

Not crowded

24 seconds ago by MBTA



Crowded

17 seconds ago by MBTA



Some crowding

32 seconds ago by MBTA





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Crowding during COVID and beyond

How the MBTA is staying rider-focused under pressure



Massachusetts Bay
Transportation Authority

Our journey with crowding

Staying focused on riders with our research efforts

Capitalizing on existing technology to get crowding data

Designing crowding information for various platforms



Are we solving the
right problem, in the
best way we can?

MBTA Crowding

PROJECT GOAL

How can the MBTA help riders prepare for their trips in these unprecedented times?

How can we do it sustainably?

Surveying riders

Understand rider needs during the pandemic

Check our assumptions that crowding is where we should focus

Learn the best ways and places to display crowding data

1,000+

respondents

73

neighborhoods

67%

feel crowded

Timing is most important factor

Riders want predictions more than crowding information, but knowing could help some make different decisions.



If I'm on track to be early for work: **wait for next bus.**

If I'm on track to be on time or late: **take that bus anyway.**

Data is only as helpful, as it is actionable

Riders either have the privilege of flexibility in their travel time, or on transit now because they *need* to be.

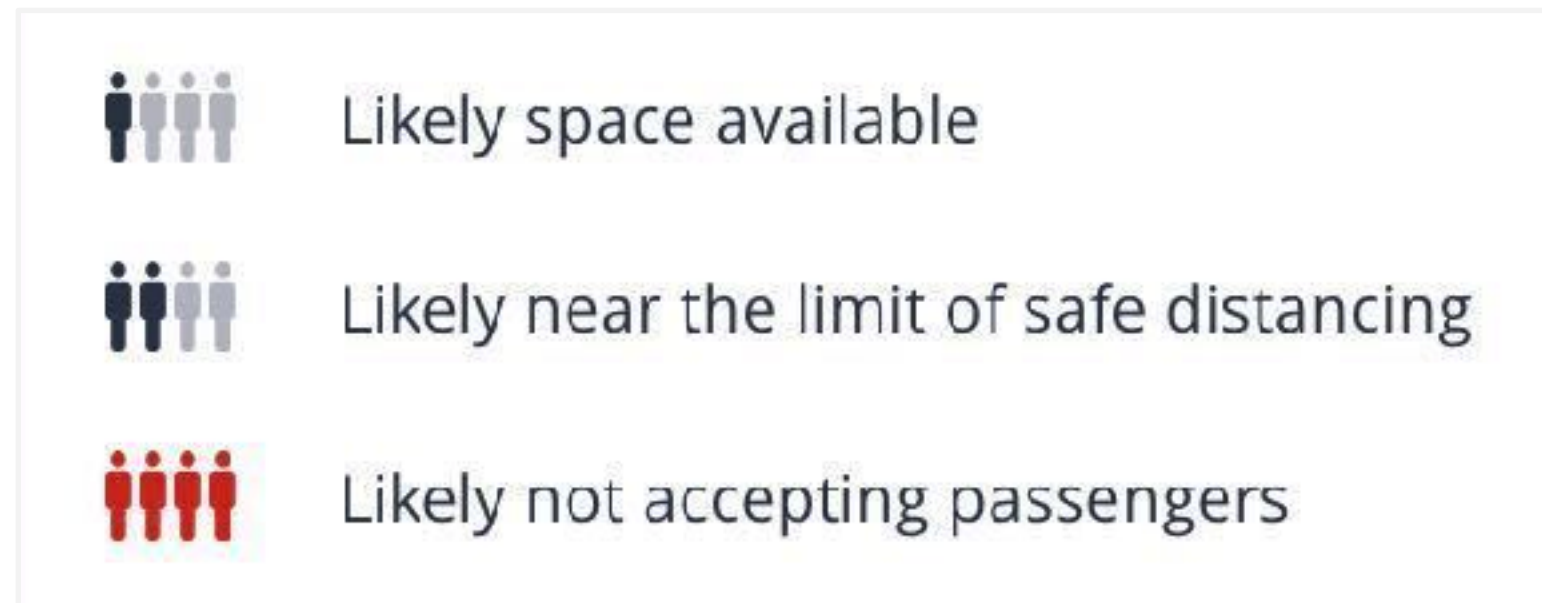
People considered “essential” are in potentially dangerous situations when taking public transit.



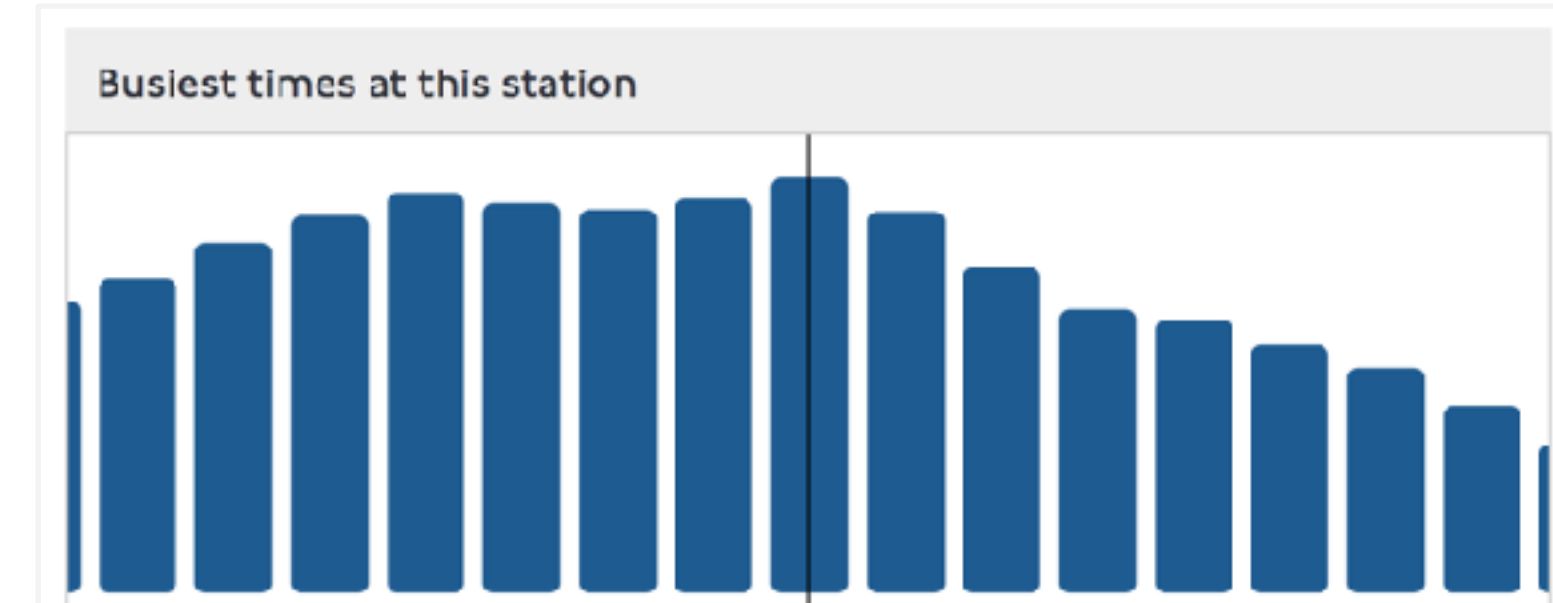
Means I have to risk **getting sick or fired** from an hourly job

MBTA Crowding

Riders want two kinds of information



Essential trips, already in transit
real-time data



Trip with flexible timing
historical trend data

example images are from other transit agencies—TFL and Auckland, NZ

Getting the data

Bus and subway differences present challenges

Collaborating with external + internal partners

Understanding APC accuracy with spot checks

APC & AFC & data, oh my!

	<i>Data source</i>	<i>Real-time Data</i>	<i>Historic Data</i>
Bus	APC	✅ 70% of fleet	✅
Heavy Rail	AFC	❌	✅
Light Rail		❌	❌

Crowding buckets to match design

We've automated a process to take the raw APC data, put it in one of these buckets for us to assess crowding level in real-time.

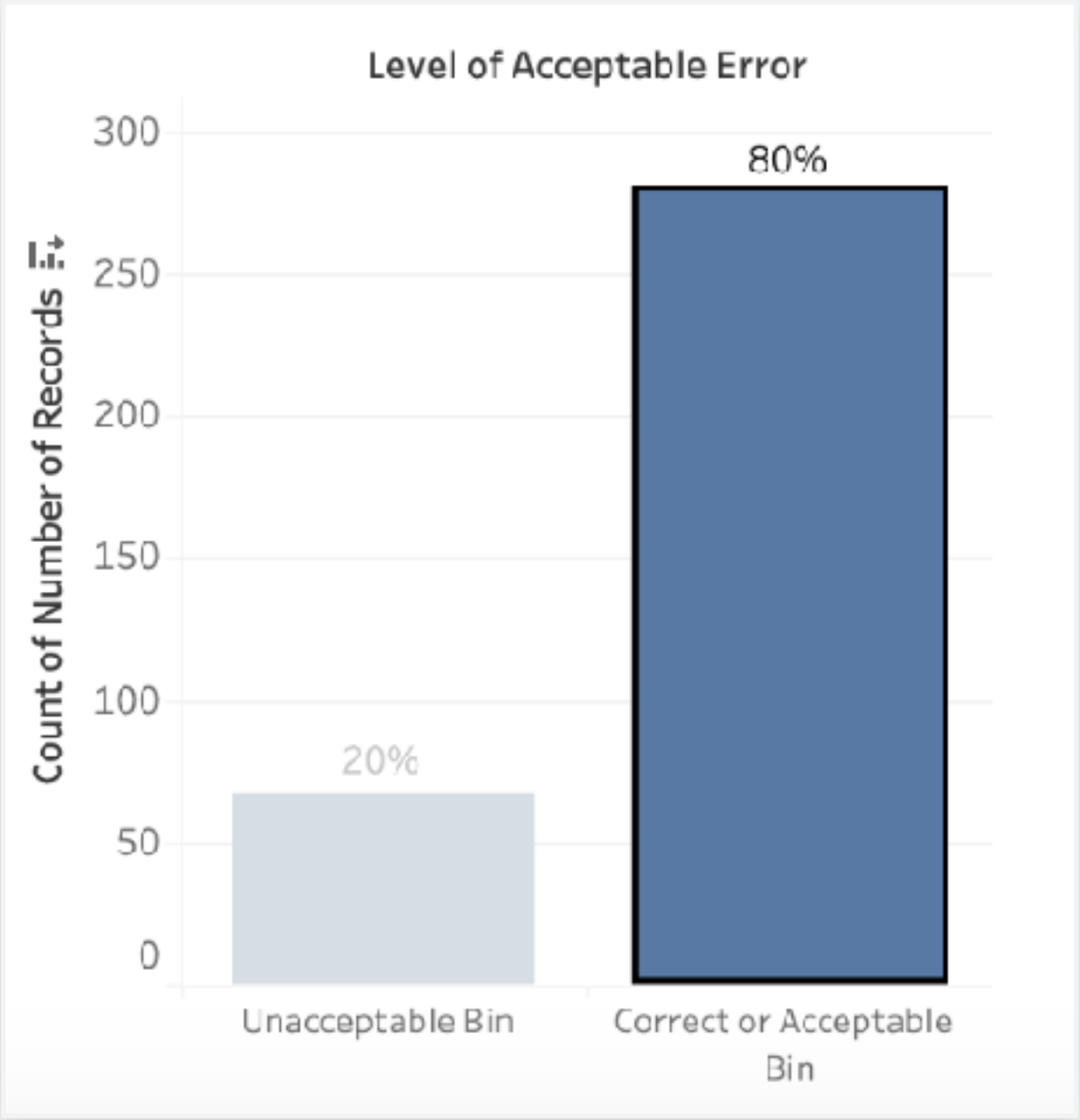
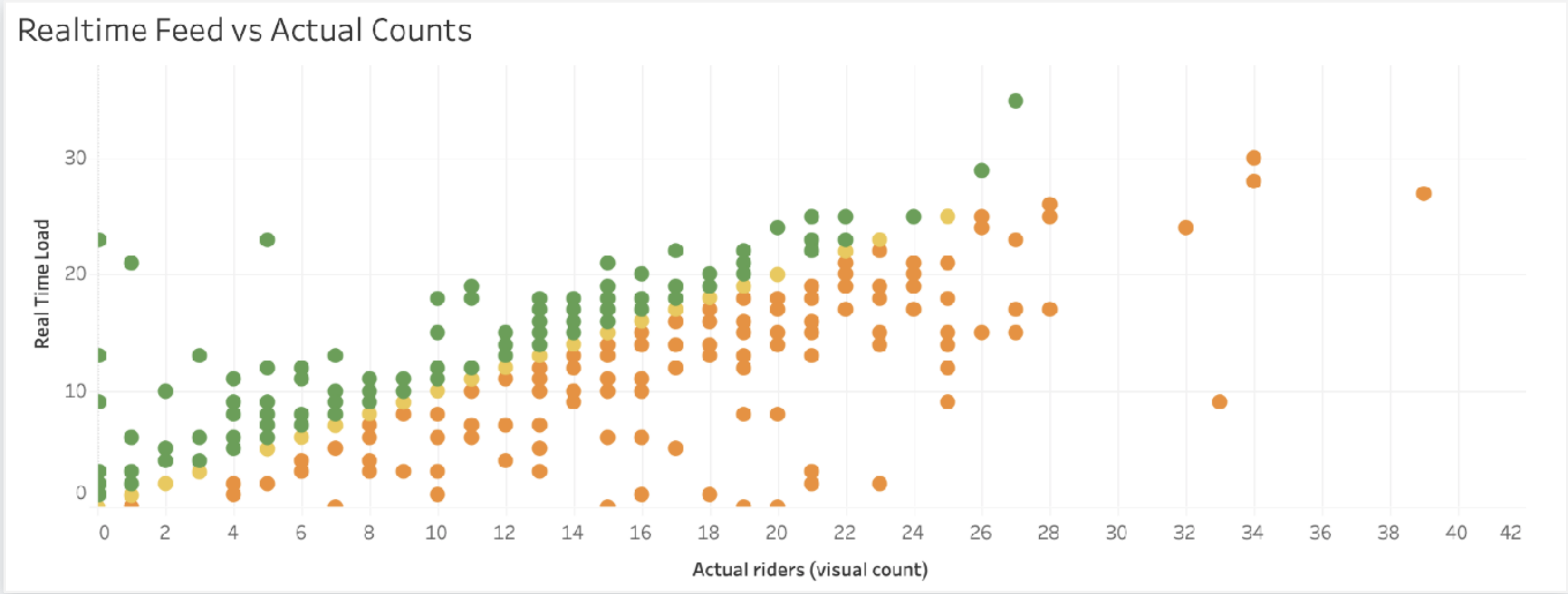
Buckets of crowding
rough # of riders

<10
Not crowded

| **11–20**
Some crowding

| **20+**
Crowded

Keeping track of accuracy



MBTA Crowding

Spot checking security footage



Deciding which routes to launch

Route	# of full bus reports	Usable data	# of correct categorizations	Planned Release
117	486	N	N/A	N/A
116	342	N	N/A	N/A
23	302	Y	15 (80%)	6/15
22	139	Y	16 (86%)	6/15
16	119	Y	10 (83%)	6/22
109	108	Y	17 (85%)	6/15
455	108	N	N/A	N/A
...

above is an excerpt of table from our real-time bus crowding release planning document

Conveying the information

Understanding the importance of language

Keeping design elements consistent

Continuing to involve riders in our process

Deciding how to communicate

Short and simple wording allows riders to spend less effort decoding.

Warning colors help communicate urgency to those who can see colorization.

People icons help convey information visually to those with LEP or color-blindness.

 **NOT CROWDED**

 **SOME CROWDING**

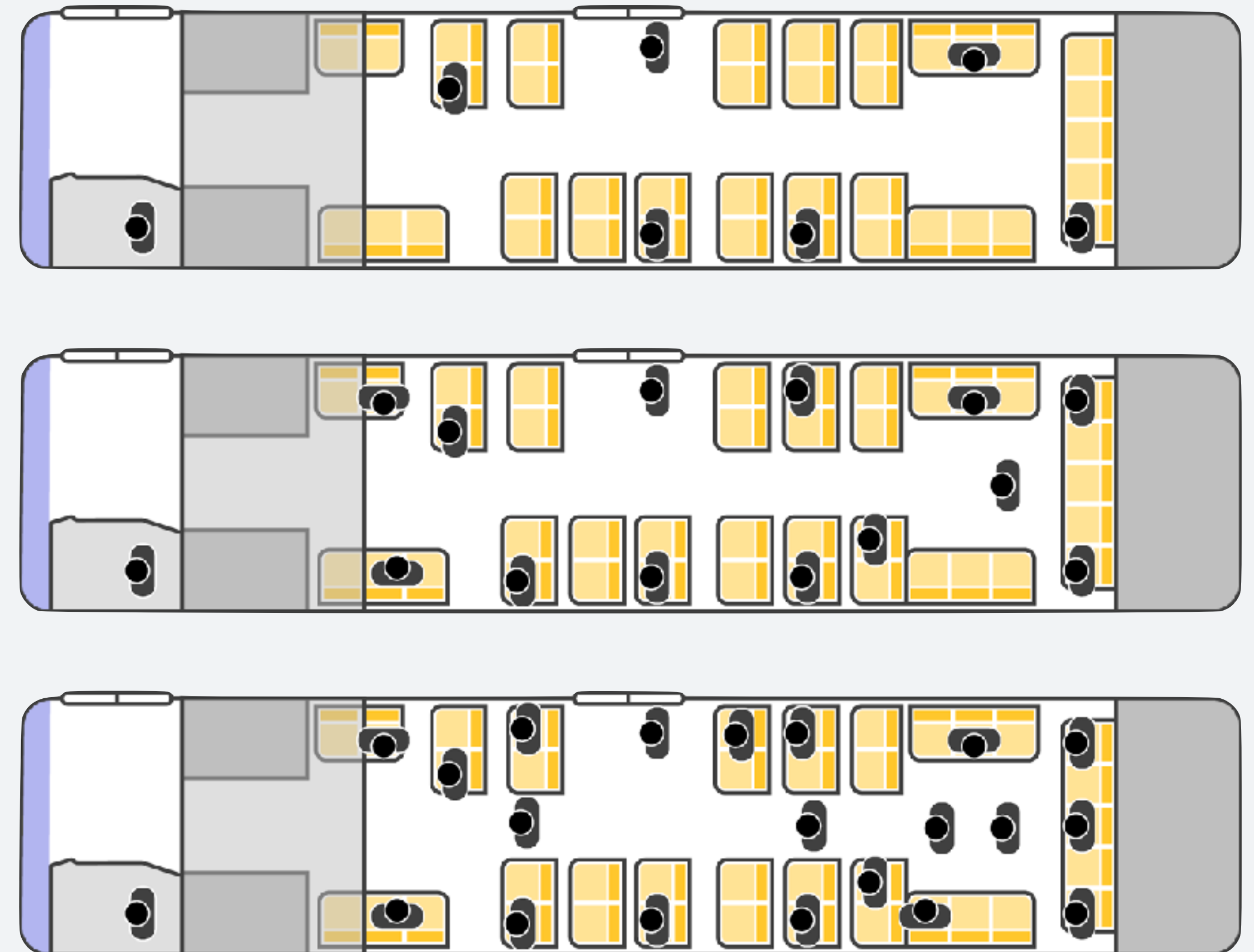
 **CROWDED**

Testing our language

We showed current riders these schematics in Userlytics, and asked:

Which of the following options best represents how you would describe the condition aboard this bus?

- *Not crowded*
- *Some crowding*
- *Crowded*
- *Very crowded*
- *Full*



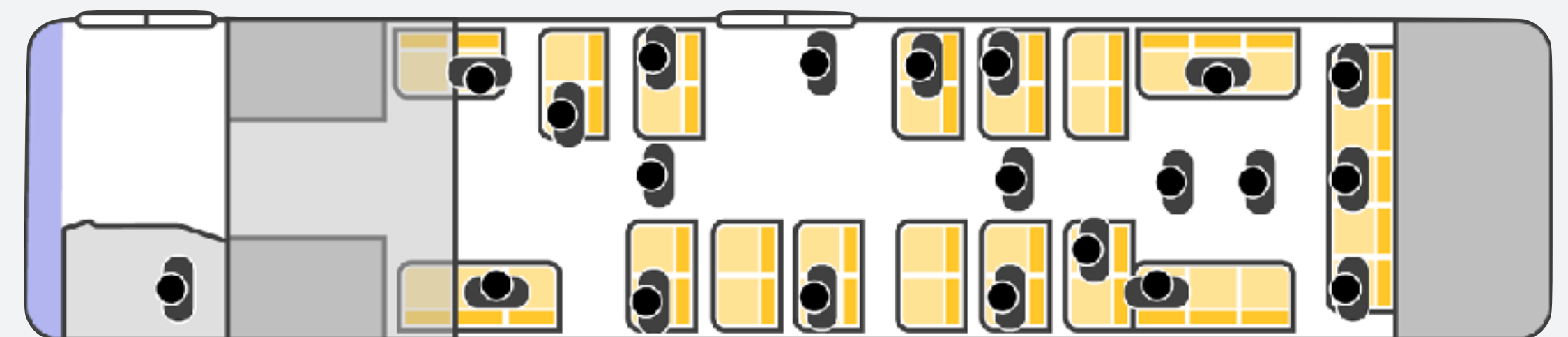
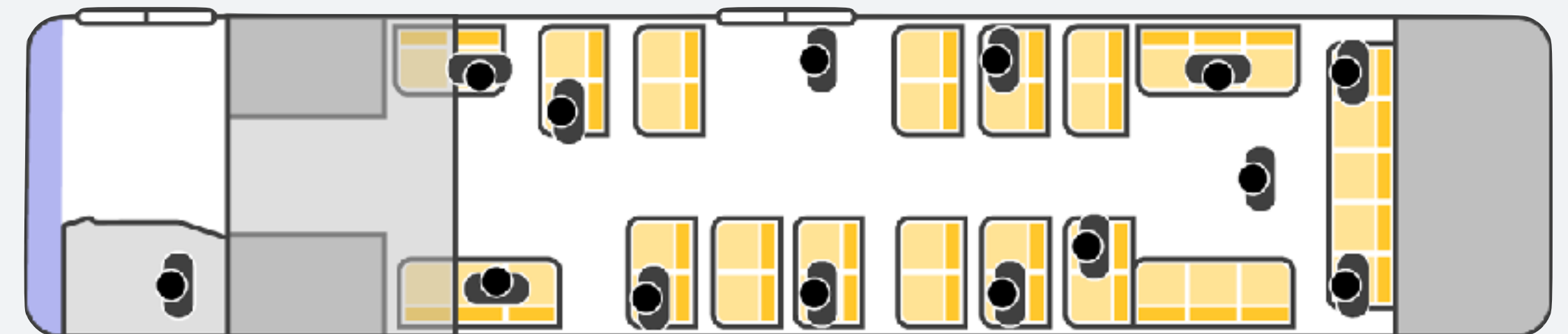
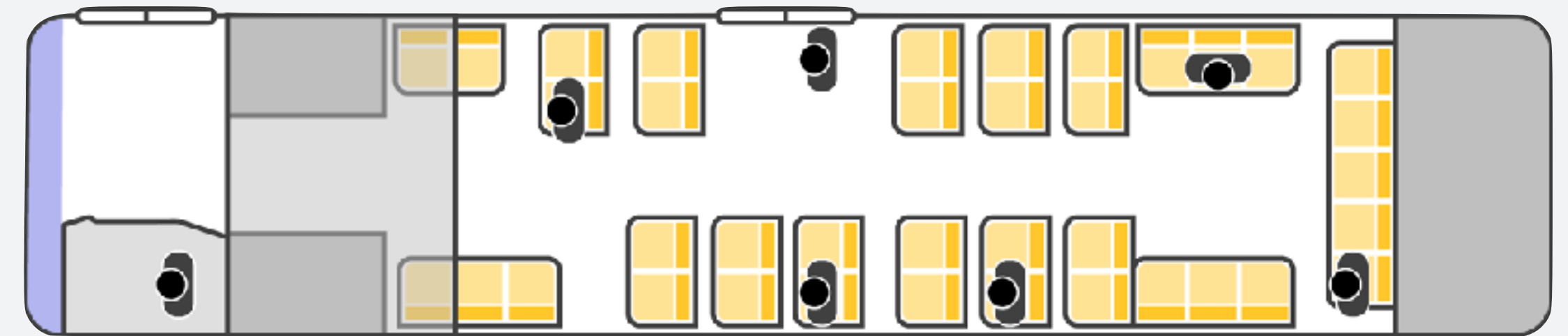
MBTA Crowding

Testing our language

i NOT CROWDED

ii SOME CROWDING

iii CROWDED





12:34

Hawthorne @ Broadway

UPDATED LIVE
EVERY MINUTE

117	Wonderland	iii	2m
111	Cary Sq	iii	2m
111	Woodlawn	iii	7m
⚠ DELAYS			
111	Cary Sq		13m
117	Wonderland	ii	47m

9:41

Stops

Search for a stop or a station



South Station

RL SL1 SL2

Chelsea 5 min

Chelsea 7 min

[View schedule](#)

Courthouse

SL1 SL2

Chelsea 1 min

Chelsea 9 min

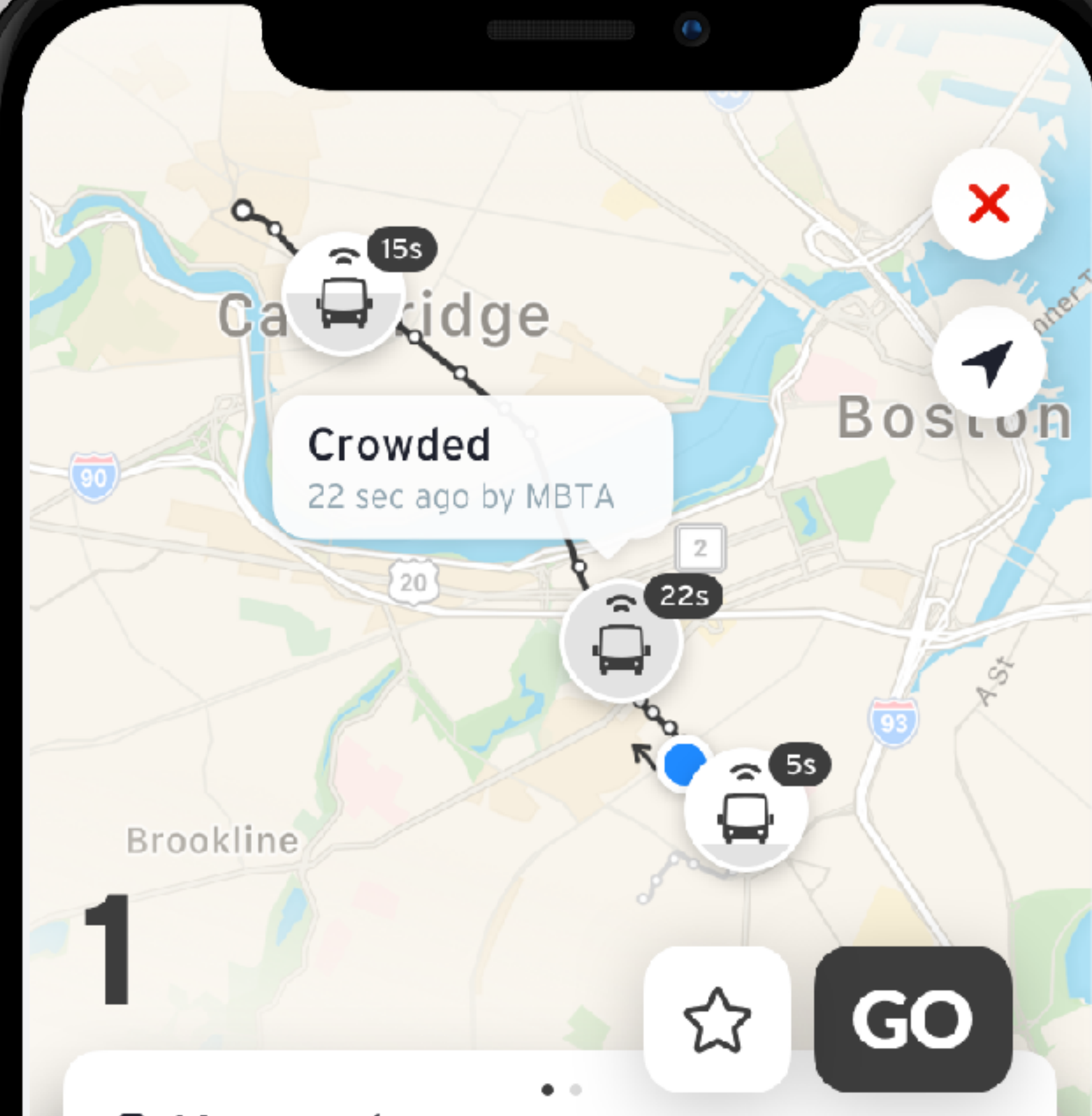
[View schedule](#)

World Trade Center

SL1 SL2

Chelsea 2 min

Chelsea 9 min



Harvard

Massachusetts Ave / Tremont St

1 min

14 min

22 min

Future efforts

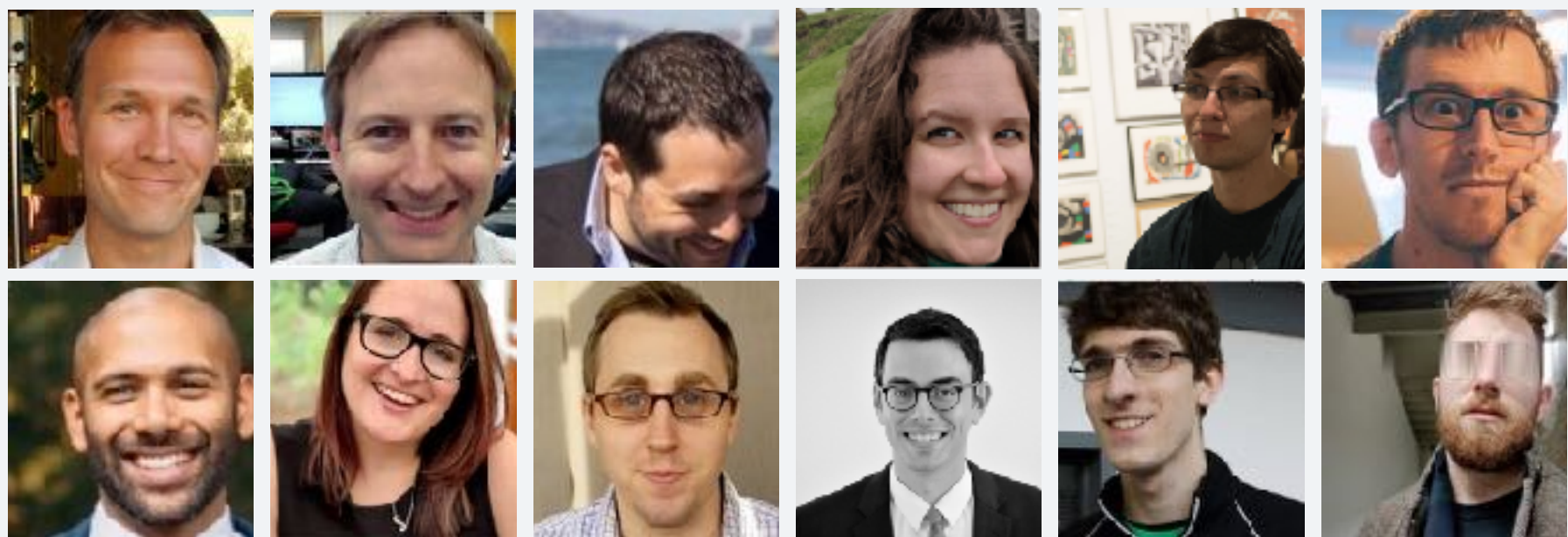
Continued conversation with riders about our work

Real-time crowding is more accurate and on more bus routes

Historical crowding for heavy rail lines

Transit is a team sport

Kudos to all our colleagues that supported this effort, and our fellow MBTA departments—OPMI, Policy and Security.



Crowding Team
Customer Technology



Akira Hakuta
Product manager



Ashli Molina
Product manager



Ingrid Pierre
Principal designer



Maeg Keane
Lead researcher



Miles Taylor
Trusted intern



Paul Swartz
Lead Architect



Thank you



EMILY GATES

Crowding in Transit

How our users think about crowding data



transit







How does Transit do crowding?

- 15 cities in early March
- Rapidly grew to 30 cities now

It's useful for transit operations.
What are the busiest lines? At what time of the day?

It's also useful for riders.
Are there any seats? Should I wait for the next bus?



	CAPACITY	DESCRIPTION
	10%	Bus is empty
	25%	Many seats available
	50%	Few seats available
	65%	Standing room only
	90%	Bus is very crowded
	100%	Bus is full

User survey within *Transit*

- June 2020
- 6,000+ respondents
- Six cities



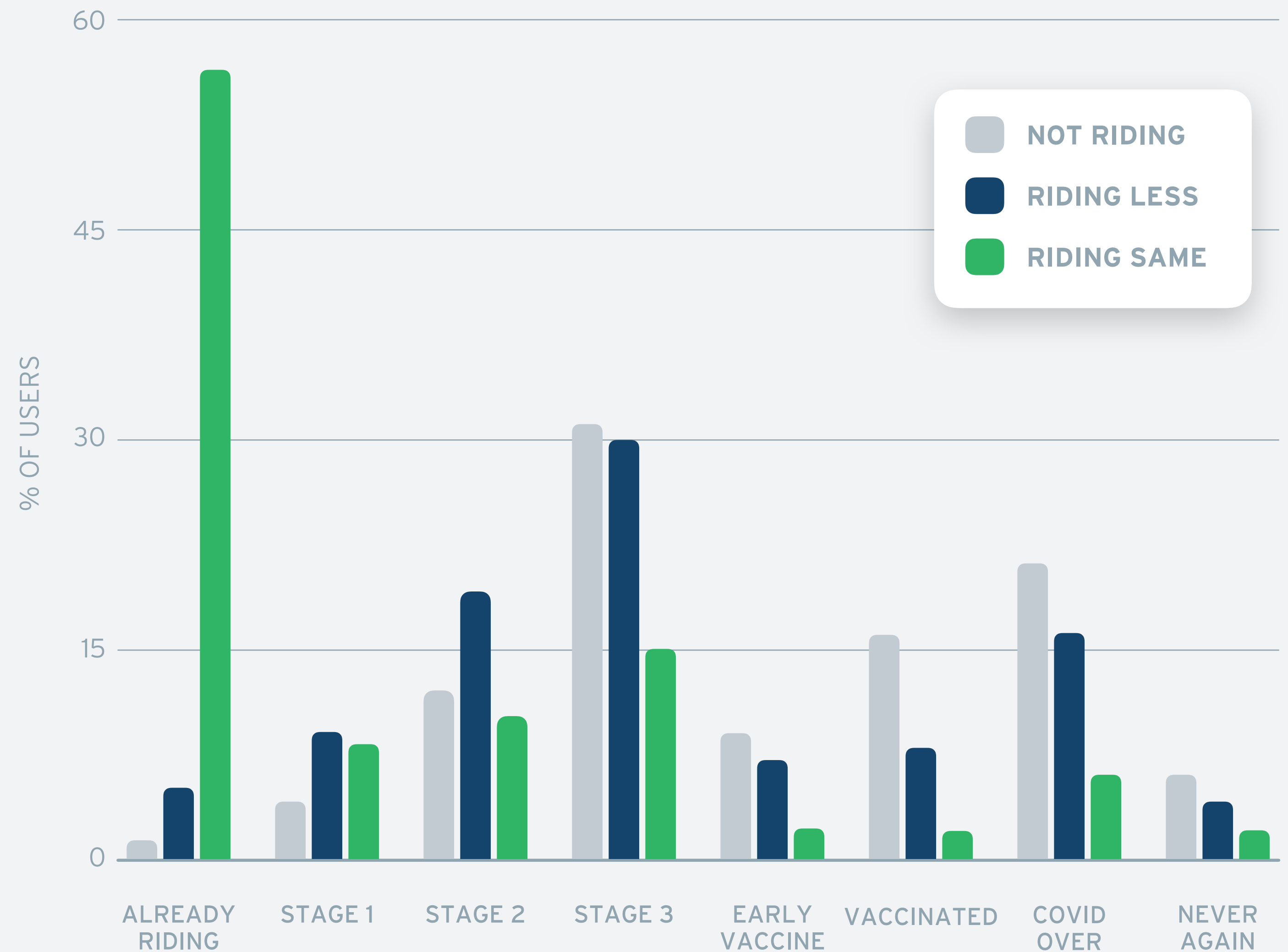
At what stage will riders return?

Among those riding less
or not at all, public health policy
(stage of re-opening) and vaccine
development are both key factors
BUT outside of agency control

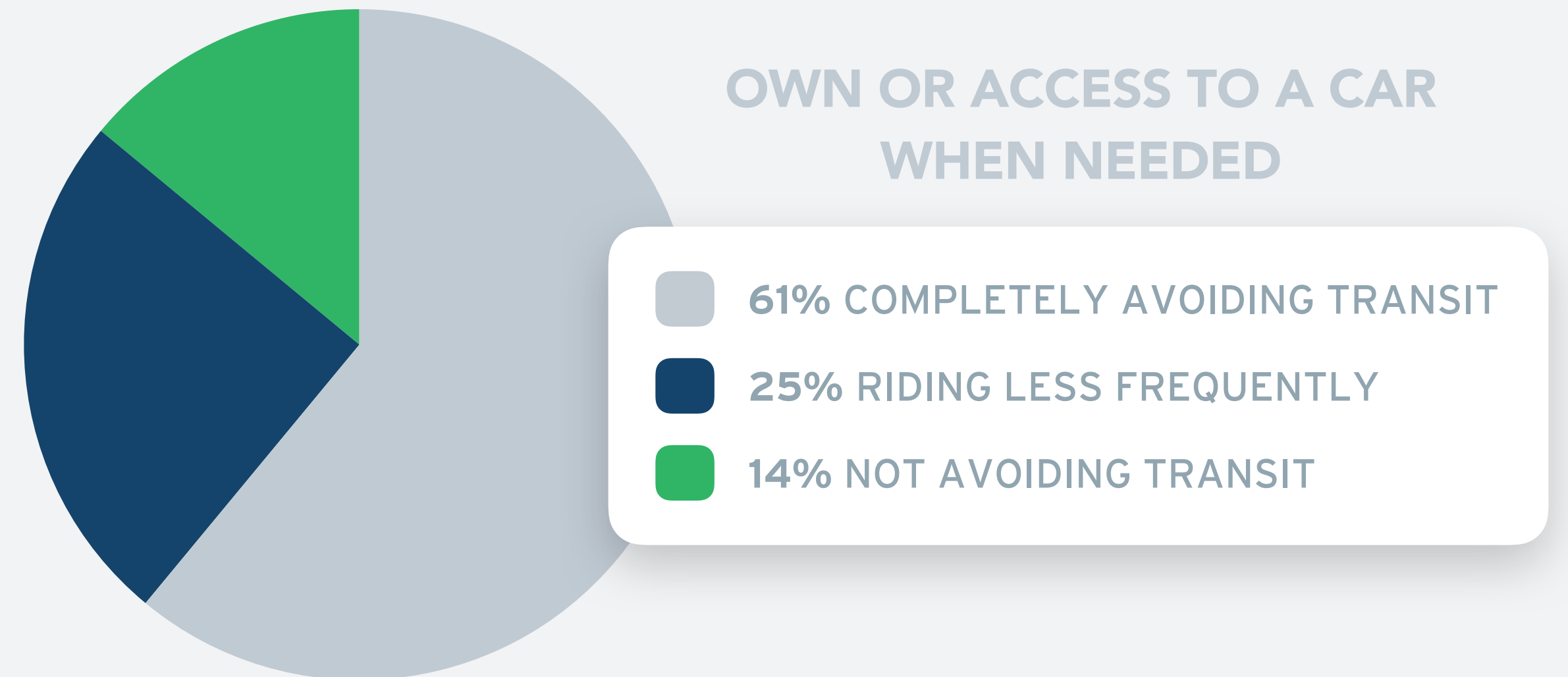
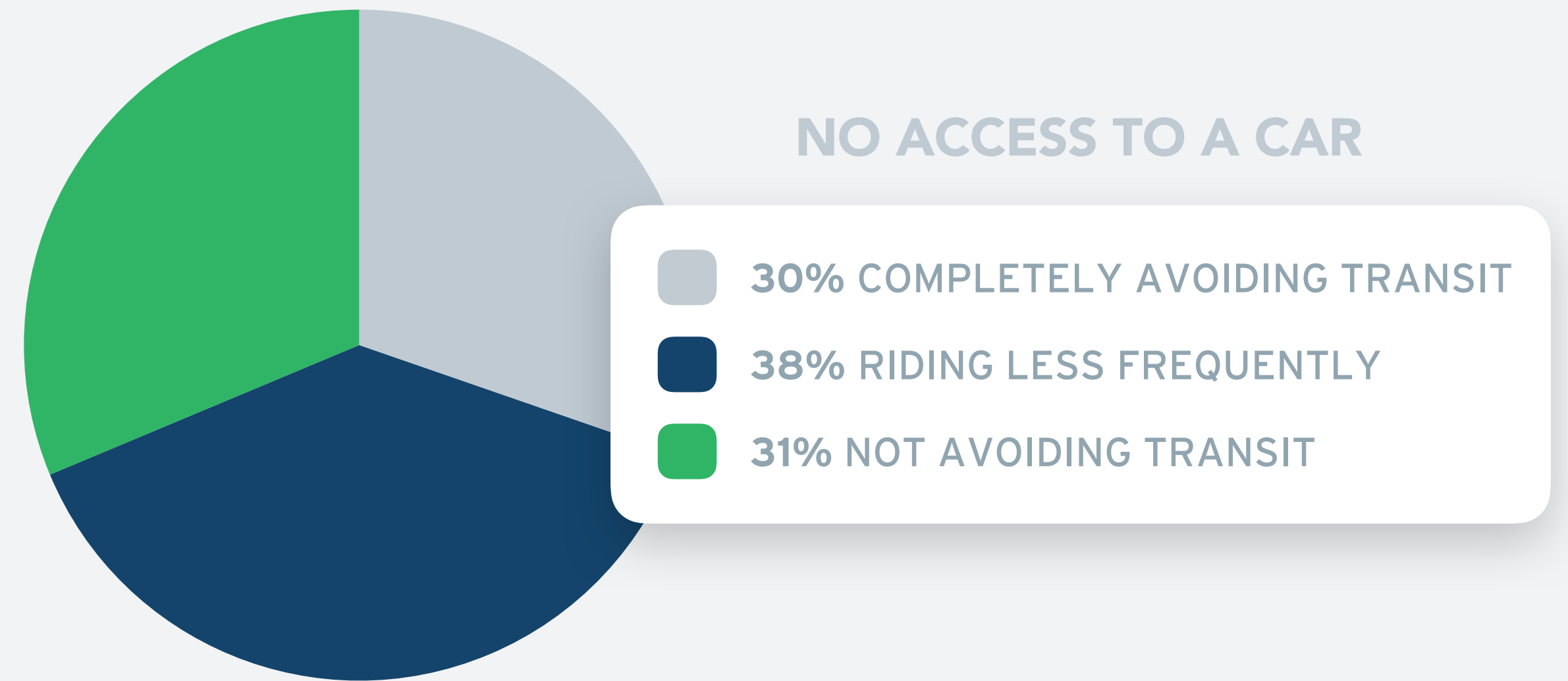


SOURCE: TRANSIT APP SURVEY, JUNE 2020

WHEN WILL YOU RESUME RIDING AS OFTEN AS YOU DID BEFORE COVID-19?



Car access & transit avoidance

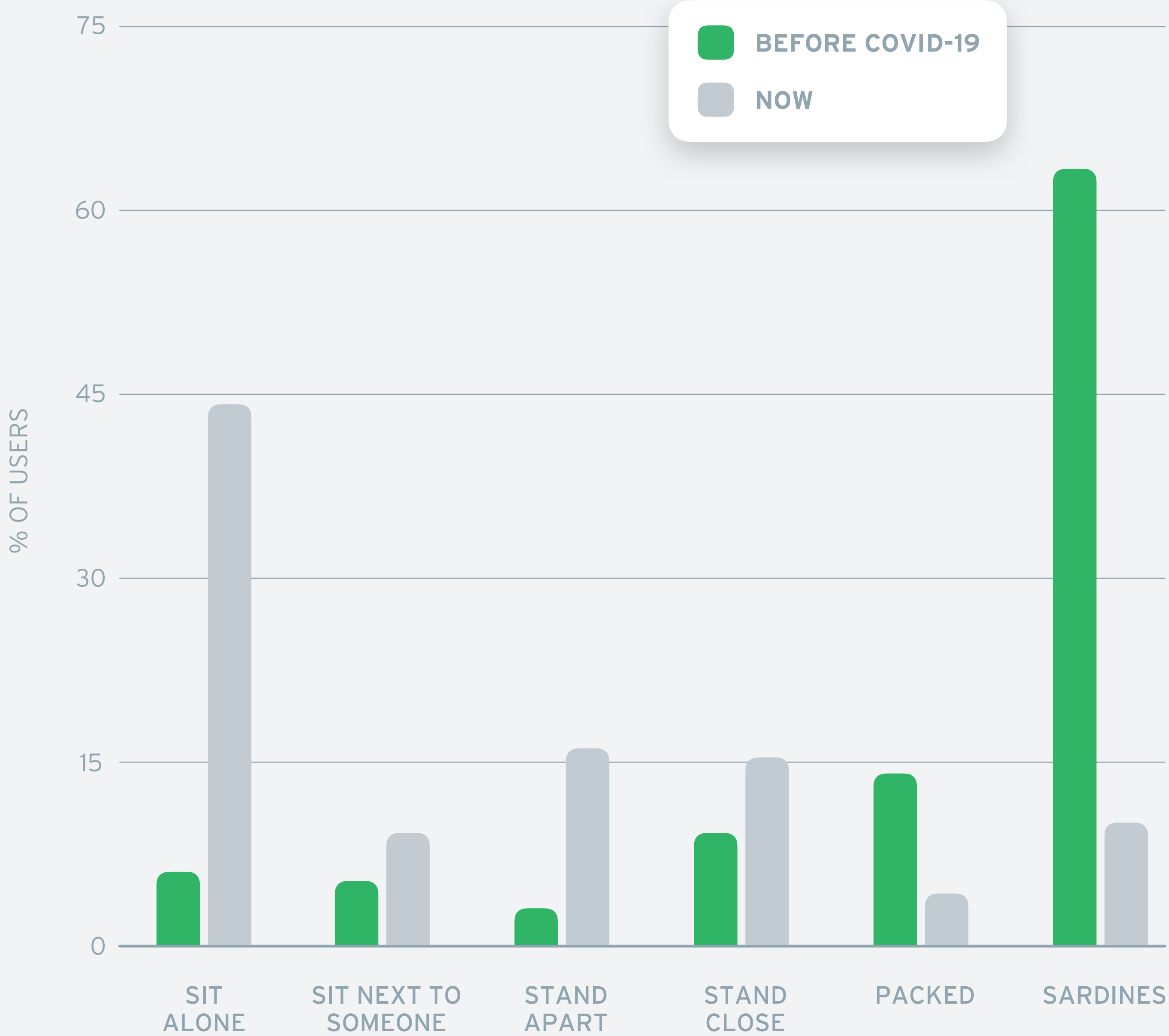


SOURCE: TRANSIT APP SURVEY, JUNE 2020

Crowding threshold to ride



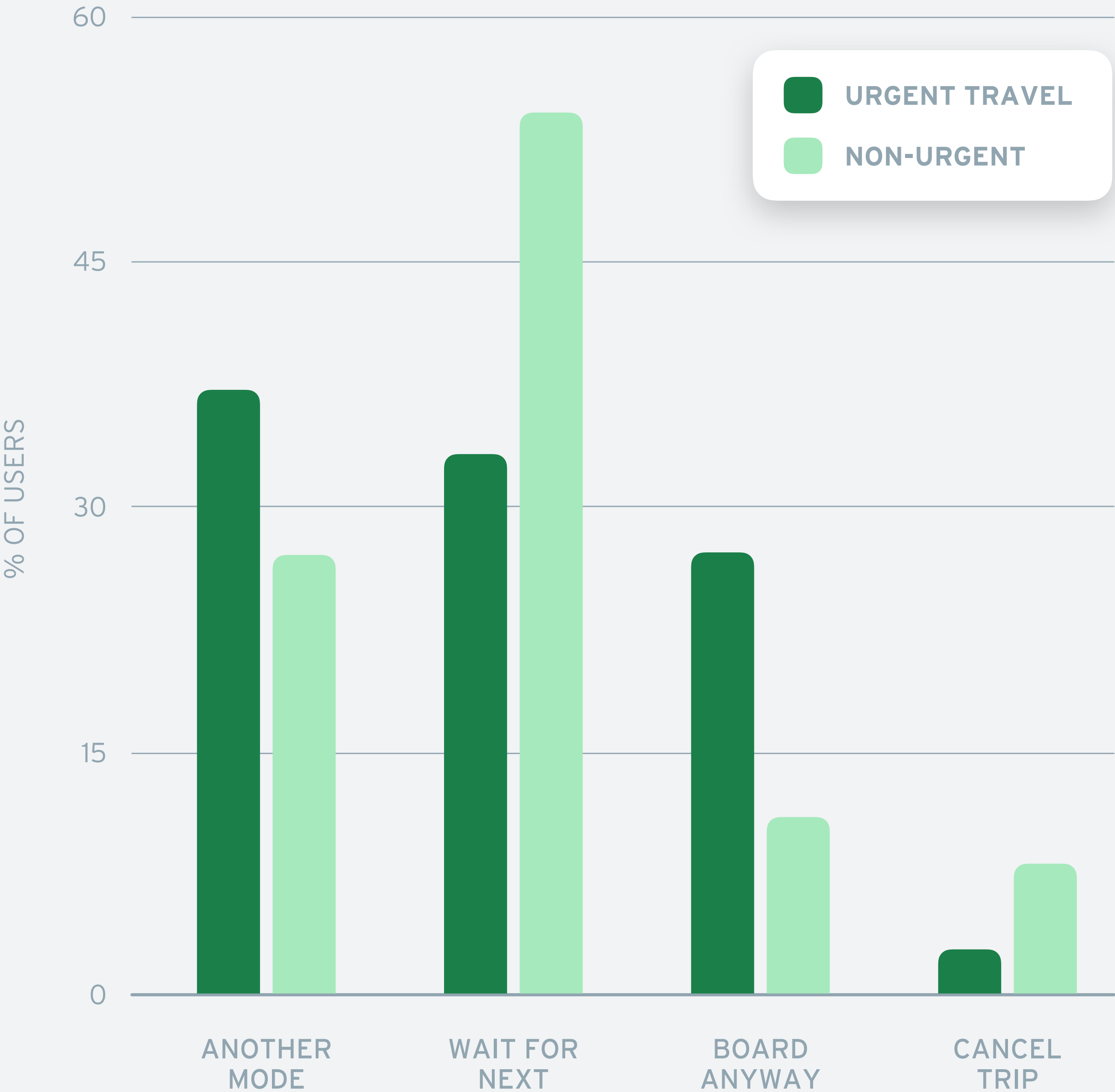
SOURCE: TRANSIT APP SURVEY, JUNE 2020



When the bus/train is too crowded, what do you do?



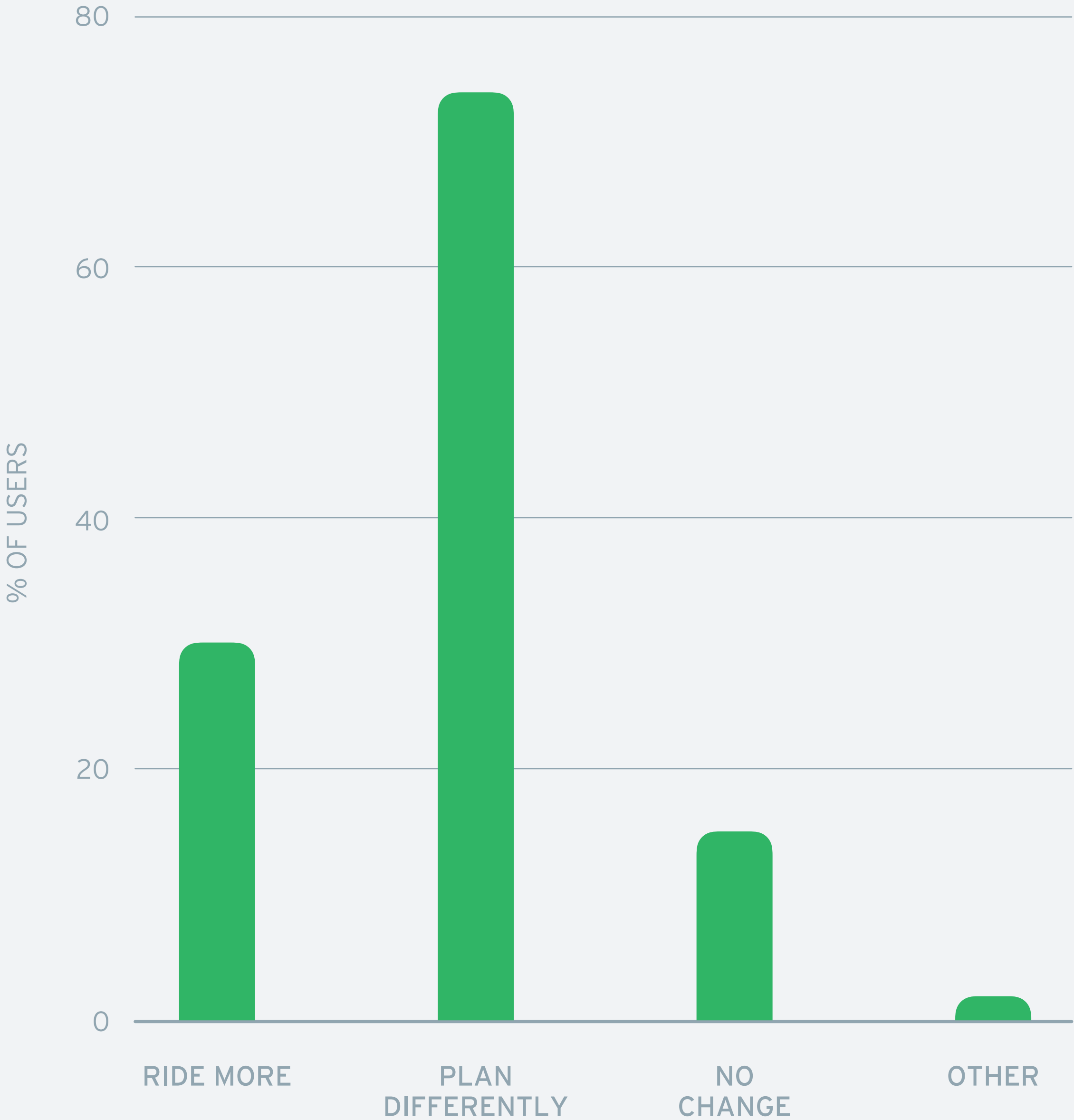
SOURCE: TRANSIT APP SURVEY, JUNE 2020



Would real-time occupancy change your riding habits?



SOURCE: TRANSIT APP SURVEY, JUNE 2020



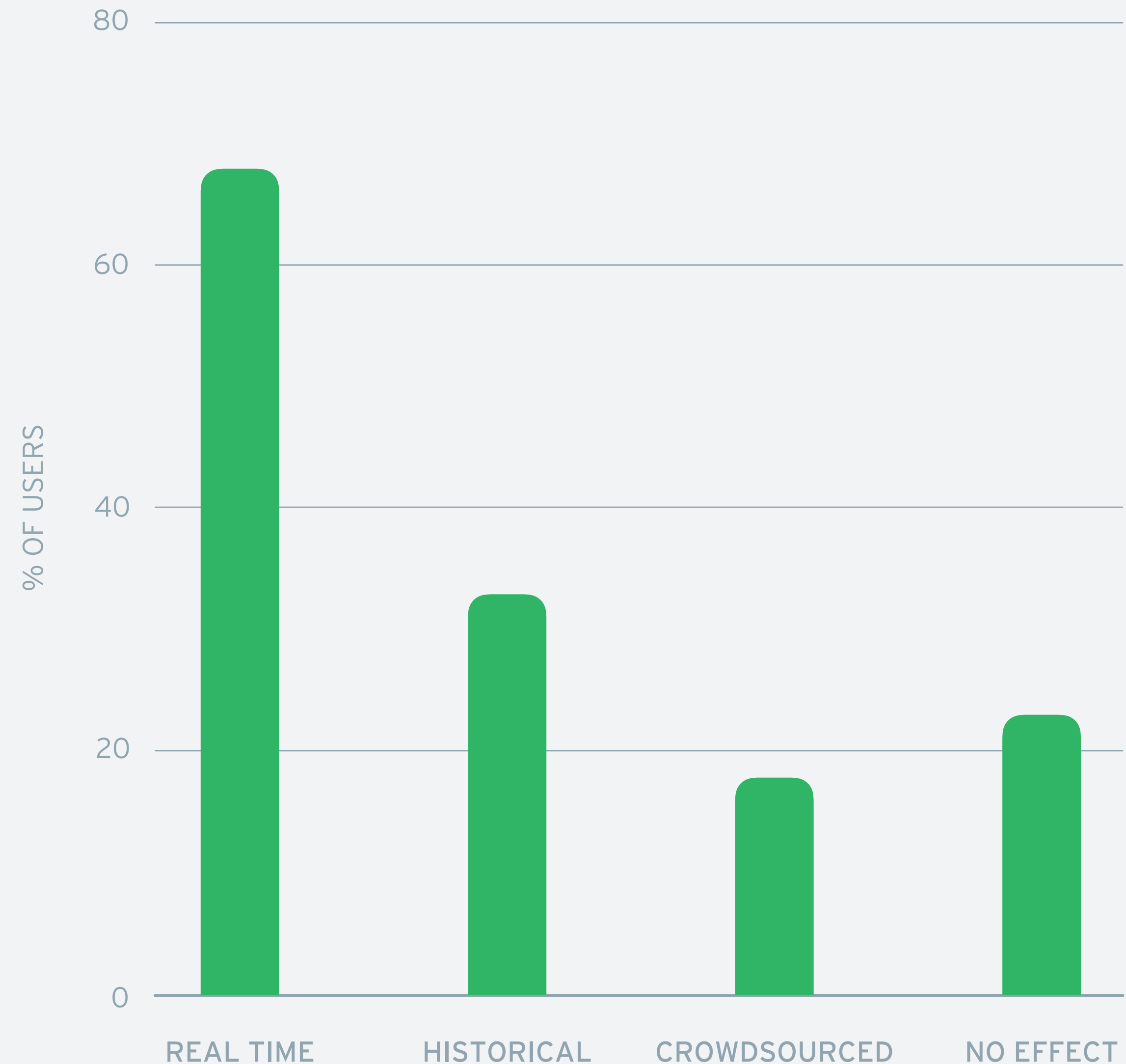
Riders value real-time occupancy

Particularly when it is available
all the time, in real time.



SOURCE: TRANSIT APP SURVEY, JUNE 2020

WHAT KIND OF OCCUPANCY DATA WOULD CAUSE YOU TO RIDE MORE OFTEN?







NATHAN REYNOLDS

Transit Technology: Getting and Using Passenger Data

How automatic passenger data (APC) technology has changed

Ensuring quality data

Integrating this data throughout your systems



APCs – What's the Tech?



Side by Side Beam

Most Cost Effective

Less Accurate

Struggles to handle
crowded doorways
or bi-directional flow

VS

Overhead Infrared / Optical

More Expensive

More Accurate

Able to handle
crowded doorways
or bi-directional flow

APCs

What's different
about real-time?

Historically

APCs' primary use case
was historical reporting
& NTD

APC Cleansing

For historical use cases
can leverage sampling
& statistics to improve
accuracy that doesn't
happen in real-time

Variable Accuracy

In real-time, accuracy
is variable & will drift
throughout the day

Real-Time Adjustments

Manual overrides built-in
for load adjustment
to correct anomalies

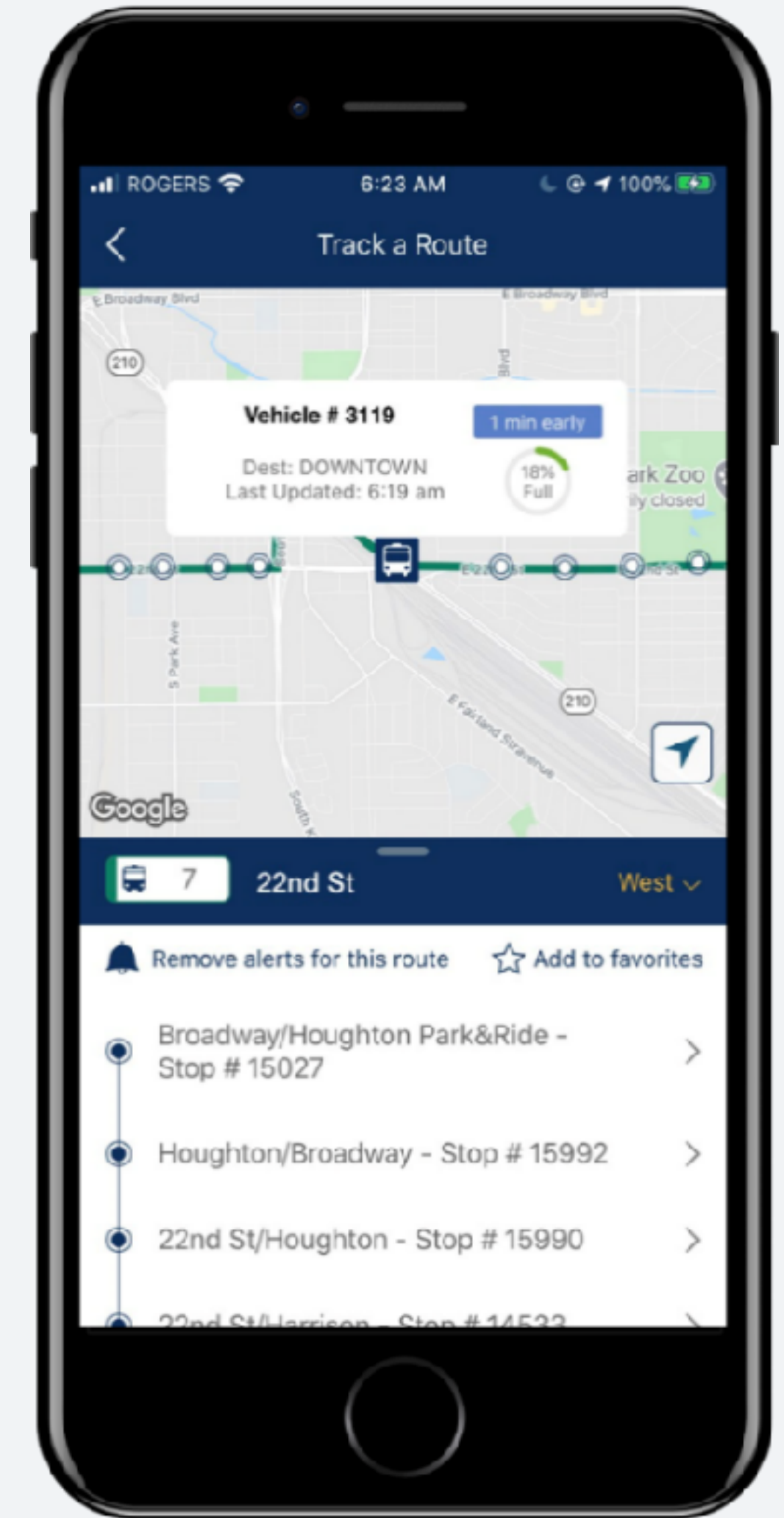
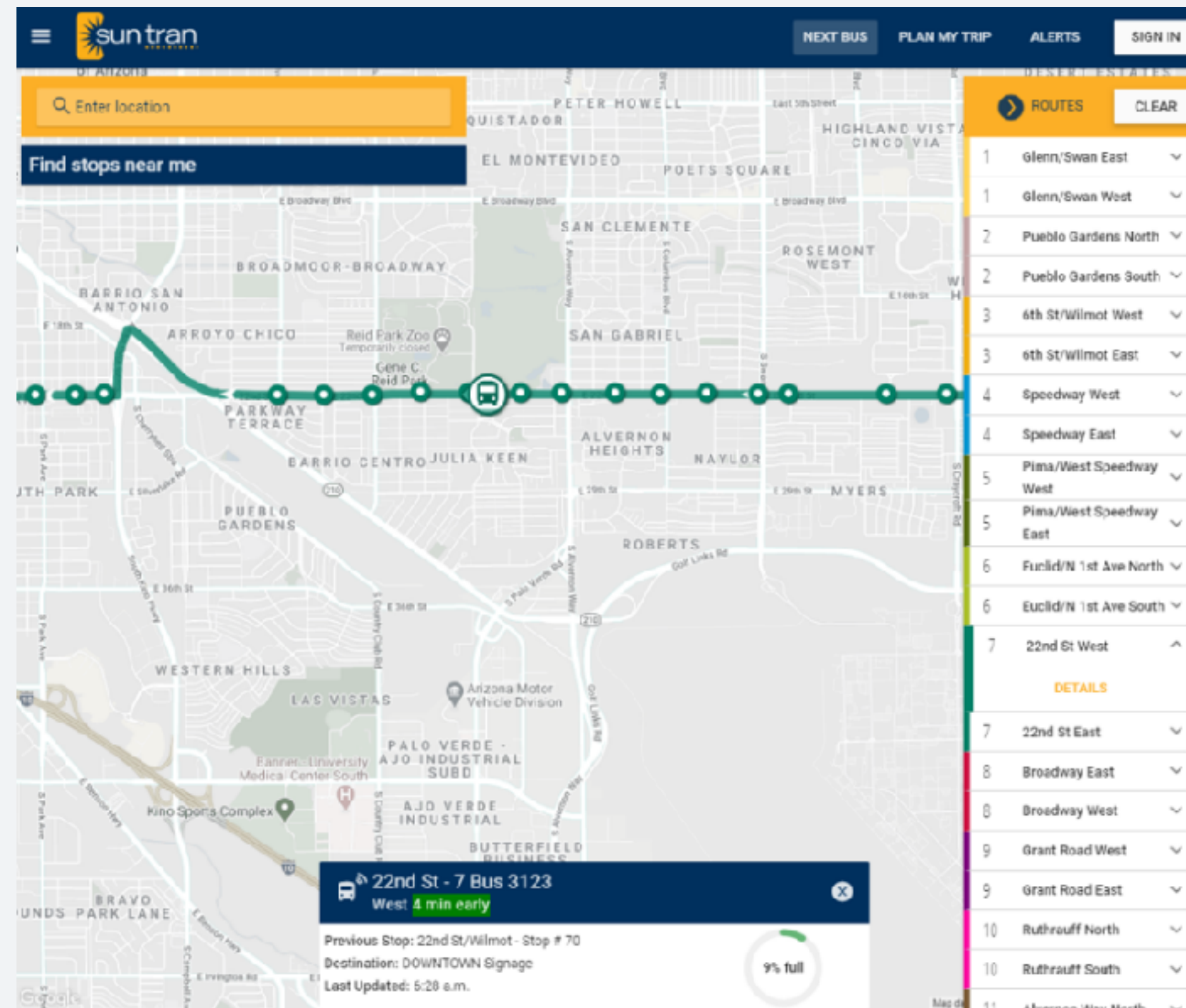
Ensuring Quality Data

- APCs: Automatic Counting, Not Automatic Maintenance
- Proactive Health Checks
 - On/Off Comparison or Door Checks
- Preventative Maintenance
 - Sample Counts, Wipe Down Sensor
- Ongoing Maintenance is Minimal Effort



How Do We Populate Crowding Data?

- Crowding Data Available in GTFS-RT
 - Occupancy Status
 - Occupancy Percentage
- Native Integration to Trapeze Passenger Information Suite
- Capacity Configuration Critical



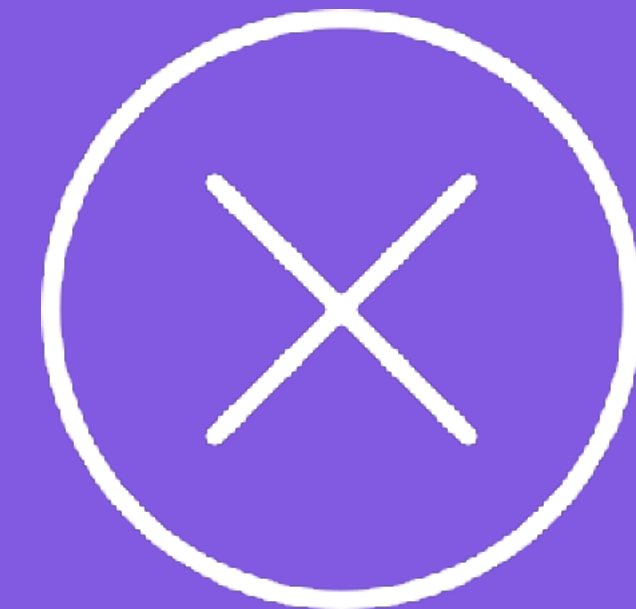
Key Takeaways



Boarding behavior
can impact accuracy,
depending on sensor.



Capacity
configuration is
critical for the right
information
downstream.



APCs automatically
count, but don't
automatically
maintain themselves.



Thank you!



MARLA WESTERVELT

Standardized solutions for crowding

GTFS occupancy extension

Who am I?



- **Community and Partnerships for North America and Pacific for MobilityData**
- Passionate about building frameworks that enable the transportation industry to effectively leverage technology to meet its goals
- Former roles include: Global Data Policy and Business Development @ Bird, Head of Research in the Office of Extraordinary Innovation @ LA Metro, Sr. Policy Analyst @ Eno Center for Transportation





MobilityData enables
**interoperability in transportation
systems** by identifying interests
shared by stakeholders,
responding with **data formats**
and **shared data infrastructure**,
and supporting the adoption of
standardized data practices
worldwide.

Occupancy Pre-Covid: The Sleeper

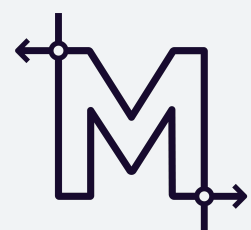
State of the Specification

- Experimental enum `occupancy_status` field in GTFS-RT introduced in 2015
- GTFS-occupancies extension draft proposal for static GTFS



State of the Industry

- Very, very few producers of `occupancy_status`
- Challenging to use pre-existing hardware within vehicles to process data in real-time to determine occupancy
- Google was the only large consumer of `occupancy_status`



Occupancy during COVID-19: The Reactive

State of the Specification

- Active issue and [PR](#) opened on Github
- New experimental `occupancy_percentage` field added to GTFS-RT defined for current operating regs
- [Robust conversation](#) on how to best describe occupancy within the spec and the real challenges of counting occupancy effectively

State of the Industry

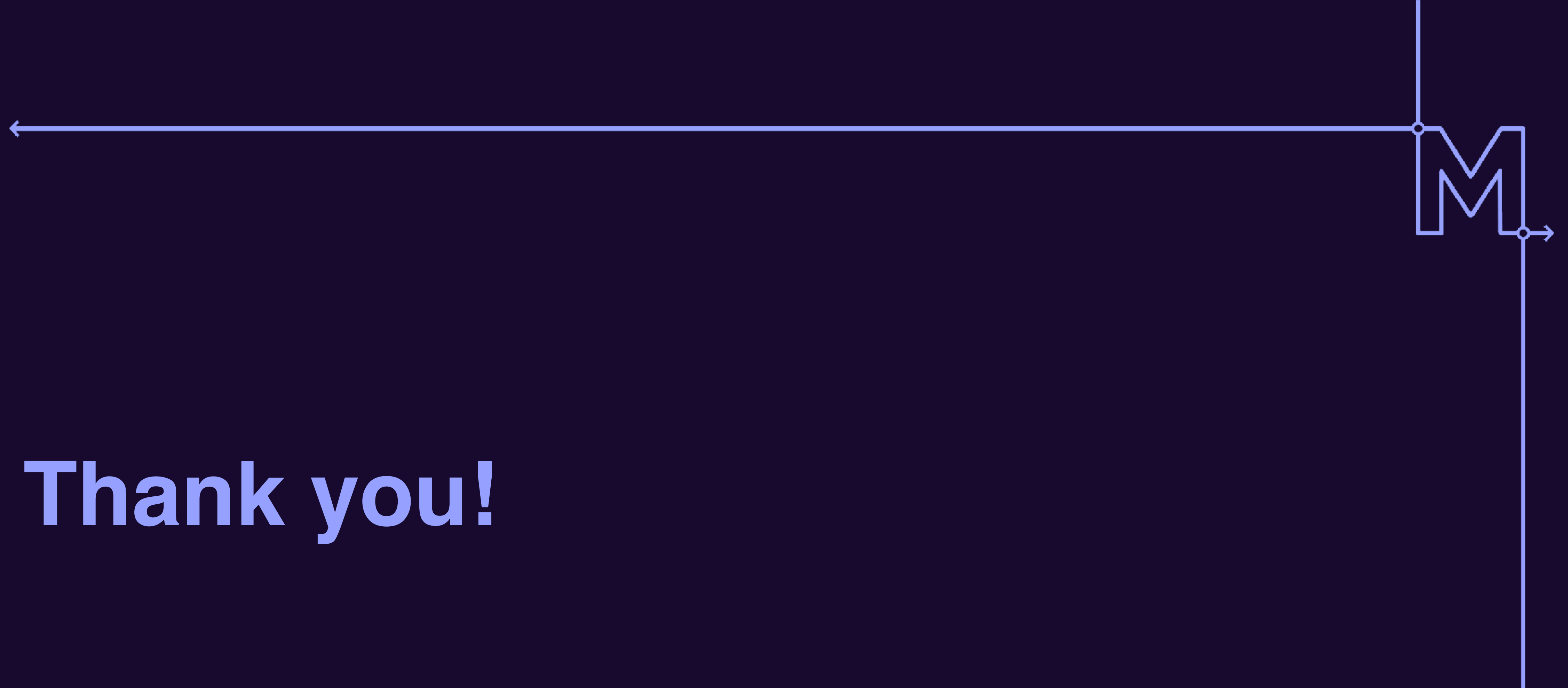
- Number of producers of `occupancy_status` or `occupancy_percentage` quickly increasing
- Consumers, such as *Transit*, have begun consuming these data
- Hardware and software vendors seeking to quickly provide solutions



Where does the specification go next?

- Encourage more data producers and consumers to generate/use these data, and hardware vendors to support them
- Continue to facilitate community discussions to determine how to effectively standardize the way we describe occupancy within the spec
- Work with the community to define best practices for high-accuracy counting
- Finalize occupancy as a permanent field in the specification





Thank you!

Q&A



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