



# Project Beckett: Discovery Findings

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# Project Summary

## **Gap:**

The bus is a more productive option for urban corridor transportation, but not automatically as accessible as it could be, leading to more people with disabilities and older adults to need higher-cost, lower-efficacy, demand-response A-Ride paratransit and GoldRide senior services. This means that we cannot yet more fully benefit from current fixed route operations as a whole.

## **Pilot Solution:**

Do a trial-run of autonomous wheelchair securement systems on-board buses in this larger urbanized area to promote independent mobility for people with disabilities, like anyone who may be traveling from assisted living centers, and reduce delays from traditional safety set boarding with manual assistance.



# Project Summary

Past research focusing on wheelchair securement and occupant protection for wheelchair-seated passengers in large accessible transit vehicles suggests that the key issues to assess include:

- Wheelchair securement time
- Level of user comfortability with the rear-facing orientation
- Ability of the rider to identify, anticipate, and signal for departure stops
- Wheelchair stability during vehicle maneuvers
- Level of security and safety experienced by the user
- Ease of use of the docking system
- Ease of wheelchair engagement/disengagement with the system
- Potential for increasing motion sickness during travel
- System feedback on successful engagement/disengagement of wheelchair
- Gap between the rider and the head/back restraint during use
- Ease of turning to access and maneuvering into the docking station
- Accommodation of service animals
- Any observable misuses of the system
- Any other user concerns/compliments/feedback



## Key Takeaway


Users are enthusiastic about the Quantum concept, but the implementation needs refinement to gain user adoption



# Quantum Concept

**Passengers requiring mobility aids desire the ability to use public transportation without feeling like they are inconveniencing the driver or other passengers and without drawing attention to themselves. Because of this, both passengers and the AAATA staff like the concept behind the Quantum wheelchair securement system:**

- Passengers with mobility aids can be more independent as the driver does not have to strap the passenger in place
- The securement system removes the discomfort of invading personal space in order to secure the passenger
- Passengers and drivers identified that the existing strap system gets sticky, dirty, and worn out
- The securement process is faster so passengers with mobility aids feel like less of a burden/annoyance to the other passengers on the bus
- Drivers don't have to get out of their seat in order to secure the passenger with the Quantum system

The image shows the interior of a bus with blue seats and a wheelchair securement system. A speech bubble is overlaid on the image, containing a quote. The bus interior is visible through the windows, showing a bright outdoor scene.

“Being in a mobility device is a curiosity at best and a derision at worst”

“The Quantum concept is brilliant...”

# Quantum Implementation

However, due to the lack of reliability and an overall discomfort with the system design, the Quantum system seems to be having the opposite effect than what is intended. Passengers using the Quantum system feel singled out from the moment they begin engaging with the system and this feeling continues throughout the entirety of their journey:

- The loud, unpleasant beeping as the arm extends causes other passengers on the bus to stare during the securement process
- The staring becomes even more intensified when the system encounters issues during securement
- Rear facing passengers are forced to “avoid eye contact” to avoid making themselves and potentially other passengers feel uncomfortable
- Passengers using the system feel like they are ‘on display’ since everyone else on the bus is facing forward
- Passengers unfamiliar with the system don’t know what to expect, so their discomfort is magnified

**Because of the discomfort passengers experience, they have largely abandoned the system and are not using it during this pilot.**





# Observation Highlights

# Who We Observed and Interviewed

4

Passengers

3

Supervisors

5

Drivers

1

Technician





# Mobility Equipment



- 1 passenger who uses a manual wheelchair
- 2 passengers who use a Small Jazzy power chairs
- 1 passenger who uses a Permobil power standing wheelchair

\* CDC reported that as of 2020, Michigan has an adult population of 11.5% with a mobility disability (dhds.CDC.gov, 2020)

# Highlights: Rear-Facing Complaints

Facing backwards is the primary complaint about the Quantum System and is the main reason passengers opt-out of using it. Passengers don't like facing backwards because of:

- Inability to see upcoming stops and pull the cord to alert the driver
- Difficulty communicating with the driver
- Motion sickness
- Being stared at by other passengers
- Feeling singled out

AAATA installed mirrors to allow passengers to see the front of the bus

- Many have fallen down or have been broken
- They are often missed by passengers
- Even when the mirrors are in place passengers are unable to see much



"I feel ill if any ride is over 45 minutes..."

"They don't like the mirrors as they feel like they aren't a part of the same bus riding experience as everyone else..."

# Highlights: System Complaints

**Lack of reliability and system features were chief among passenger and driver complaints. Passenger travel plans have been ruined when the Quantum system failed and the forward facing spot was already taken**

- Wheelchair securement does not always work due to:
  - Driver lack of system knowledge
  - Wheelchair incompatibility
- Some passengers want to be able to hold onto a railing or handle while the bus is moving
- Passengers using the Quantum do not want to use the headrest over concerns of cleanliness
- The headrest blocks the view for other passengers on the bus
- There are some concerns that the wiring in the device is delicate
  - Wiring is not waterproof
  - Cleaning is causing wire erosion

**“It’s heartbreaking to miss an appointment at the hospital you’ve been waiting 6 months for.”**

-on not being able to ride due to a failed securement

**“I don’t know what’s going on either...”**

-on cracking a joke to hide embarrassment of attention



# Highlights: Lack of Knowledge

Drivers are trained to use Quantum, but the infrequency of use prohibits them from mastering the system. Due to the limited number of deployed systems and the fact that the Quantum system does not reliably complete the securement process, passengers and drivers are persistently unfamiliar and untrusting of the Quantum system.

- Passengers are in a hurry to board the bus and don't take the time to read the instructions
- Passengers didn't have a way of knowing if the system would work with their mobility device before boarding the bus
  - Passengers would research the system online and were worried the system might damage their mobility device
- Instructions are too far removed from the passenger's seated position
  - Passengers are facing rearward and the instructions are facing sideways, making them very difficult to read
- Drivers are often forgetting to push the button a second time to finalize the securement
- Drivers do not always hold the button long enough
- The Quantum is only available on 10 buses so there is less opportunity to be able to use the system

"My chair doesn't always connect...I've given up and gone to the other side..."



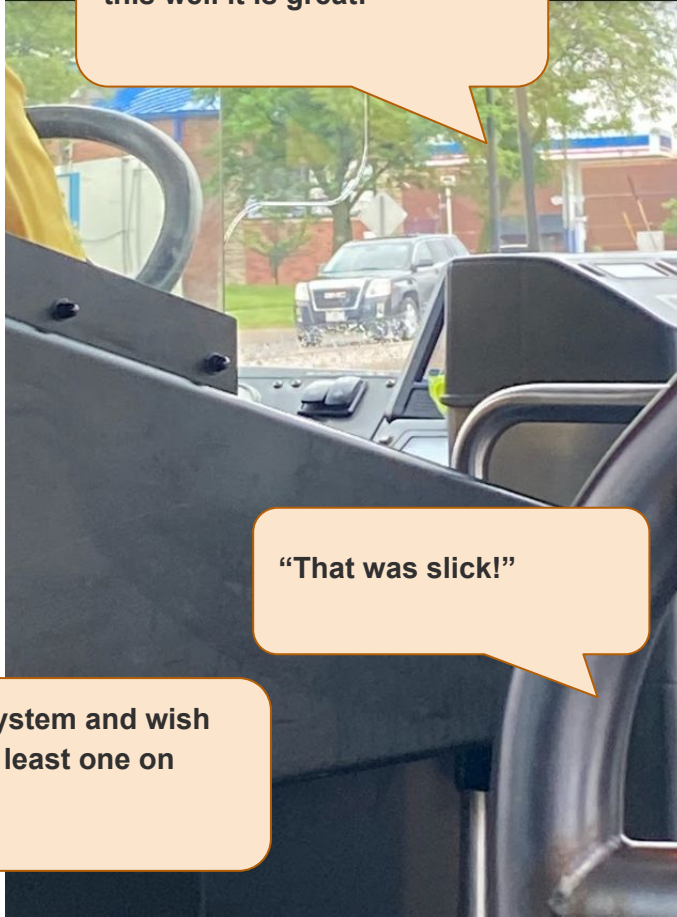
"Driver errors are the primary reason for tech issues"



# Highlights: Likes

There are several aspects of the Quantum securement system that are viewed as working well, and in some cases, improvements from previous versions:

- Securement is fast and easy
- Driver does not have to invade a passenger's personal space
- When the system secures a passenger without error or troubleshooting, both passengers and drivers trust that the system will keep the passenger safe throughout the ride
- It is much easier to secure a scooter
- If there aren't any issues, the driver does not have to leave their seat to support the passengers
- The equipment is very low maintenance
- Q'Straint provides good customer support
- The Quantum system provides a good amount of space behind the chair allowing passengers to store grocery bags



**"If the system always works this well it is great!"**

**"That was slick!"**

**"I love the system and wish there was at least one on every bus!"**





Magic Wands

# Magic Wands

**“Make it front facing!”**  
-passengers, drivers, dispatch

**“Install a ‘center point’ to help with alignment when backing the chair in”**



**“Have a backup system in place [eg. straps] so people can ride even if the Quantum isn’t working”**

**“Wheelchairs should not be on fixed routes, but are instead served through A-ride and the alike”**

**“Give them more space!”**

# Outcome Hypotheses and Potential Experiments

# Hypothesis 1: Unwanted Attention

## The system is undesirable to riders because it draws unwanted attention

- There are several elements of the system that draw attention to the rider being secured. Using a mobility device is already something that can draw unwanted attention in our society, riders reported that further attention only compounds this risk
  - The rider is faced backwards and the rest of the passengers are facing forwards, directly facing one another
  - The beeping sound when the system is securing is loud and irritating
    - It is not a pleasant beep, it sounds like an alarm indicating that something is wrong
  - The novelty of the system itself draws attention

## The system could be improved by lessening the attention on the riders

- We know that the system is engineered to be backwards facing for safety and securement, however, a forward facing system may improve satisfaction
  - What's important is that all riders are facing the same direction
- The tone of the beep could be less abrasive
  - The tone could be supplemented with a light or other signal (this would have an added benefit of serving users who have hearing impairment)



# Hypothesis 2: Unfamiliarity

## **Riders and drivers are uncomfortable with the system because they are unfamiliar with it**

- Part of the discomfort in using the system was simply unfamiliarity
  - Only 10 buses have the system installed
- Drivers and buses are switched around to the point where drivers don't have the system installed most of the time, preventing them from gaining familiarity
- Riders have the same lack of familiarity
- Drivers were trained at the very beginning of the pilot
- There is not much information on AAATA sites about which mobility devices are supported by the system

## **The users' familiarity with the system could be improved by changing how the buses and drivers are scheduled**

- AAATA could identify drivers that would be good 'early adopters' of the system
  - They could be given a refresher course in the field
- Those drivers could be scheduled to be on buses equipped with Quantum as much as possible so they can gain proficiency and confidence
- Additionally or alternatively, the Quantum equipped busses could be scheduled on the same routes, so that passengers can gain familiarity with the system
- AAATA could publish information from Quantum about supported mobility devices on their website
- If the AAATA is interested in moving forward with implementing the Quantum system, installing it on more busses would provide more opportunity for drivers and riders to develop mastery of the system



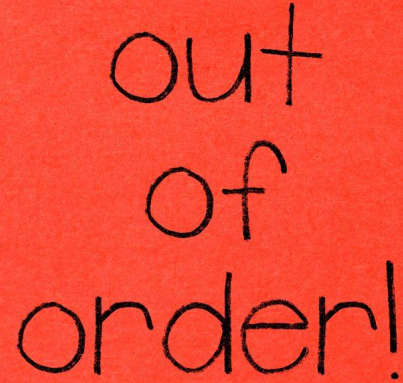
# Hypothesis 3: Reliability

## The system's unreliability has led to users abandoning its use

- Drivers are hesitant to use the system after having experienced it fail to secure riders
- Riders have also discontinued use for the same reason

## We have seen reports from other transit authorities that Quantum systems natively installed in buses, rather than retrofitted to existing buses, have been reliable and produced enthusiastic user adoption

- AAATA could include the Quantum system when acquiring new buses to improve reliability



out  
of  
order!

# Additional changes to consider

- **Problem:** The instructions placard is placed along the wall, making it nearly impossible to read from the secured sitting position
  - **Experiment:** Place the placard to be visible from the rear-facing seated position of the rider
- **Problem:** The rider cannot see their stop because they are rear-facing
  - **Experiment:** Internal bus marquees displaying the next stop that the riders can see (the one at the front of the bus is not visible to the rear-facing rider)
  - **Experiment:** An auditory announcement of all upcoming stops when the Quantum system is engaged
    - Currently, AAATA announces all major time points or points of interests more than 1.5 miles apart. Drivers must verbally announce every stop along a route at a customer's request
  - **Experiment:** If the AAATA phone app has real-time bus location information, it could have an option to notify the user that their stop is upcoming or to view the upcoming stops in real-time



# The Current Future of AAATA and the Quantum System

# Current AAATA Plans



## **No Plans to Purchase More Quantums**

Due to lack of consistent use,  
price, and little demand



## **Maintain Current Quantum Restraint Systems**

As an option for riders going  
forward



## **Investigate Menlo Recommendations**

To boost adoption among  
AAATA riders

# Appendix



# Menlo Process

- The Menlo High-Tech Anthropology® (HTA) process prioritizes observational data as the most meaningful for assessing how well a technology is working for a user base
  - Users often display unconscious competence that they cannot describe in an interview or aren't even aware of
- For this project, Menlo HTAs went to meet the users (riders, drivers, etc.) in the environment where they travel and work to observe their workflows and interview them
  - Being in the space allowed us to see their interactions with their environment, developing insights that would not be possible with a simple interview
  - This also allowed HTAs to identify differences and alignment between what was said in interviews and what was actually observed in the field
- HTAs used non-leading questions to better understand the reasons behind the behaviors that we saw and the statements that users made in interviews
  - This allowed us to get a better understanding of the root causes of both positive and negative outcomes
- HTAs used open conversation and rapport building to gather more complete context about each interviewee's needs, wants, and lifestyle
  - This system can develop data from a relatively small sample of the user population because the patterns emerge very quickly. This is explained further in the following article from the Nielsen Norman Group:  
<https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/>