INCLUSIVE DESIGN ACROSS THE TRAVEL CHAIN

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SIP-adus Workshop 2021
November 9, 2021

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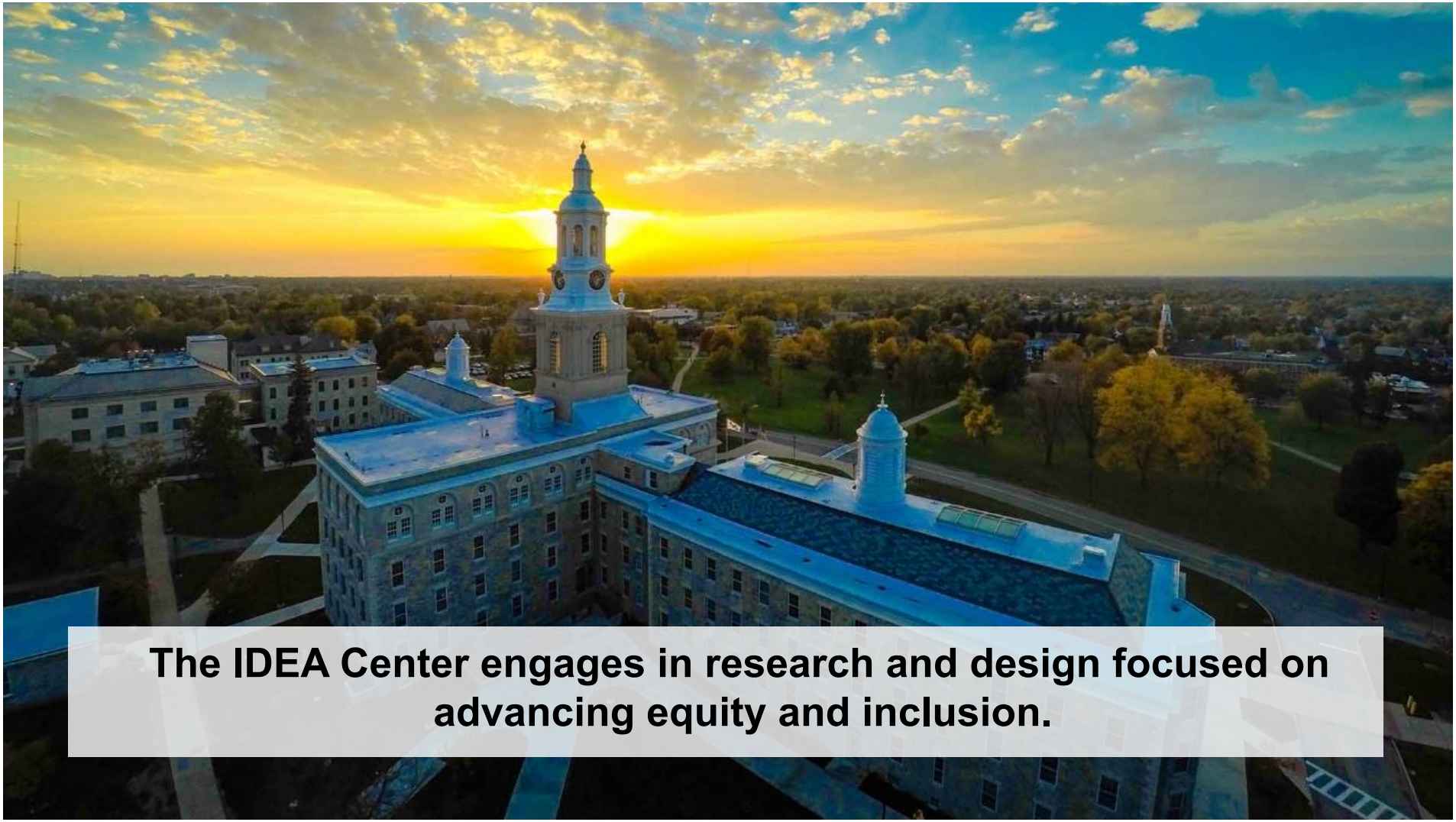
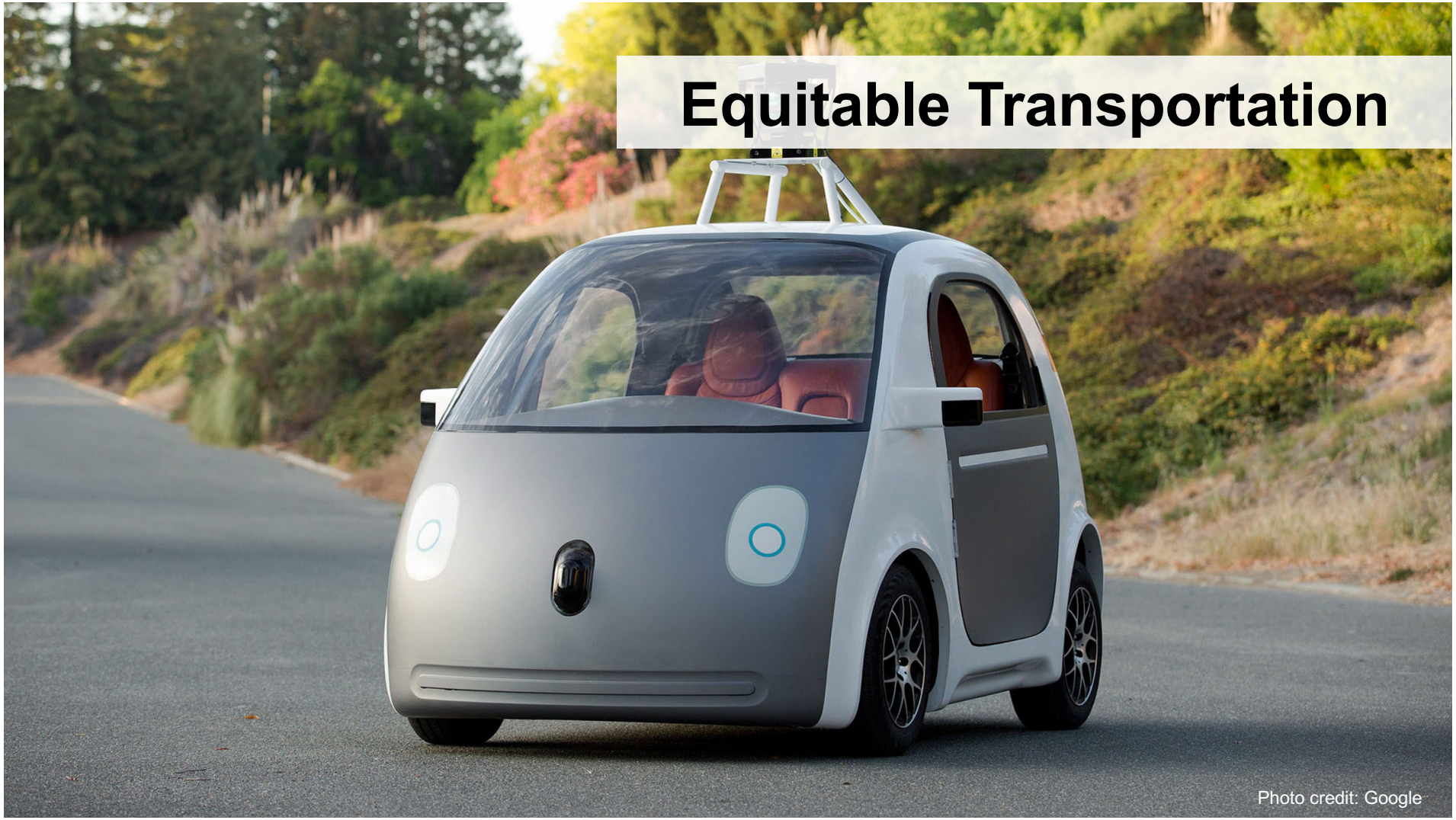

The IDEA Center engages in research and design focused on advancing equity and inclusion.

Importance of Transportation

Transit Barriers

Vehicle Automation

Equitable Transportation



A *process* that enables and empowers a diverse population by improving human performance, *health and wellness*, and social participation.

Steinfeld and Maisel (2012)


Goals of Universal Design
1 Body Fit
2 Comfort
3 Awareness
4 Understanding
5 Wellness
6 Social Integration
7 Personalization
8 Cultural Appropriateness

Goals of UD Adopted by Industry

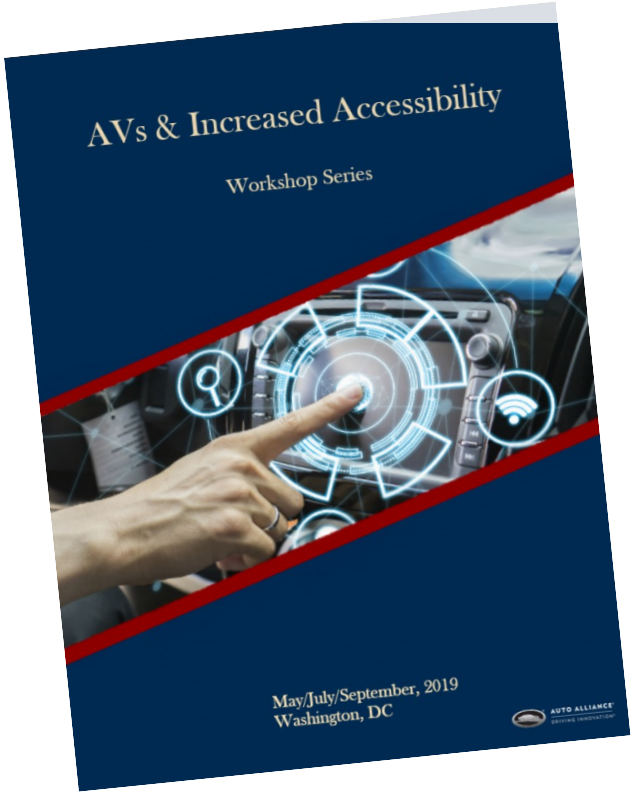


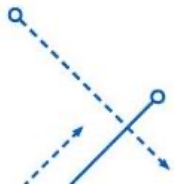
Table 1: Stakeholder Attendee Input on Potential Inclusive AV Design Considerations. A visually enhanced version of this table is available in *Appendix A: Technical Considerations Table, Enhanced Version* however this version may not be accessible to people with visual disabilities.

Proposed Needs Identified in Workshop 1	Technical Considerations Identified in Workshop 2	Relevant Stakeholder Groups	Relevant Universal Design Goals	Relevant System Design and Operations Considerations
Accommodate service animals	Space and floor surface (flat preferred) to accommodate a range of service animals, e.g., chihuahuas to great Danes	Cognitive, Sensory	Body Fit	Crashworthiness
	Entry / Egress for animal	Cognitive, Sensory	Body Fit	Accessible Entry and Egress
	Passenger profiles include service-animal-related needs to customize experience	Cognitive, Sensory	Personalization	Ride Service
	Allergy and contamination concerns for those with allergies or fragile breathing	Cognitive, Sensory	Wellness	Ride Service
App is easy to navigate and understand for people with sensory disabilities	Non-visual interfaces for persons with visual disabilities (e.g., audio and tactical).	Sensory	Awareness, Cultural	In-Vehicle HMI, Ride Service
	Non-audio interfaces for persons with auditory disabilities (e.g., vision and tactical).	Sensory	Awareness	In-Vehicle HMI, Ride Service
	Multi-modal interface lag time (e.g., dynamic braille) can negatively impact trip comfort and response time	Sensory	Awareness	In-Vehicle HMI, Ride Service
	Passenger profiles include disability-related HMI needs to customize experience	Sensory	Awareness, Personalization	In-Vehicle HMI, Ride Service
App is easy to navigate and understand for people with cognitive disabilities	Tunable and multi-modal interfaces can improve comprehension for persons with cognitive disabilities ranging from short term memory loss to Autism, e.g., through reduced verbosity and adjusting stimulus intensity	Cognitive, Older Adults	Awareness, Personalization, Understanding	In-Vehicle HMI, Ride Service

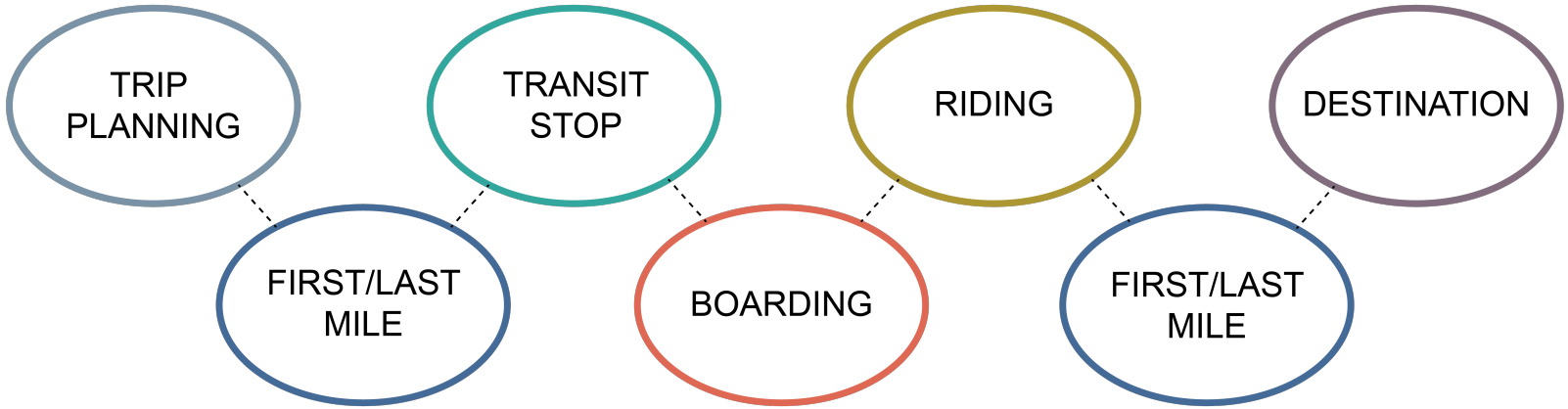
8

This report is a best faith effort to summarize the discussions of all attendees, which comprise of a variety of stakeholders. It is not a verbatim transcript and it does not reflect the views of the Alliance of Automobile Manufacturers or its member companies.

Proposed Needs Identified in Workshop 1	Technical Considerations Identified in Workshop 2	Relevant Stakeholder Groups	Relevant Universal Design Goals	Relevant System Design and Operations Considerations
Understand trip progress, including reminders and the possibility to communicate with remote persons	Tunable and multi-modal interfaces for persons with cognitive disabilities can reduce stress (and increase comfort) through trip progress communications	Cognitive, Older Adults	Awareness, Comfort, Personalization	In-Vehicle HMI, Ride Service
	Tunable and multi-modal interfaces for persons with sensory disabilities to receive trip progress communications	Sensory	Awareness, Comfort, Personalization	In-Vehicle HMI, Ride Service
	Line of sight issue for those in wheelchairs when seated in a vehicle which inhibits the passenger's ability to understand where they are going	Physical	Awareness, Comfort	In-Vehicle HMI, Ride Service
	Placement of screens with trip progress visible to all passengers	Older Adults, Physical	Awareness, Body Fit, Comfort	In-Vehicle HMI, Ride Service
	Tunable and multi-modal	Cognitive	Awareness,	In-Vehicle HMI



Travel Chain



TRIP PLANNING

FIRST/LAST MILE

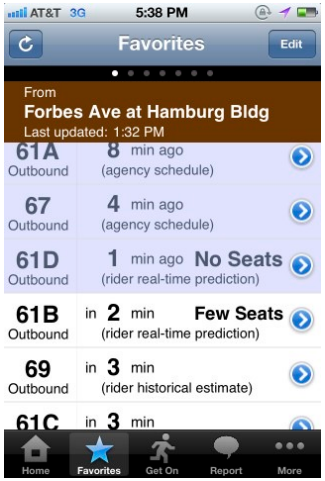
TRANSIT STOP

BOARDING

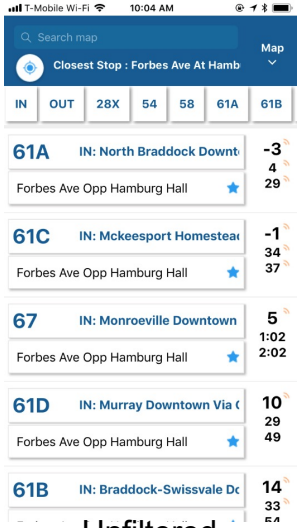
RIDING

FIRST/LAST MILE

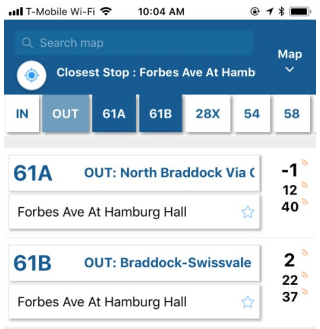
DESTINATION



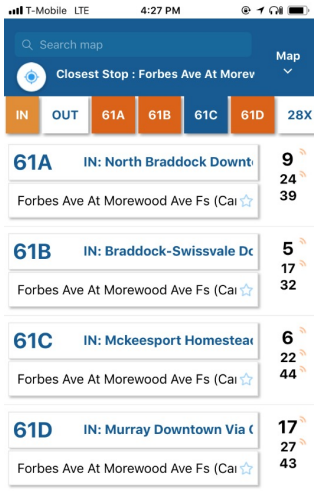
Version 1&2



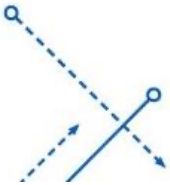
Unfiltered



Manual Filtered

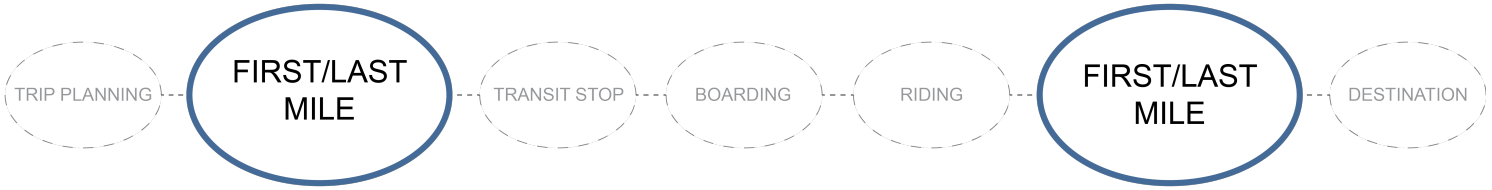


Pre & Manual Filtered




TRIP PLANNING
FIRST/LAST MILE
TRANSIT STOP
BOARDING
RIDING
FIRST/LAST MILE
DESTINATION
SIDEWALK
CLOSED

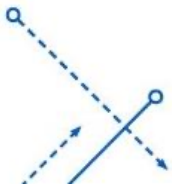

TRIP PLANNING
FIRST/LAST MILE
TRANSIT STOP
BOARDING
RIDING
FIRST/LAST MILE
DESTINATION
SLOW
EXTREMELY LOUD INCREDIBLY CLOSE
BROADWAY

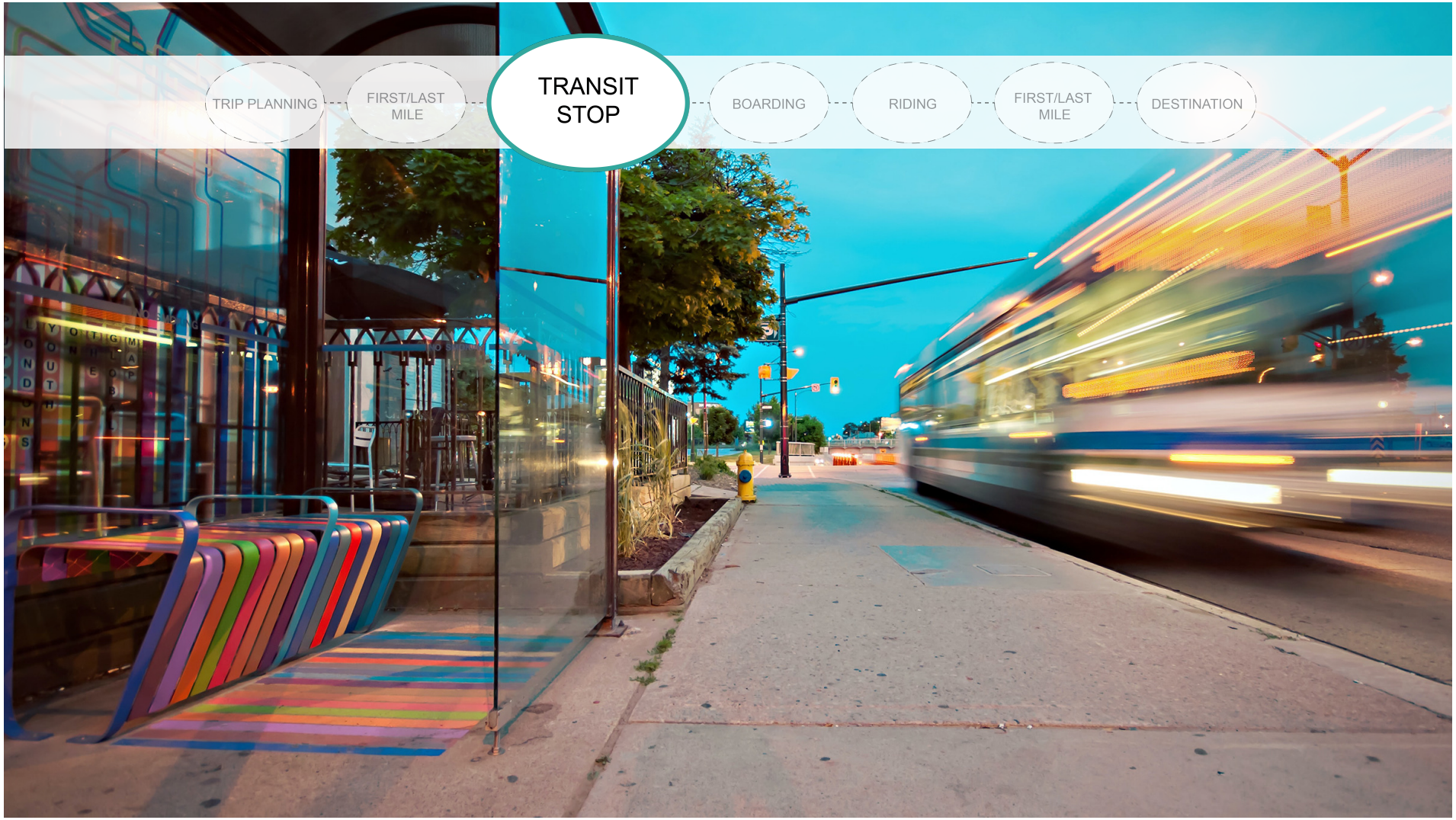


The most important factors influencing fixed-route transit usage (n = 1435).

1. **Barriers** in the pedestrian **environment** getting to and from stops/stations;
2. **Distances** to or from stops/stations;
3. Fixed-route service doesn't run often enough;
4. Complex or multiple transfers on fixed-route service;
5. Fixed-route service doesn't run at the hours I need to travel; and,
6. **Lack of information** about potential **barriers** I may encounter getting to/from fixed-route stops/stations.

(Maisel, Ranahan, Choi, 2021)




TRIP PLANNING
FIRST/LAST MILE
TRANSIT STOP
BOARDING
RIDING
FIRST/LAST MILE
DESTINATION


TRIP PLANNING
FIRST/LAST MILE
TRANSIT STOP
BOARDING
RIDING
FIRST/LAST MILE
DESTINATION

TRIP PLANNING - FIRST/LAST MILE - TRANSIT STOP - BOARDING - **RIDING** - FIRST/LAST MILE - DESTINATION

Photo credit: Q'straint

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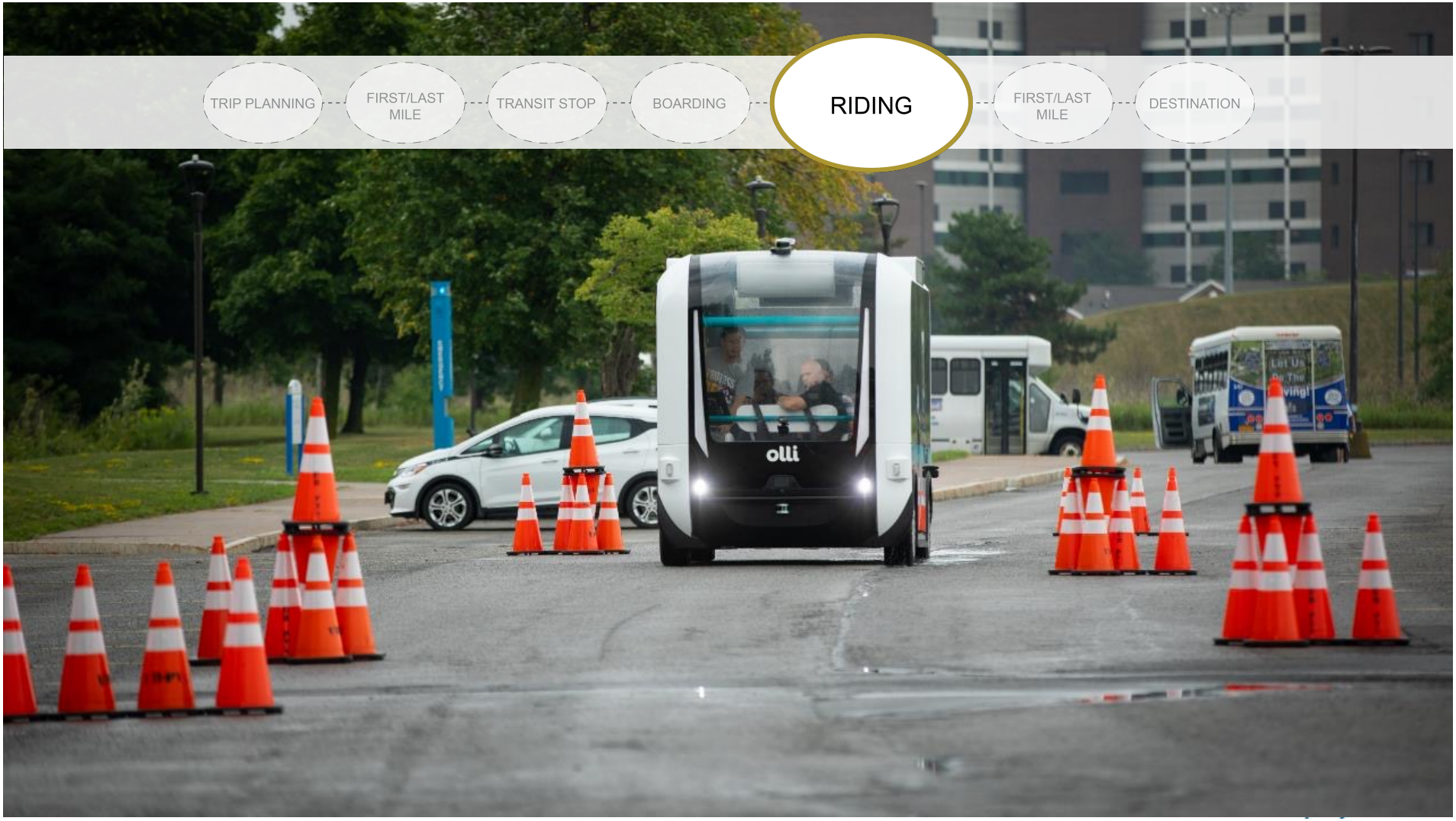
TRIP PLANNING
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FIRST/LAST MILE
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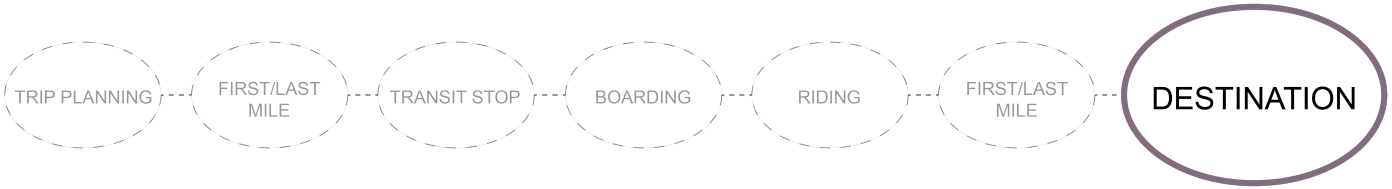
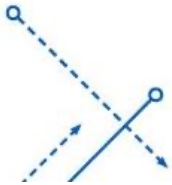


- ✓ Address usability across the travel chain
- ✓ Engage diverse stakeholders
- ✓ Participate in multidisciplinary research
- ✓ Increase efforts related to sensory and cognitive needs
- ✓ Focus on social equity




Complex Problem
Vehicle Accessibility
Fleet Design (quantity, type)
Street Infrastructure
Connectivity of Users
Innovation
Branding
Solution
Marketing
Analysis
Ideas
Success
Management
100000
10000
8000
6000
4000
Jan
Feb
Mar
Apr
May

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This presentation was funded in part by grants from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant numbers 90REGE0007 and 90RE5022-01-00). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The contents of this presentation do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.

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QUESTIONS / COMMENTS

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