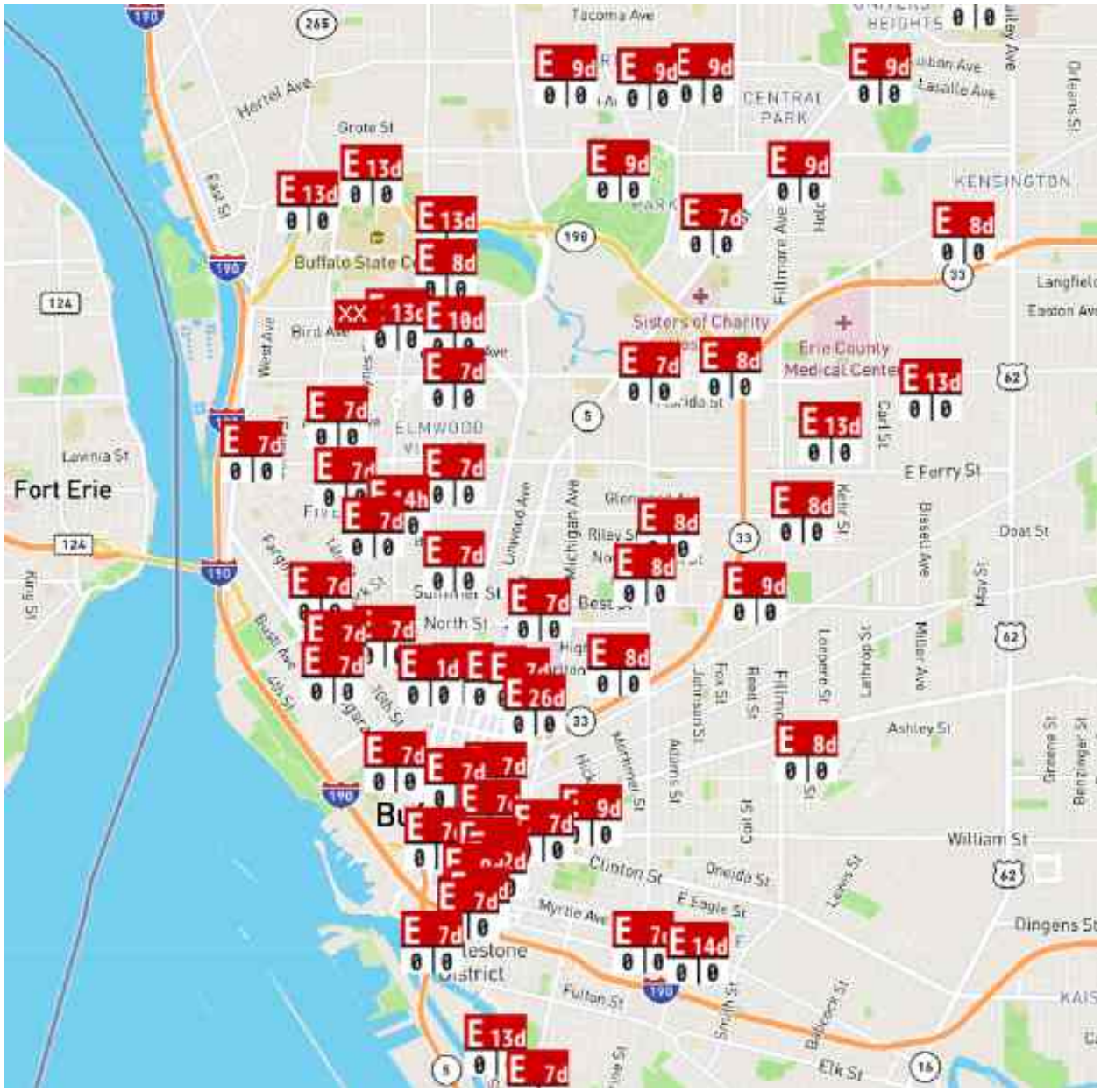
Jaime, Joe, Matt and Rebecca during springtime deployment. Photo credit Simon Husted



Reddy and Clean Mobility Coalition - Buffalo. Photo Credit Simon Husted

Currently the Fleet Tech street operation schedule is 7 am to 3 pm, 7 days a week. Generally, Buffalo and Niagara Falls aren't as fast-paced as places like Washington, DC, Seoul or Toronto and the bikeshare map reflects this. Fleet Techs decide which areas need attention at the beginning of their shifts and then use the "Sobi" "Rebal" systems of Mobility Cloud. Effectively each Fleet Tech is self-dispatch and 95% of the time uses a van to move bikes around and make minor repairs in the field. In this way anywhere from 50-100 bikes are "touched" per day. Touching means everything from counting all bikes at a station to verify that all the bikes noted on the application are indeed there, to finding, fixing or bringing broken bikes back to the workshop for repair.

Rebal and Sobi are the software applications that our Fleet Technicians use to determine where the trouble spots in the system are, and using that information, we determine what our priorities for the day will be. When I originally started at Reddy bikeshare, my boss Matt helped with rebalancing, there was another Fleet Tech who also did mechanical work. I exclusively did fieldwork.



Station map on Rebal (Off-season)

To properly “service” a station, all the bikes need to be checked for functionality. Depending on factors like poor locking, soft tires, mechanical or software problems, Fleet Techs also look for graffiti, remove trash and field questions from potential customers. Reddy had a record year for ridership. I often made critical decisions in the field. On days when I was alone on shift, I still had to make sure that the maximum number of bikes were available in three geographical areas

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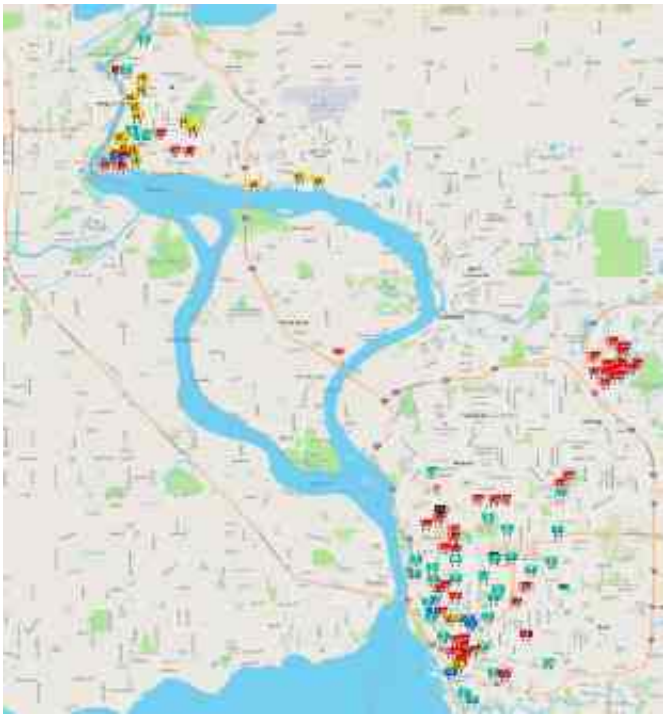
For rebalancing, trucks are the typical conveyance. Photo Credit Simon Husted

Impact after busy days on the rest of the team is that less time is spent per station and more bikes collected to be repaired in the warehouse. Demand is strong if people can depend on bikes being in stations, so operating bikes at all stations is always the goal. You try to hit the maximum for that station, but sometimes you just do the best you can.



Rebal map in the middle of spring bike deployment

Currently, all the Fleet techs and our manager meet in the morning and discuss the map and determine our strategies for the day. We decide amongst ourselves who will go where and do what. Since you can continually update the map and all of us carry iPads with us, the entire team can monitor the system within seconds. Since all of us work in all the areas, we all can read the map and interpret it, lending each other suggestions or help along the way.



Reddy total system: Buffalo, Niagara Falls & University of Buffalo

Fundamental in working as a team is that we have trust. Buffalo is small and it is easy to get to know a lot of people in the bike community quickly, most of us knew each other before working at Reddy bikeshare. Also, the Executive Director has insisted that the whole team gets to know and welcomes each new member. We do fun group events together, one of the first of these for me was a group ride to the beach in Canada. Being able to chat with a coworker, on a beautiful day while doing something we both love, is a great way to build a relationship. That trust translates into an ability to trust someone enough when they are at work to not micromanage their every move which would be easy for Matt to do using the Rebal system.

Another aspect that helped me to assimilate to the work is that Matt, the operations manager is a rigorous trainer, but will also give autonomy and plenty of support. Though I was new at the company, as soon as Matt thought I was able, he let me work on my own. There was always an open invitation to call him if I had any questions or issues. He let me make all my own decisions throughout the day. It made me feel trusted and supported. If I made mistakes, it was treated as a learning experience and I was never dealt with harshly. As a consequence I have felt empowered to come up with new ways of doing things, test those methods and bring them to the team. In many cases, my ideas have been adopted and implemented by the rest of the team.

Total Jobs By Hour on Aug 27, 2023

Hour	Rebecca Reilly	Low Batteries	Soft Broken	Hard Broken	OOH	Available Bikes
11h to 12h	5	0	9	15	10	349
12h to 13h	3	0	9	15	15	349
13h to 14h	21	0	8	12	20	353
14h to 15h		0	10	12	29	351
15h to 16h	14	0	9	16	27	348
16h to 17h	15	0	11	18	22	344
17h to 18h	18	0	10	20	23	343
18h to 19h	13	0	10	17	27	346
Average	**13/hr**	**0**	**10**	**26**	**14**	**337**

*note: the above average is only across hours in which interactions occurred.

Interaction Summary for Aug 27, 2023

Name	First FTI	Last FTI	Total FTIs	Total Jobs	Batteries	Inspections	Rebal PU	Broken PU	Map
Rebecca Reilly	11:35am	6:22pm	89	89	0	89	0	0	23 Stops

Sample Fleet Tech shift

Hamilton, Canada

The principal difference between Hamilton and Buffalo fleet operations is that Hamilton Bike Share maintains most of their bikes outdoors year round. The main reason for this is because they simply don't have the warehouse room to store all bikes and stations in the off-season. Hamilton, although it is north of Buffalo, tends to run a bit colder on average, and has far less snowfall per year than Buffalo. To a large extent this encourages riding throughout the winter.



Mechanic Shop, Hamilton Bikeshare. Photo credit Tyler Madell

Hamilton is much like Buffalo in that it is an old steel town and port. Hamilton is the only bikeshare operation of all the operations I visited and explored that runs a year-round rebalancing program by bicycle. In their case, it is actually a modified rickshaw tricycle. Rickshaws (two in operation), are hardy, powerful vehicles. Both of the rickshaws are outfitted with sturdy bike decks that can carry up to 400 lbs each. If more capacity is needed, the operation also has a modified trailer to accommodate four more bikes. Hamilton bike share operates a Sprinter van and a truck with a “taco” trailer for easy loading of bikes. Though this capacity is important for further distances and greater number of bikes the rickshaw fleet technicians shoulder a significant amount of work. Their range is more restricted than the vans, but because parking for the vans is difficult, the rickshaws make up time with their flexibility.



Art Racks in Hamilton. Photo credit Tyler Madell

The rickshaw decks are elevated nearly 1’ ½” and it requires some finesse to load the bikes by putting the front wheel on first and then shifting the rear wheel up. Operators say that the rickshaw makes them feel safer because of the tripod of wheels making it easier to mount and dismount the bike in icy conditions.

For mechanical checks, during the busy season, one of the four mechanics will be designated to ride the electric cargo bike to go to stations and flag or fix bikes with a

greater thoroughness than rebal operators. Also, due to storage issues, mechanics can also be sent to various storage spaces to fetch parts and supplies while they are checking bikes in stations. There are plans to upgrade the current cargo bag with a lockable cargo box since there is a high likelihood of theft. The rickshaws have been stolen, but are always found.



Mechanics' area. Photo credit Tyler Madell

What is notable is that the rickshaw operators love their job. Karen loves the job because she loves being outside. Shawn loves the job no matter what the weather and

he rides all winter long. They do note that they feel they don't get much respect from impatient drivers but haven't had any serious close calls to date. Ryan Waddell and the rest of the team support them even though they don't see them much of the day. The team accommodates Karen in the winter, bringing her inside to work. Shawn still rides all winter, but when the weather is too bad the team will train him on mechanics inside.

Operational Flexibility

The Hamilton system has 900+ bikes currently with 700 in the field. The team does about 40 touches per day in the winter. Coverage area is from McMaster University in the west, to the water, to the base of the mountain (escarpment) in the south and Ottawa Street in the north. The rickshaw rebalancers can move 40 bikes on a busy day and 20 on a slow day. Working at McMaster during the height of the season they can move 60 bikes per day. This is because the station density is particularly high on campus.



Taco Trailer

Video: Load Taco trailer

There is an understanding between the field staff and the indoors staff, likely borne of the fact that the mechanics will each take a turn riding the cargo bike and doing bike inspections. *empathy* They understand from a tactile perspective, what it is like to have cold hands when doing a repair, what it's like to have a car cut you off. It is clear that the Hamilton team is a team, and that creativity is supported. The mechanics, when it is slow in the colder months, will take on reconditioning old parts projects.

Though it was not said directly, there is a decided thriftiness (*as opposed to solving problems conventionally and with money*) in everything about the Hamilton bikeshare operations. Most bikeshares are not funded as much as they'd like to be, but the sudden demand of Covid and then the following supply line struggles hit the bike industry hard. Like Reddy, it is conceivable that Hamilton came up with innovations like winterizing e-bike motors, rebuilding drive shafts, creating their own tools and leaving bikeshare bikes outside, were responses to fiscal tightening and an overall lack of resources.

In the case specifically of the rickshaws, the motors were not winter proof. Their mechanic Cory took them apart and applied silicone and lacquer on copper wiring and replaced the gaskets making them as winter proof as possible. For a chain dropping issue, mechanics found a special accessory and installed it. To them, abandoning the rickshaw for another van wasn't the challenge, improving the rickshaw was the cheaper and more viable option.





Tyler and Rebecca test Rickshaw rebalancers

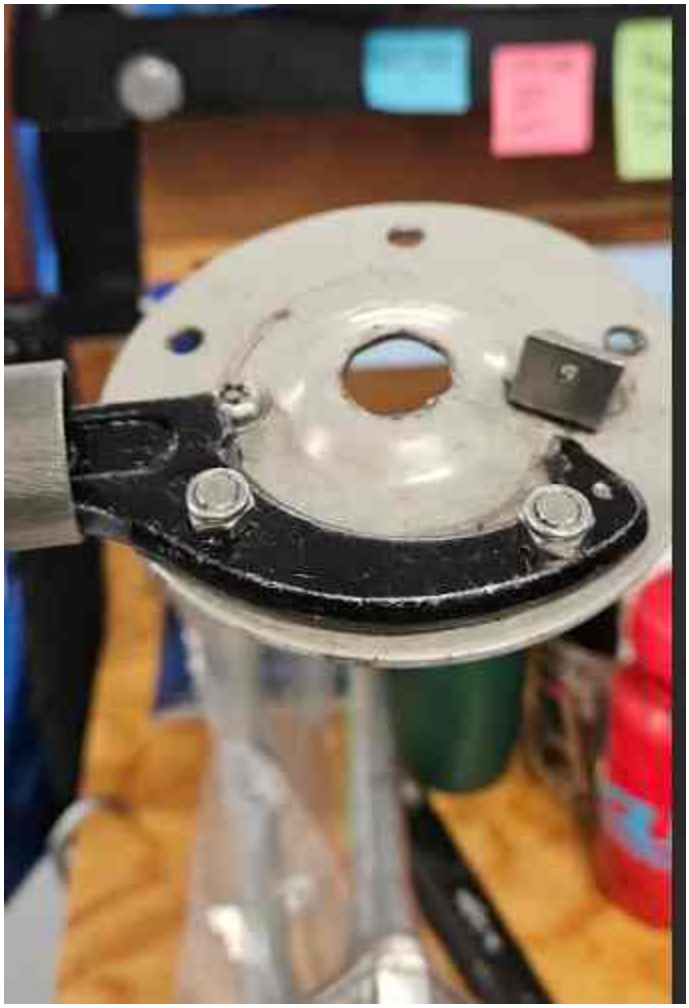
Hidden battery and air pump





Video: [Shawn and Karen ride rickshaws]

Hamilton also uses Sobi and Rebal software applications like Reddy. Due to the KPI's (Key Performance Indicators) set out by the City of Hamilton they have to check all the hubs within two weeks, so every bike needs to be touched within 15 days.



A Hamilton tool invention a la Pete “Popeye”

Some special programs Hamilton bikeshare offers are cheaper rates for people in need as well as adaptive bike rentals for other abled people. People can reserve these special bikes in advance and pick them up in a container that is positioned for loaning out the bikes. Among their adaptive bikes are tricycles, hand pedaled bikes and bucket tricycles with a bench for an additional rider. All people need to present to use these are connections through local food banks and other existing community programs.



Adaptive bikes and container (Everyone Rides, 2024)

The system has 900 rides per day in the winter and 1840 per day in September. During the bus strike last November they did 2,300 rides per day.

Toronto

Toronto presents a very different style of operations. While Hamilton has its share of commuters, the movement of bikes is not in any general direction at any point of the day. Toronto on the other hand basically sees some 3,000 bikes move south (into downtown) everyday. To ensure that these bikes are available for the next morning, the practice is basically to move a large number of these bikes back north.

Primarily, ridership tends to be using these bikes to commute. This is borne out by a personal account of a former bike messenger Reba Plummer who remarked, “I was coming south on the GO train in the morning and the train was completely full of food delivery guys coming south to work in the core with all these bike share bikes.”

The massive nature of the mission in Toronto is immediately evident in the number of trucks that sit in the parking lot ready for work. According to Dan Tepliakov there are currently 30 trucks and they are getting an additional 15 for the coming season. There are typically 70 people rebalancing the system on shift during the riding season. There was an effort to improve ergonomics by taking rear doors off the Transits and putting in a ramp that seals up the back of the truck. Unfortunately, the cost of the ramp and the labor to replace the doors amounts to around $28,000. The size of the trucks imply to

me that they carry at least 20 bikes each, possibly up to 25 bikes. There are also pickup trucks that pull large trailers that are likely about 25 feet long and presumably take 20 or more bikes.



$28,000 to convert doors to ramps. Photo credit Tyler Madell

All operations vehicles are gas powered as there has been difficulty with the E Vans. Apparently the E Transit van motor had a tendency to fail and there were problems getting replacement parts. Rivians weren't much better, so the Shift, the company that operates Toronto's bikeshare, does not have any electric vans or trucks in their fleet.



Pickup truck and "Taco Trailer." Photo credit Tyler Madell

Currently, due to continued year on year expansion, they will be settling into the other half of the main building on Booth Ave. Mostly this building has offices, bike workshops and spaces for various kinds of equipment that is needed to keep the system running. A big continuous task is charging the car batteries that are used to power the stations that shared bikes dock to and stations that actually charge the electric bike. There are solar panels on the stations, but that is really only enough power to keep the station running in the event that the batteries run out of charge.

Bikes mostly just move in and move out. They leave the majority of bikes out in the winter, and because electric bikes pretty much stop working in extreme cold, those are just left until the weather warms up and they appear to still not be working.

There are two other warehouses that have bikes and stations for expansion plans.

The Toronto system has 800 stations and will grow by another 150 stations with 9,000 bikes on the street at any given time. This year the fleet will be augmented by a further 3,000 bikes. There are 20 e-bike charging stations but in the cold they don't charge at all because the batteries have to be room temperature in order to charge.

Expanding the E bike charging station footprint is difficult because connecting the station to the grid necessitates connecting the station to the grid for a constant power supply, in order to do that it is often necessary to dig a trench across a parking lot or a similar situation due to future building plans in that area. The cost of setting up an E Bike charging station with a trench is $175,000. So it is a real commitment.

All the managers working on the bike movement plans are cross trained and capable of running the whole system. Instead of dispatching what an oncoming team gets at the beginning of the shift, they instead make plans in advance of the shift. The sheer volume dictates planning that takes into account station repairs, planned events and the weather.



Toronto Shift Rebalancing map generated by QSet

On the mechanical side, mechanics can do 10 bikes a day, partly because E bikes do not break down as much or as seriously as “classical” or simple push bikes. Also, there is a standard operating procedure that everyone is trained on. In the event that

rebalancing for demand is outstripping staff on the street, mechanics can go out and help with that part of the team.

In the winter there are 20 mechanics plus rebalancers equals 300 staff with actual hands on the bikes on a basic day. Vice versa, when there are more rebalancers than needed, they come in the shop and learn the mechanical side of the operation.

The nature of the Toronto bike share system has much to do with the requirements of the City of Toronto. According to Toronto by-laws, it is illegal to track someone's ride. Therefore the bikes are only tracked when a customer unlocks a bike from a station and then when that rider docks the bike again. There are no GPS chips on the bikes, so if they are stolen they cannot be tracked. Luckily, the Shift staff tell us that though 200 bikes might go missing throughout the year, most come back and only about 20 are written off as a total loss.

Cross training

So, as a result of the docking situation, there are staff that are scheduled to be at certain stations that get the biggest influx of inbound bikes. There they set up "corrals" of up to 300 bikes that rebalancers in trucks will later come and get. The bikes are locked with a long cable lock and then several rebalancers with trucks, given orders through the 60 cellphones that are specifically designed for this work per shift.



Shift's bike corrals, photo credit Tyler Madell



Due to experience and strong teamwork, the Shift team is able to efficiently anticipate events and have enough staff to receive bikes or make sure that the right amount of bikes are taken away from a given location. On a nice night nearly all bikes might be ridden after a game at Rogers Stadium, but if it is raining, the planning team has a very good idea how many bikes to leave because it is likely people who rode to the game won't ride home because few people will actually ride in the rain.

Video: Bike batteries



Car batteries, shovels and solar panel scrapers. Photo credit Tyler Madell

It is important for a system this size to run for 24 hours, the general manager Amir tells me. It is the overnight shift that is the backbone of the entire operation. Conceivably because it is the one and only chance a busy bike system can catch up to itself.



Shift, bike computers needing repair

Not all rebalancers are in trucks, many also do their rounds on foot and by bike. It makes sense to use the ebb and flow of traffic to your advantage in a city like Toronto which has some of the worst gridlock in North America.

Steel Toes





Tyler in the Shift kitchen

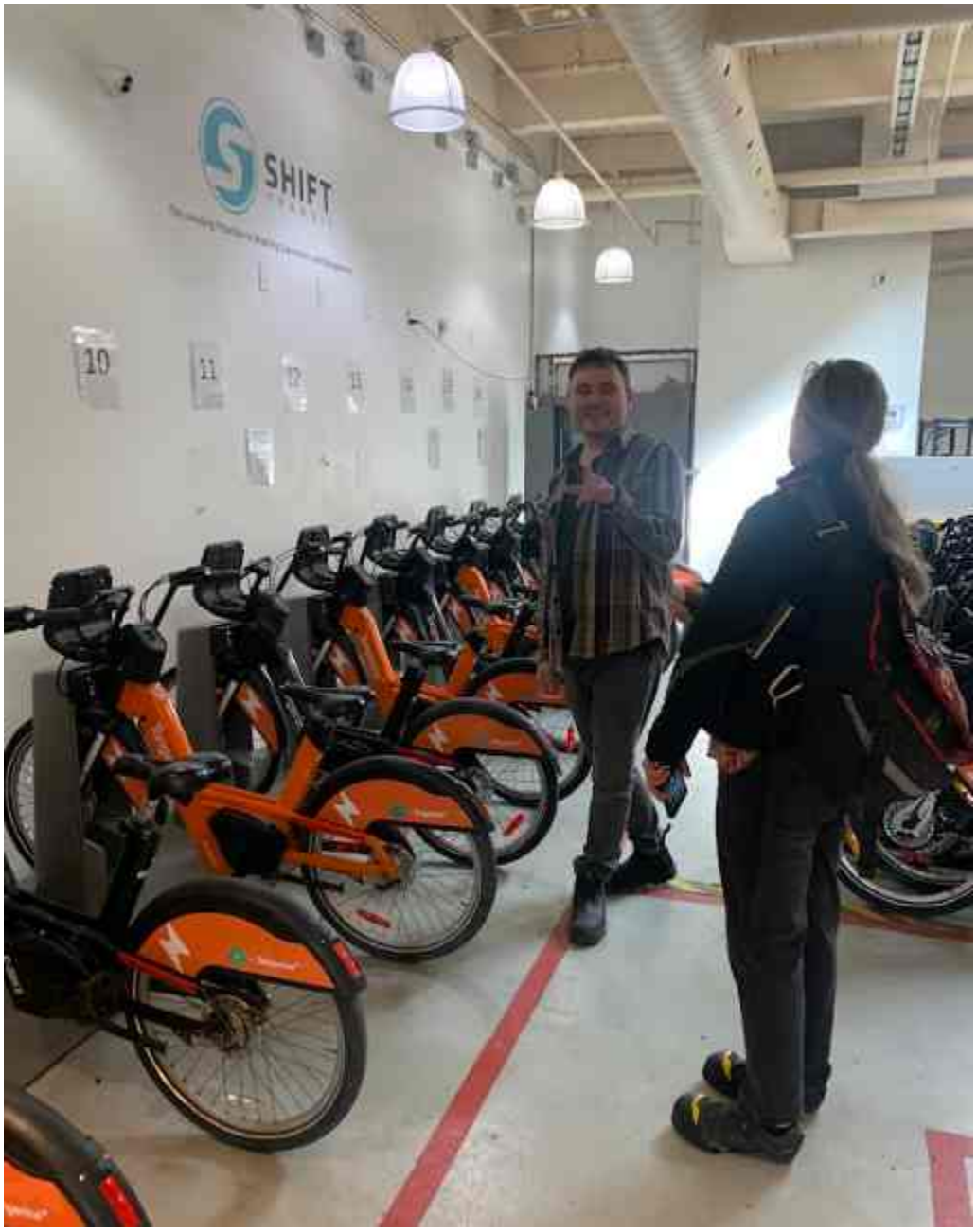


Mechanics' shop with lift assist bike stands. Photo Credit Tyler Madell

The bike, according to Amir, is the foundation of the whole system. Like the lead mechanic in Hamilton, Jordan says, the bikes feed everyone else. The customers push the bikes around and this is the fundamental churn of the system that getting a handle on is key to sustainability. A virtuous cycle demands system expansions every year. A vicious cycle on the other hand, likely leads to a lack of solvency and an inability to maintain sustainability and ultimately bankruptcy.

Amir remarks that bike repair, of all the functions at Shift, is the most difficult to teach. There are a couple of different bikes, and as a mechanic myself, I know that building that knowledge, particularly when there are almost annual updates, makes knowing how to fix things on bikes complicated for the uninitiated. Amir puts it succinctly, "You can't teach it over the phone." There are a lot of other instructions having to do with the

station operation, how to get around, and how to load bikes that are comparatively more simple and straightforward.



Mechanics' shop charging station. Dan Tepliakov and Rebecca.
Photo credit Tyler Madell

According to the KPI's given by the City of Toronto, every bike must be touched once a month. Stations need to be preventatively maintained and have battery swaps every day.

Then of course there is the responsiveness to customer needs. One of the oddest complaints they receive at HQ is that people don't want E bikes in the park because users are trying to exercise with more intensity than using an E bike.

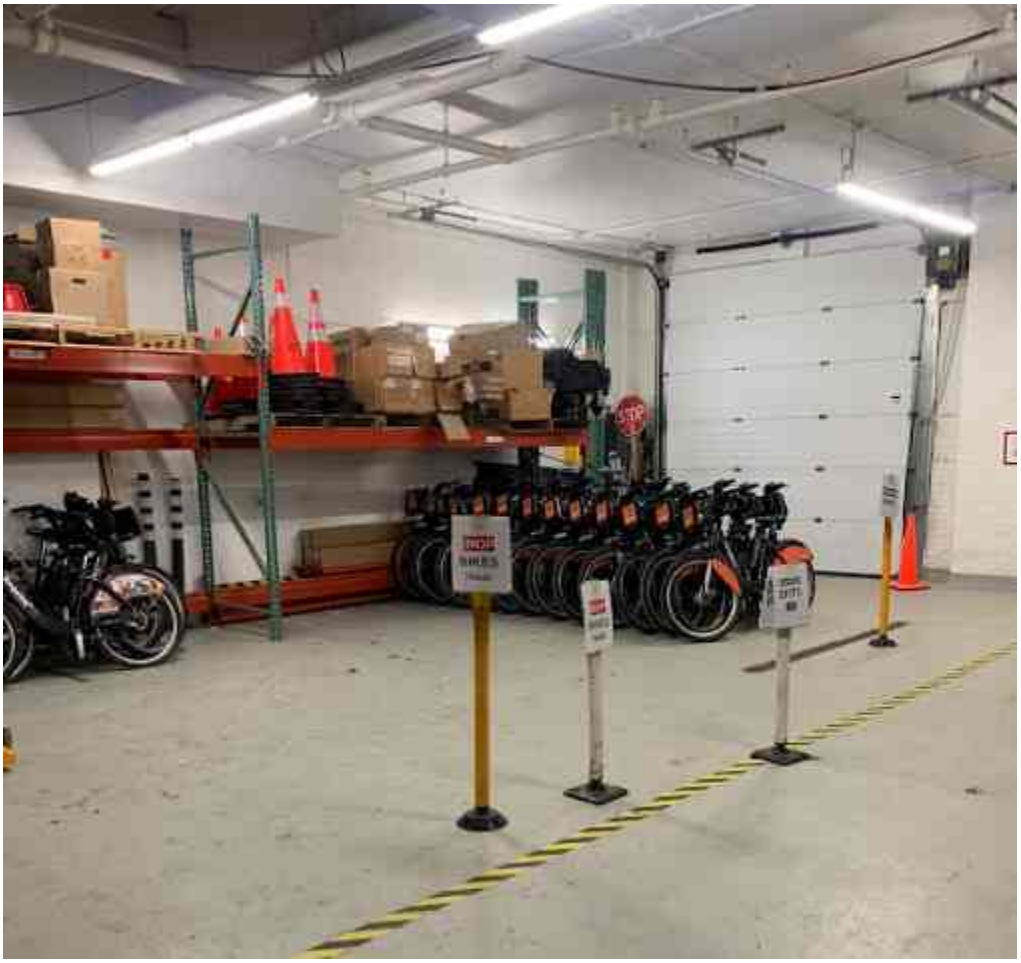


Station car battery charger. Dan Tepliakov and Rebecca. Photo credit Tyler Madell

The team at Shift is always looking at ways of fitting more stations into high intensity locations. One location at the CNE (Canadian National Exhibition) houses their biggest station on Fleet Street with 86 docks.

Video: Rebalancer loads truck on Front Street

Compared with people in the U.S.Canadians seem to have an almost blase attitude towards the cold. As a frequent visitor to Canada, it's hard not to notice how many more people will be outside, in general, than would be in the states in the same kind of weather. Even in cold places like Buffalo.



Fixed bikes, ready to be deployed. Photo credit Tyler Madell

So the people there are out more. Canada has always been a bit ahead of the US in terms of bicycle acceptance. Although it still isn't as nice to ride a bike there compared with almost anywhere in Germany. Still, I was harassed less, and certainly with less violence in Canada than almost anywhere in the U.S. And then there is markedly more and better bike infrastructure in a place like Hamilton compared to Buffalo.

Environmental factors affect ridership?

Seoul

Seoul has the feel of New York City, but from an on the street perspective it is much nicer to navigate on a bike because the roads are in good condition through much of the city and protected cycle tracks are the norm rather than the exception. In areas where there is no bike infrastructure, Seoul drivers are more inclined to yield to bicyclists and hang back rather than crowd someone on a bike. The culture, on a whole, is more polite than most cities in the U.S. and even Canada.





Innovative bike racks made of composite plastic

Contrasting with Western society, Koreans are culturally group related and in public terms, it is more likely that people will behave better because losing one's temper publicly is a decidedly non-Asian trait. I kept noticing, wherever I went in Seoul, that the City of Seoul's bikes were all in the station area rather than singles deposited all over the place haphazardly. Even privately operated bikes were staged neatly around town, out of the right of way, unlike the U.S. where at times they seem to litter the streetscape.





“Salaryman” Korean style

A Korean politician Oh Yung-yul, an alderman on the Eunyoung district council relates, “I am a politician and bicycle expert” relates from his constituents he finds, “Seoul citizens love shared bicycles very much” and that “In City of Seoul policy rankings, it has ranked first every year.” He expands on the impact shared bicycles have had on the City of Seoul, “Shared bicycles can be seen as a means to increase the utilization rate of bicycles as well as providing convenience to citizens.” The city of Seoul has had high aspirations for ridership overall, but it rests currently at 3% modal use. Though cities around the world chase cities like Groningen, Germany at 50% (City Clock, 2023), Seoul is actually right on track with Toronto’s 3% mode share. The difference that isn’t obvious is that Toronto has been working on improving city-center bike infrastructure for more than 30 years whereas city-center bike infrastructure development in Seoul has only really started in the past decade.

Mr. Oh further explains that the city of Seoul undertakes, “...systematic education and campaigns,” in concert with shared bicycle services and data from these campaigns is used towards creating more bike infrastructure.

When I first rode my bike in Seoul in 2008, the only bike rentals I saw were down by the highly tourist focused Han River parks. In 2008 there was already an extensive network of park and river bike use only trails and Koreans were well on their way to a biking boom. Most cycling that I saw was either collective riding in large groups on these paths, one off riding with friends and family riding the rental bikes in pairs or utilitarian cycling of the extreme poor and street vendors.



Information sign for bike share



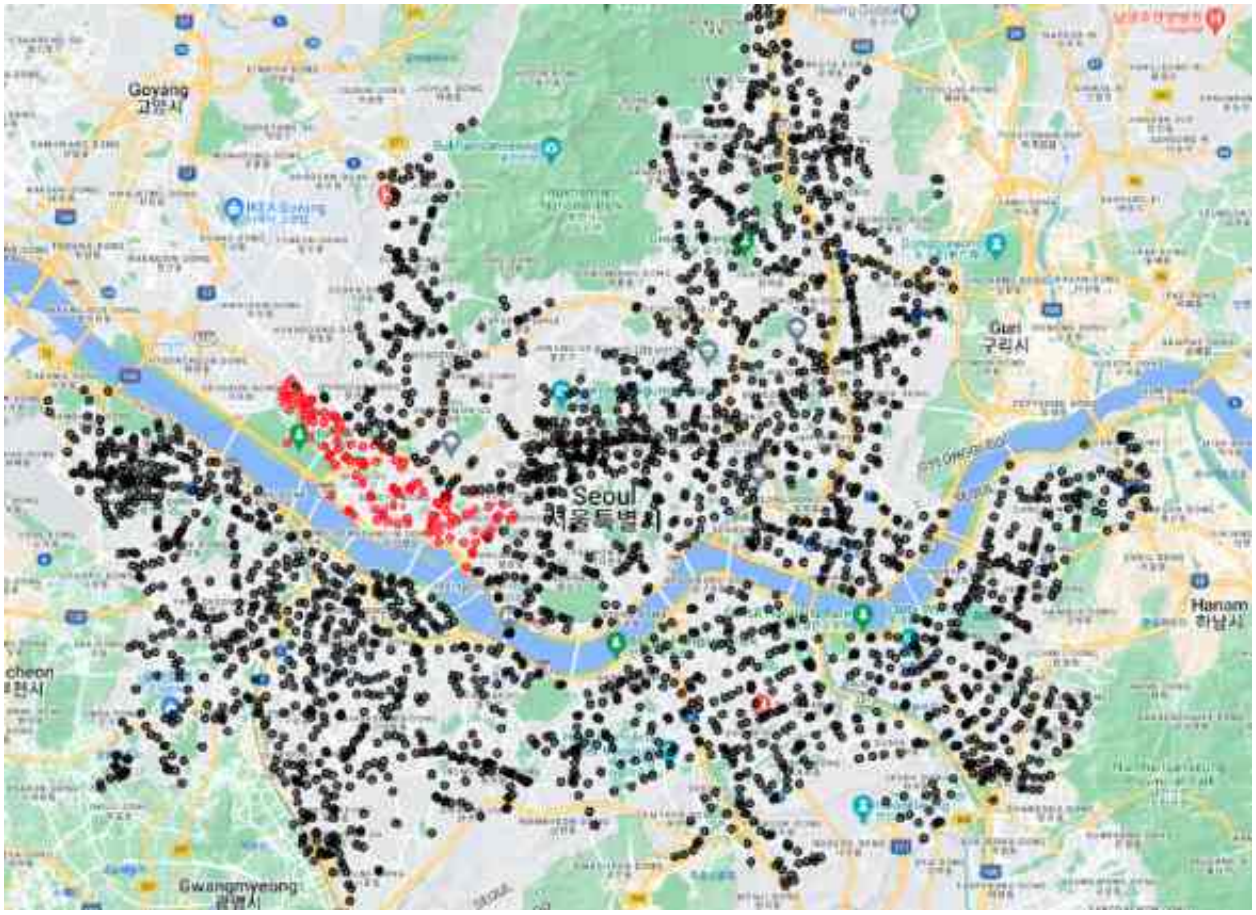
Privately operated bike and scooter share





Privately operated bike share (Counted at least three brands)

During my visit during September of 2024, bike share had thoroughly blanketed every corner of the city of Seoul. Looking at the bikeshare map for Daerungi, the locally operated bikeshare, it is clear that the city of Seoul is trying to get people thinking about using bikes for everything including getting them out of their cars for the daily commute.



Seoul bike share map (Artekin, Kim, Novoa, Zafari, 2023)



(Shulz, 2023)

New York City has a smaller population but Seoul has a smaller land area which means that Seoul is far more densely populated, that population residing in hundreds of high-rises throughout the city. Notable with this crush of humanity is that some 10% of that land area is mountains popping up throughout the city. Generally speaking, there are no residential areas on these orphan urban mountains. This lends to the population density.

This means that cooperation is key to getting along. This has long been a character trait of Asian cities. If the citizens of Seoul behaved like the mostly self-interested New Yorkers, there would be daily bloodbaths.

There is also more enforcement of bike infrastructure. Police will stake out bike lanes and penalize drivers with heavy fines for driving and parking in bike lanes. In contrast, in the states, police will stop cyclists doing anything illegal including riding outside of a bike lane, even when there is a squad car parked in a bike lane that a cyclist is forced to ride around, thus leaving the bike lane.

Needless to say, compared to NY, LA or virtually any large American city, I feel perfectly safe riding a bike in Seoul.

In the main core of downtown, bike stations appear nearly every block. In 2023 there were 43,500 bikes in service and in the summer high season there were 110,000 rides per day. To manage the work there are 300 delivery staff and 60 mechanics. There are 11 delivery maintenance areas that include a mechanic workshop/warehouse. They run 1 ton trucks that can take 15 bikes at a time. Bikes don't come off the road in the winter per se, as with stations. However, as bike usage decreases, they pull off a similar percentage of bikes and put them in storage.

Seoul, South Korea, is quite cold. It is on the same latitude line as Buffalo and Hamilton. It doesn't get the amount of snow that Buffalo gets, in fact municipal authorities use industrial sized sweepers for snow instead of plows. On snow days you can see shop owners out first thing in the morning with their brooms, sweeping the sidewalk in front of their shops. From September to December rides decrease by 46%.

The City of Seoul manages and owns the main bike share Daerungi, it also employs the rebalancers and mechanics. The department in the City of Seoul government responsible for bikeshare is the Pedestrian and bike department. The system has seen a steady 9% growth for the past 3 years and has 4 million members as of August 2023. Mostly the rides are short distance transportation, like from a subway stop to an office, commuting and leisure. Since the membership is cheap they don't provide any discount programs.

Washington, DC

I worked at Capital Bike Share (Capital Bikeshare, 2024) in 2013 as a mechanic at the behest of former messenger friends. What astounded me when I returned to DC after having been gone since my days of being a messenger in 2002, was the incredible explosion of cycling. When I left DC in 2002, messengers were far and away the majority of cyclists on the road. When I started being a bike messenger in 1991 messengers were effectively the only cyclists on the road with only the stray hippy or environmentalist commuter.

Eric Gilliland started at CABI six months after their launch coming from the Washington Area Bicycle Association, "In advocacy you can ask was it messengers first, it's a chicken and egg situation, basically bike share is a gateway drug" Eric Gilliland relates, "Because it is an easy way to get people riding bikes. The bikes are easy to use because they have chain guards, fenders and three gears. It's a great way to get

people riding more. When people are riding more, the city freaks out and realizes they need to make it safer for those people to ride. These days DC is different, now there are more bike advocacies, more funding, more facilities." Eric continues, "For instance, in NE in ward 5 where I live, there are families biking and they have their own little bike organization. It's nice, and it didn't exist with WABA back in the old days. It was hard then to get people on bikes, it was only environmentalists, hippies and messengers."

When Eric started there were still conversations about where stations would be placed. From an engineering perspective, the inclinations are different than using the human geography influenced perspective of a former bike messenger. At CABI, there were enough messengers around to be a critical mass, and they drove their point, for instance suggesting putting bike stations at subway station entrances.

The initial launch in 2010 with 99 stations and 1,000 bikes throughout DC including the Nationals ballpark and Arlington.

By 2011 CABI, begun by Alta Planning, was the same firm that helped to launch the Citi Bike Program in NYC. When I was there they were undergoing a major expansion in the DMV (DC, Maryland, Virginia) area to bring the fleet up to 6,000 bikes. At the same time NYC was beginning to launch their system and the CABI staff was providing a lot of guidance in that pursuit to the NY operations.

Ultimately, Alta was bought out by Motivate and the workers at CABI unionized. When Lyft recently bought CABI, they contracted out the work to Motivate in DC but ran their Maryland and Northern Virginia operations as non-unionized employees.

In DC there is one mechanic shop and warehouse. I visited it a couple years ago and I remember it being cavernous. There were twice the mechanics we used to have, but CABI still runs on 2 shifts instead of 24 hours like Toronto (Maus, 2013)



Photo: Bike Portland

What is extremely unique and interesting about how CABI conducts its street operations is their bike checker team. Rebalancers, are drivers with one ton trucks that can carry 15 bikes, and are not responsible for checking or fixing bikes per se. That is largely the responsibility of bike checking teams who go out on bicycle, or cargo tricycle. Bike checkers do routine basic repairs like adjusting gears, replacing saddles and pedals. They don't fix flats because that is too involved a process to do well out of doors. There is a team supervisor who coordinates with the rebalancing dispatcher and then deploys his team to different locations around the city.

The main dispatcher dispatchers rebalancers effectively treating the bikes as packages instead of the rebalancers carrying their own tablets with maps and relying on a SOBI type system to figure out where to go next.



Bike checking cargo bikes Photo: Bike Portland

Now CABI has a 700 station system with 7,000 bikes operated by 13 rebalancing vans and two shifts with one person per van.

Albany

CDPHP Bike share (Capital District Physicians' Health Plan) is notable in how far flung the CDPHP areas of responsibility are. As in the case of every bike share, the bikes drive the work and since the bikes are in population centers that are quite far from each other, the necessity of using gas-powered vehicles to service those bikes is evident.

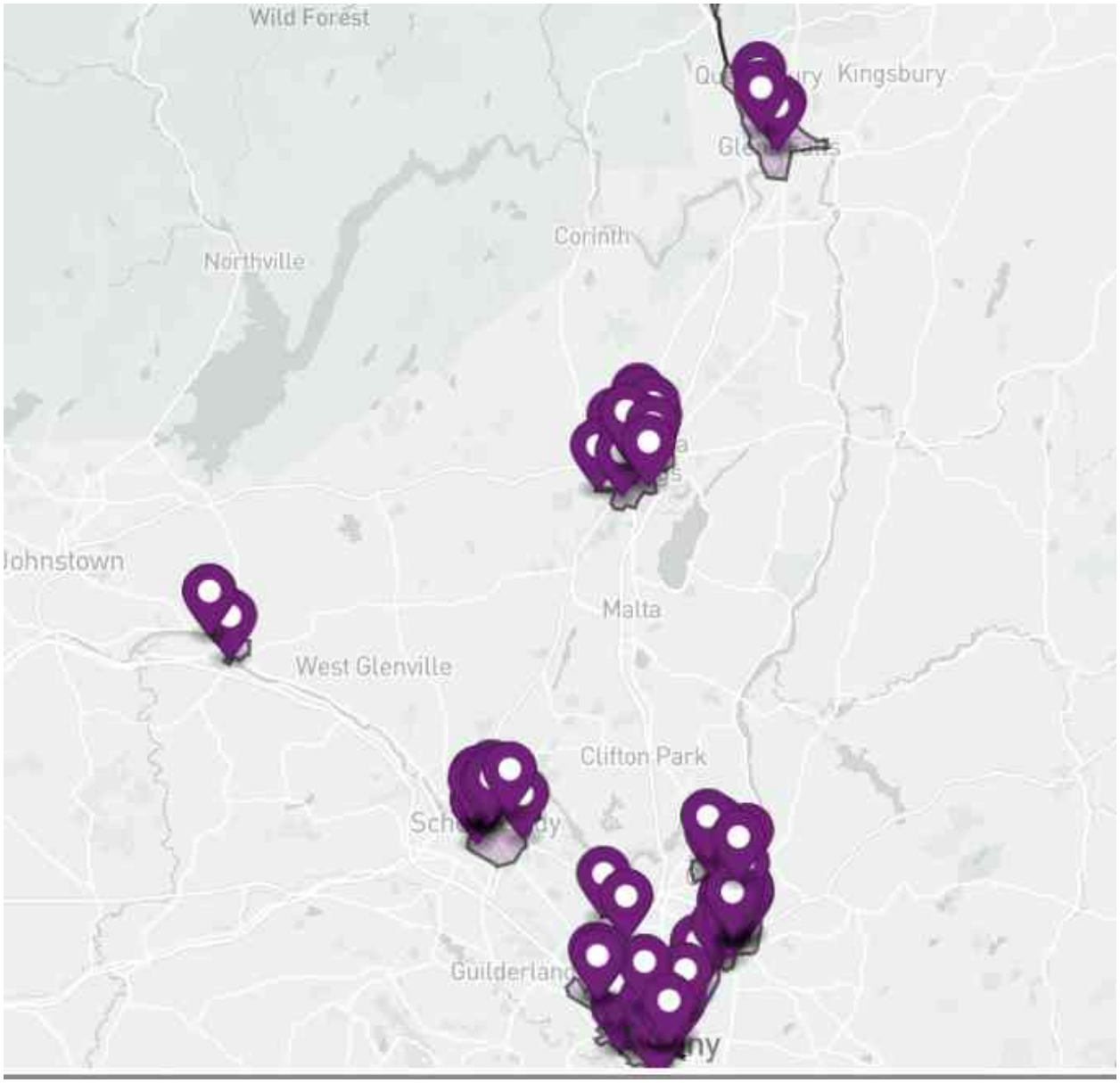
CDPHP Bikeshare falls under the umbrella of SMI which is also Reddy Bikeshare's parent organization. As an employee of this organization, I can attest to the effort on the part of the head office to ensure that though we are geographically separated, we work together on all things. Recently, in fact, both teams were brought together in person to work on the strategic vision for the next five years. It is one thing to mouth that sentence and conduct a seminar with that intent. What is harder to pull off is encouraging a team to dream big and support each other and to become one team. It is clear to me, as a worker with no real management responsibility, that personally I am expected to dream up innovative ideas and pursue them and that I will receive support in that aim. Having met with the Albany staff, I am inclined to believe that they feel this way as well.

The Hudson Region bike share includes several different cities including: Albany, Schenectady, Cohes, Saratoga Springs, West Glenville, Amsterdam, Watervliet, Menands, and Queensbury. The system has approximately 500 bikes on the road with a split of 200 classic pedal bikes and 400 Ebikes. The difference between on the road bikes and the 600 bike total is bikes that are scheduled for later deployment. Growth has largely consistently increased with an odd year where bike numbers went down due to the switch from the previous operator to the current operator SMI. Generally, growth has doubled each year.

To run the system there are two full time and four part time rebalancers. This is due to the fact that the work is seasonal and in December all the bikes are pulled up and brought back to the warehouse for storage and refurbishment. Typically they redeploy these bikes in the spring and with the increase in activity there are seasonal hires. There are also two full-time mechanics and one of them doubles as a field technician.

The touch average per field tech (also referred to as a Fleet Tech & rebalancer), are 30 touches per day which may seem low when compared with other bike shares, but the drive time between cities makes it impossible to raise that number past a certain point. From our experience at Reddy Bikeshare, servicing geographical areas separated by at least 35 minutes of driving, necessitates driving. Additionally, servicing those areas generally would not justify hiring some who lives in that area because often times that person would be needed elsewhere and it only shifts the responsibility of covering that distance to the employee which isn't a good value proposition for the employee and thus difficult to hire for as people are reticent to shoulder that burden for a company. Then it is also important to have eyes on management and accountability of staff. It is likely to some degree that there will always be staff, knowing they are unsupervised, will take advantage of that fact.

Mechanics repair between five and eight bikes per day. Much of this, like the trips and rebalancing numbers are weather dependent. Student ridership stays high throughout the season, but numbers tend to dip when weather gets cold and wet. Like other bike shares in colder places, e-bike batteries stop working well in colder months.



CDPHP Bike Share areas of responsibility (CDPHP Bike share website)

Given the situation CDPHP Bike share is faced with, they produce 83,000 trips per year from 118 stations and additional geo-fenced areas across 10 cities in a region that spans 1,300 square miles. As someone who drives sometimes daily between the Western New York triangle of University of Buffalo, Niagara Falls and Buffalo, I am absolutely gobsmacked that they achieve what they do given their parameters and

constraints. The increase in rides has doubled each year from 2017-2021 and then slowed to 15% during 2021-2022, again, due to the change in operators. They have two bike shops/warehouses and three vehicles doing rebalancing work. To date, there are no bikes doing rebalancing work, however there are plans to use an e bike trailer combination to do battery swapping. The plan is for rebalancers to take the e bike and trailer in a van and then work in congested areas like Saratoga Springs and Albany proper where congestion and parking are more difficult.

Operating hours are seven days a week 7 am to 8:30 pm. CDPHP bikeshare offers discounts to Universal Access members for free classic pedal bikes and discounts on E bikes. Universal Access is granted through universities, hospitals, municipal employees who have negotiated free bus service as a benefit through CDTA (Capital District Transit Authority). Guests of certain hotels can also enjoy a 50% discount and CDPHP insurance users get a 20% discount across the board.

Conclusion:

Bike share is a new industry. It is going through growing pains. That means that poor decision making can lead to catastrophic results for some companies. The bulk of the industry is controlled by for-profit companies that seem to run on a similar ethic as technology driven companies. Though there is a lot to be gained from the power of algorithms and the advent of Artificial Intelligence (in all its forms), it is clear from my research and perspective that there is still a great deal of wisdom in listening to people, particularly people who have experience working on the front lines.

Customer usage drives entire systems. Managers who ignore customers and their needs risk steeply falling trip numbers. Trip numbers are paramount when demonstrating to donors, sponsors, investors and municipal authorities that bike shares are worth it.

In that pursuit, the operations team of any bikeshare is a critical piece of the business. They see how customers are treating bikes and come up with measures to mitigate bike breakage and the time that bikes are off the street. The fewer bikes available due to vandalism, breakage, slow mechanical turnaround times and rebalancing inefficiencies, lead to lower the trip numbers, which lead to lower the financial support, municipal support, and revenue.

Human geography, weather conditions, infrastructure and space/time continuums determine how that job is done. Parking on the East Side of Buffalo in a huge unoccupied parking lot is easier than parking at King and Bay Streets in Toronto on a

Friday afternoon. Doing gear adjustments and seat replacements is far different in the freezing rain of Hamilton, Ontario with no heated van to crawl into, compared with doing those repairs on a beautiful day at one of the World's Great natural wonders, Niagara Falls. Rebalancing is simply a different job in different places, at different times.

This variance requires the creativity that only human beings can bring. I believe providing a fertile ground for creativity, management has to be committed to a certain level of autonomy on the part of operators.

At DC's CABI, using bikes for operations was born of a culture with a huge proportion of opinionated former bike messengers. A bike messenger's tendency is to think how everything can be done by bike. Avoiding using vans for every function has saved CABI unknown millions of dollars in van maintenance, parking, insurance and gas expenses. Those same opinions also influenced station placement which became key in growing ridership quickly.

The danger in success is that scaling up leads to an attrition of communications and innovation. Often those are the very things that got the organization where it is. This then can lead to an overall system degradation causing system-wide failures that cascade into problems that are difficult to get control of.

Efficiency measures, in corporate - for profit terms, are often conducted with the cool calculation. Amazon does it by tracking employees and contractors movements and penalizing them for inefficiencies (Hamilton, 2023). These days the tendency is to look to algorithmic solutions for efficiency problems. But like Amir from Shift says, you can't coach mechanics on the phone. You certainly cannot do it by app either.

In Peachtree Corners office park, Georgia there was a pilot project (Robotics and Automation News, 2021) where you could summon a scooter via app. Great way to manage a fleet of bikes if it were possible to apply that technology to a bikeshare fleet, right? As someone who has seen first hand the vandalism and misuse of bikeshare bikes and having spent much of my working life out of doors in big cities, I am immediately skeptical. Check out the following delivery robots video and it won't take long to understand why automating rebalancing via autonomous bicycle has a high likelihood of being a catastrophic failure (Menhoff, 2023).

After talking with certain bikeshare workers who asked that their names and place of work not be mentioned, it is possible, in my opinion, based on who they work for and efforts that are underway currently at their employers, that efficiency measures instituted

without their direct participation have led to adverse effects directly on them in the field, as well as the systems at large.

Simply pushing workers for higher touch rates could lead to unintended consequences. When you weigh unreasonable KPI's to traffic, distance and weather conditions, re-balancers' work lives start getting a lot harder. If one can't maintain an unreasonably high touch rate for conditions and limitations, necessarily one has to start cheating the system. Physics and human endurance has limits (City of New York Comptroller's Office, 2023, Bursztynski, 2023).

Overall, from the companies I've visited, I've sensed that people on those teams felt they had a worthy mission and a bold purpose.

Seoul has drowned a city with bikes. It is a "Build it and they will come," optimism that has led to an explosive growth in ridership. Seoul is a city that is desperately combating suffocating pollution by getting people out of their cars. It is an interesting contrast with the individual private efforts in the west which makes the piecemeal approach more frustrating for operators in the U.S. and elsewhere in the west, but a reminder that we too can achieve scale while maintaining an empowered workforce.

Also encouraging in Seoul's example is that private operators still exist in that ecosystem. It indicates that there is still a lot more room for growth.

From Reddy Bikeshare's bike libraries in poor communities, to Hamilton's adaptive bikes for the handicapped, bike shares are providing a democratization of transportation of sorts. The sheer volume of bikes in Toronto and the magnificent ballet Shift performs, moving 3,000 bikes a day in the name of making bikes available to the poor, the immigrant food delivery guys and the young professionals, has created its own economic ecosystem. Bike share is providing equality of opportunity to move but also it is employing people.

That Reddy Bikeshare allowed me to prototype a plan for our own E bike + trailer battery swapping project, is the kind of attitude that promotes innovation throughout the ranks and builds resiliency for the organization as a whole.

Covid and the following supply chain stoppages dealt serious blows not just to bike share but to the bike industry as a whole. The wild swing of exploding demand to ride during Covid, to the cataclysmic fall off a cliff when Asian suppliers of bike parts couldn't get shipments through to ravenous bike hungry populations was apocalyptic for many bike shares. Unable to innovate and flex for the moment, many failed.

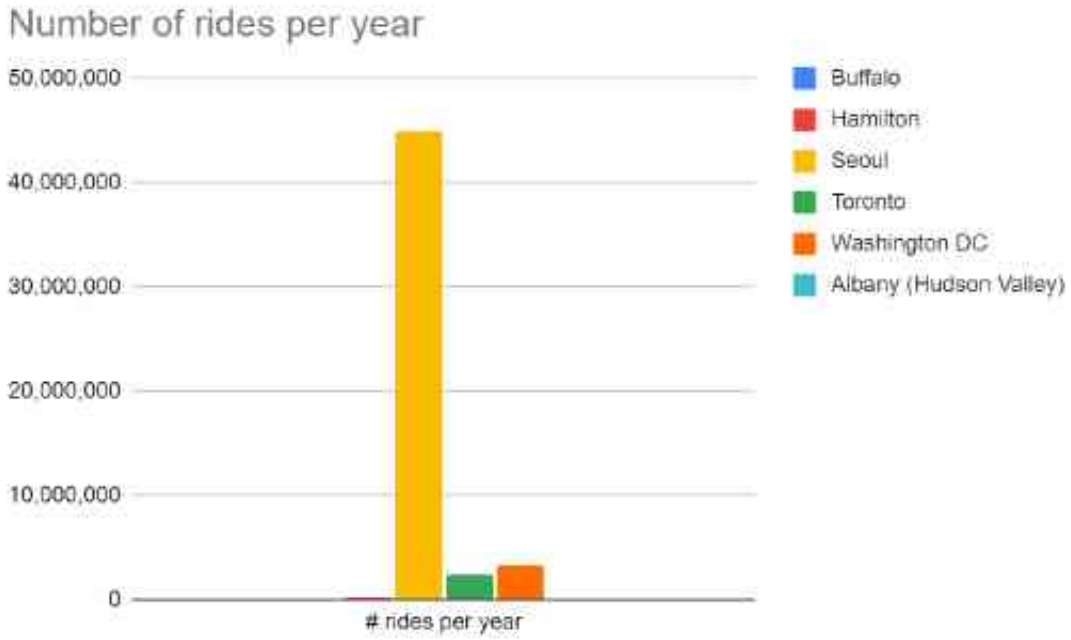
It takes the audacity of Hamilton Bike Share allowing a master mechanic to rebuild parts that don't have manuals, to allow a Pete "Popeye" to build his own tools out of spare parts that in the long run can save hundreds, possibly thousands of dollars.

It's Amir at Shift Toronto proudly proclaiming that his entire management came from the street, worked their way up and still, any one of them could run the system by themselves.

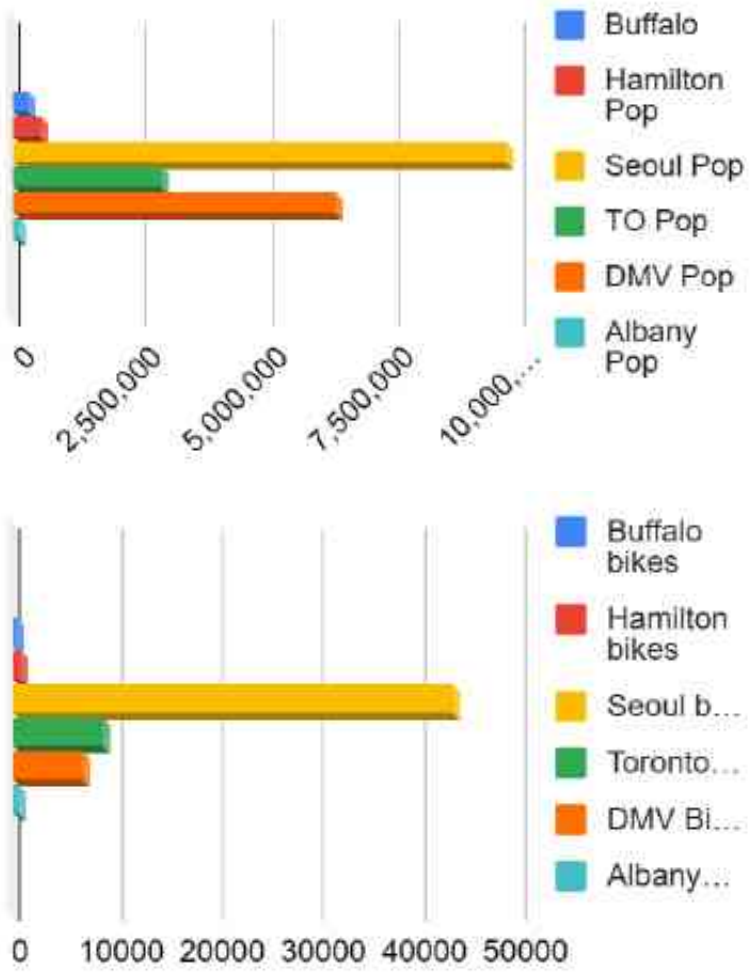
Success in building a team is letting the bike messengers go out on their bikes and fix and flag bikes at CABI in Washington DC. It leads to money saved on the vans that would have to be driven to replace them. And an understanding that the people on the bikes, on the street, can make a lot of sense.

Simon, communications director at Reddy bike is an incredibly empathetic individual. He is also humble. So when he moved 10 bikes with a van, he got a taste of what it was like to be a Fleet Technician like me and the ops staff. He made sure we knew that he knew how hard our job was. That translates into trust, into crazy ideas being heard, into your company living through whatever the world throws at it.

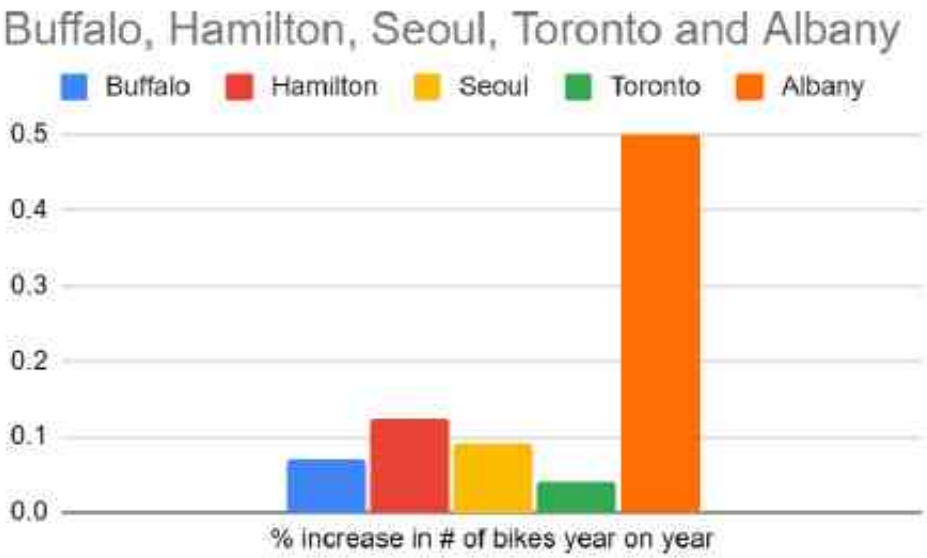
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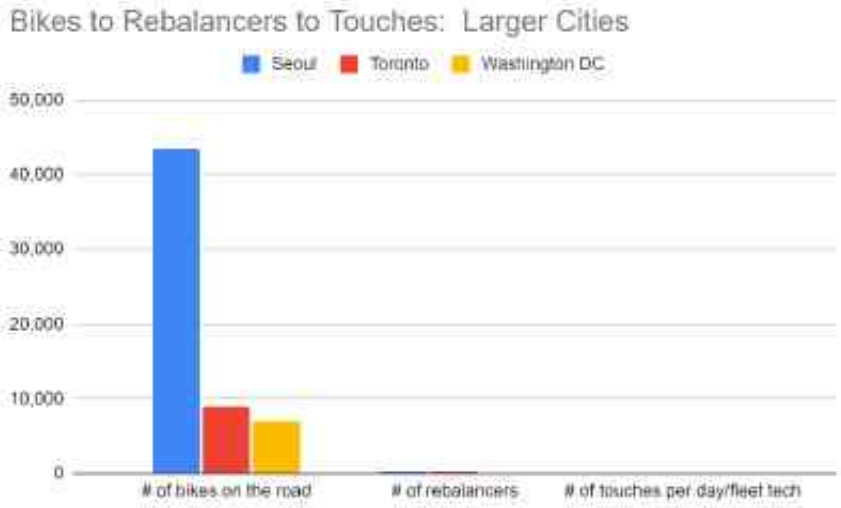


Population as compared with number of bikes in Bike share

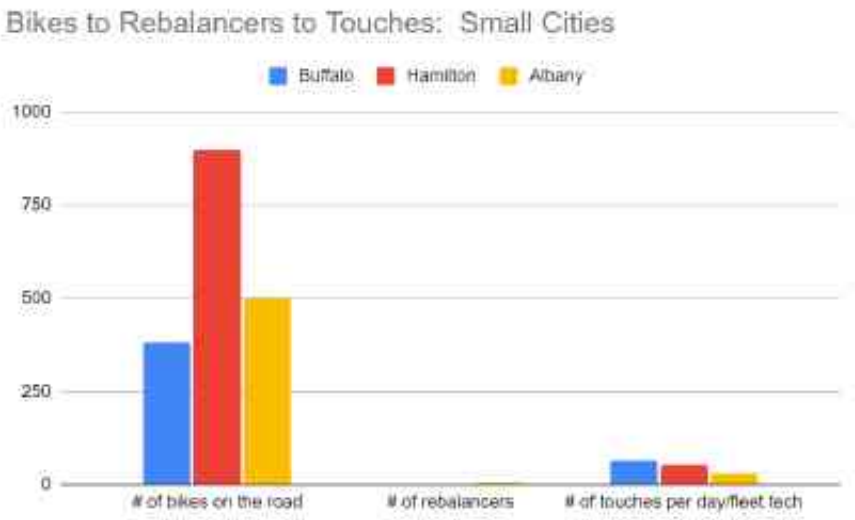


Comparison of the increase of bikes in bike share systems by city.





Smaller proportion of rebalancers to the fleet, barely registering touches per bike



Slightly bigger proportion of rebalancers to the fleet size, much more time working on fleet

Field Ops by Ebike Opplan Prototyping Project

I'd like to highlight the bike trailer project I worked on towards the tail end of my fellowship. Based on my experience, lessons learned in this role, and online product research I developed a working prototype for an e-bike trailer set up for bikeshare operations work for Reddy Bikeshare.



Bullitt E Cargo bike



Carla E Trailer



Carla E trailer with bike hauling insert (**Video**: Carla: See it in action)

Plans change, other needs of the overall operation are considered and now the project has evolved to utilize equipment we already have that will be modified to accommodate a smaller, more intensive pilot program.



Example picture of existing cargo bike



Trailer for modification to carry E Bike batteries initially, bikes later



Bike rack that will be modified for use on existing trailer

Given that the average weight of an Ebike battery is approximately 6lbs, taking 20 batteries for changes would weigh around 120 pounds. Because the Fleet Technician would also be responsible for checking, cleaning and doing minor fixes in the field, there would be a necessary additional 50 lbs of tools and spare parts. The total weight carried could be around 200 lbs, and given that the existing Ebike being used would be a Tern, this amount of weight would be unwieldy given the specific cargo carrying capacity and configuration of the bike itself, so for added maneuverability it would actually be the better option to attach a trailer.

Because the areas of responsibility that Reddy Bike carries are approximately 35 minutes away from each other by van, it makes sense to keep the bike and trailer combination in Buffalo so it has the potential to have maximum touches since the largest number of bikes and greatest density is in the city of Buffalo.

Before the development of a rebalancing system for the trailer, the initial focus will be on making sure that all the Ebikes in the system are at minimum charged status. Since they are widely spread throughout the city, the best strategy will be to prioritize all the

ebikes at stations that have the lowest charges. The route then can be determined to hit those stations based on priority, but making stops along the way at pedal bike stations to do station checks, pump tires, identify broken bikes and make minor fixes.

Generally, it is good to head due north or due south and then do major arterials with multiple stations like Hertel, Main, Amherst, Elmwood, and Niagara. This way techs will not have to zigzag so much and then can cherry pick pedal bike stations that haven't been visited in more than a week or more.

Another strategy would be to prioritize a route that includes lowest battery charges to fuller battery charges and then fill in the route from Ebike station to E Bike station with pedal bike stations that have soft breaks or reported bikes. Using this strategy the tech can also visit bikes that are out of hub, to identify them as bikes that can be taken to a station or need to be taken back to the shop for repairs.

References

Artekin, T., Kim, B., Novoa, L., Zafari, B, Research Gate, "Bayesian sequential learning and decision making in bike sharing, 2023

Bursztynsky, Jessica, Fast Company, "NY's Comptroller says CitiBike serivice is lacking in low-income areas. Citi8Bike disagrees." 2023

Canales, Katie, Business Insider, "DoorDash is paying 2.5 million in a lawsuit that accuses the food delivery app of stealing drivers' tips." 2020

Capital Bike Share

EMBARQ (@WRIcities), Smart Cities Dive, "From Amsterdam to Beijing: The global evolution of bikeshare" , 2017

Hamilton, Katherine, Forbes, "Delivery drivers sue Amazon for being forced to pee in bottles." 2023

Jawad, Ashar, Yahoo Finance, "20 most bike friendly countries in the world," 2023

Maus, Jonathan, Bike Portland, "Behind the scenes of Capital Bikeshare." 2013

McArdle, Megan, Washington Post, "Why scooters and e-bikes will soon be harder to find." 2023

Menhoff, Rachel, KTLA 5, “Delivery robots under attack.” 2023

Rogers, Adam, Business Insider, Bike Lanes are Good for business” 2024

Schulz, Dana, 6sqft, “Maps compare NYC’s footprint to other cities around the world, 2015

Shared Mobility, Inc

Staff, Anytime Estimate, “The most bike friendly cities in the U.S.” 2022

Staff, City Clock, “Data of 700 cities in 40 countries.” 2010

Staff, City of New York Comptroller’s Office, 2024

Staff, People for Bikes, “City of Buffalo Rating.” 2023

Staff writer, Portland Journal, “Where trust rides a yellow bicycle” 1994

Staff, Robotics and Automation News, “Peachtree Corners launches self-driving e-scooters.” 2021

Ustrand, Paul, Minn Post, “Can we ever have a European style bike culture in the U.S.?” 2023

Wall, Brian, Globe and Mail “The awful cycling injuries I’ve seen are preventable - governments must build bike lanes.” 2023