

- ISSUE PAPER -

On-Demand Transit Review

Key Performance Indicators





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Introduction

Dillon Consulting Limited (Dillon) was retained to support the Canadian Urban Transit Association (CUTA) in the development of an industry-wide on-demand transit dashboard. This project establishes the need for common definitions and data-sharing. A survey was conducted across Canadian transit agencies with on-demand transit service to determine the key performance indicators (KPIs) of highest importance, and to compare data available between agencies.

Of transit agencies that offer on-demand transit, a variety of on-demand technology providers are used to help facilitate service. Each of these providers provide a robust dataset which tracks various operating and customer-focused key performance indicators (KPIs) and service metrics.

While there are a number of common KPIs that are used, there is little understanding about the standardization between them. Several transit agencies throughout this project expressed interest toward greater standardization. As on-demand transit is increasing in popularity, many agencies are

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interested in further developing their service, to which more data, KPI standardization, and improved metric reporting can help. Further standardization could help specific transit agencies learn and share best practices, technology developments, and optimization technique. KPIs allow transit agencies to easily monitor the efficiency, efficacy, and reliability of the service, by highlighting certain valuable metrics that help better monitor and improve their service. The goal of this project is to build toward an extension of the CUTA Fact Book portfolio for on-demand systems, enabling consistent comparisons for agencies with on-demand systems so that agencies best know how they compare against peers.

The purpose of this report is to present a summary of the findings from the survey, and a comparison of reporting for the KPIs identified in this report. Differences in definitions between each on-demand technology provider are highlighted. A future step of this work would be the development of the dashboard and working toward industry-wide collection and reporting of KPIs identified throughout this project.



Survey Findings

Dillon developed a short on-demand transit survey that was distributed to members of the CUTA On-Demand Working Group as well as other members that operate on-demand data. The On-Demand Working Group consists of transit operators who advise CUTA on the development of on-demand transit tools and reporting. The purpose of the survey was to understand the use of on-demand transit, the KPIs that are currently reported by their on-demand technology provider, which KPIs are most useful and important, and which KPIs they would like to be able to track. The survey was open between October 28, 2024 and November 15, 2024. Respondents were asked 20 questions, which were a mix of multiple choice, selection, open-ended, and ranking questions.

Overall, 21 validated responses were received, of which 17 were complete. All responses were used where answers were provided in the following sections.

2.1 Summary of Survey Respondents

This first section provides context on the survey respondents, including the size of the on-demand system, the on-demand operating model and its use for conventional and/or specialized transit.

2.1.1 Fleet Size

Respondents were asked about the size of their on-demand fleet. Fleet size is a useful dashboard metric so that agencies can compare their performance against agencies of a similar size. Of the transit agencies surveyed:

- Two (2) transit agencies do not currently operate on-demand transit.
- Ten (10) transit agencies operate an on-demand fleet of between 1-5 vehicles.
- Three (3) transit agencies maintain an on-demand fleet of between 6-10 vehicles.
- Four (4) transit agencies operate an on-demand fleet of over 20 vehicles.

2.1.2 Network Structure

Respondents were asked the type of on-demand network they operate through a series of questions. This includes whether the on-demand network provides connections to a fixed-route network and the use of on-demand transit for specialized transit operations. These metrics are useful when creating an on-demand dashboard so that agencies can understand how other KPIs may be impacted by the organization of the on-demand network.

2.1.2.1 Integration with Conventional Fixed-Route Transit

Respondents were asked how their on-demand network integrates with conventional fixed-route transit. Transit agencies were able to select multiple options as their networks may integrate in multiple ways with fixed-route transit. Of the 19 agencies with on-demand transit:

- Thirteen (13) transit agencies have connections to their fixed-route network.
- Seven (7) transit agencies replace their fixed-route network with on-demand at certain times of day, like at night.
- Four (4) transit agencies have overlapping fixed-route and on-demand networks, where residents can choose to take either option in specific areas.
- Three (3) transit agencies do not connect to any local fixed-route network.

2.1.2.2 Integration with Specialized Transit

Respondents were asked how their on-demand network integrates with specialized transit. Similarities may exist between on-demand transit and specialized transit due to the types of vehicles used and flexibility that the service provides. As a result, the level of interdependency between the on-demand and specialized services depends on system operation and specific requirements. Of the 19 agencies with on-demand transit:

- Nine (9) use separate software for specialized transit and for on-demand transit.
- Four (4) use the same on-demand software for booking and management, but separate vehicles are used to operate each service.
- Four (4) will commingle specialized and on-demand transit riders using the same, with riders potentially riding in the same vehicles.
- One (1) does not operate specialized transit service.
- One (1) operates specialized transit using an on-demand model.

2.1.2.3 Permitted On-Demand Trips

Respondents were asked both about the degree to which trips could be personalized in the network and what stop types are used in the network. For trip personalization, the 19 agencies with on-demand transit indicated:

- Twelve (12) allow many-to-many trips, where travel is permitted between any origin and destination within the service area.
- Four (4) allow many-to-few trips, where travel is permitted between any origin to a list of specific destinations.
- Two (2) have a mixture of systems, using combinations of many-to-one (e.g., GO Transit shuttles), many-to-few, and many-to-many.
- One (1) is in the process of deciding on trip types for their network, and did not have a specific format chosen at the time of survey completion.

Regarding stop types, the 19 agencies indicated:

- Seven (7) use pre-designated signed stops where passengers can board and alight.
- Three (3) offer curbside pick-up and drop-off.
- Two (2) use pre-designated virtual stops identified in the on-demand technology provider's software.
- One (1) offers door-to-door pick-up, where the driver will walk customers to the door of their origin or destination.
- Six (6) use mixtures of any of the other options, predominantly signed stops with either curbs or virtual stops.

2.2 Key Performance Indicators

By tracking and analyzing KPIs, transit agencies and on-demand technology providers can gain valuable insights into various aspects of their operations, enabling agencies to make data-driven decisions that enhance service quality and customer satisfaction and understand operational needs, and service requirements. The survey asked respondents about their priorities across KPIs under three scenarios: KPIs they regularly track, KPIs they would like to track, and KPIs they want to compare. Respondents were also asked about different interpretations of wait time, and which definition was most useful to them when interpreting wait time. Table 1 identifies the KPIs used in the survey, identifying a short title for the KPI used throughout this report, the name used in the survey (where applicable), and the definition provided in the survey.

2.2.1 KPIs Agencies Regularly Track

Respondents were asked to prioritize the top six KPIs they regularly track that are provided by their on-demand software. KPIs identified through this question help understand what the industry regularly monitors in existing on-demand networks and would be important for measuring with standard definitions to better enable comparisons. Figure 1 identifies the top regularly tracked KPIs identified by respondents. On-time performance (both pick-up and drop-off), productivity, and no shows were identified as top tracked KPIs across most respondents. Shared rides and trip distance were also identified as KPIs of high importance across many responding agencies.

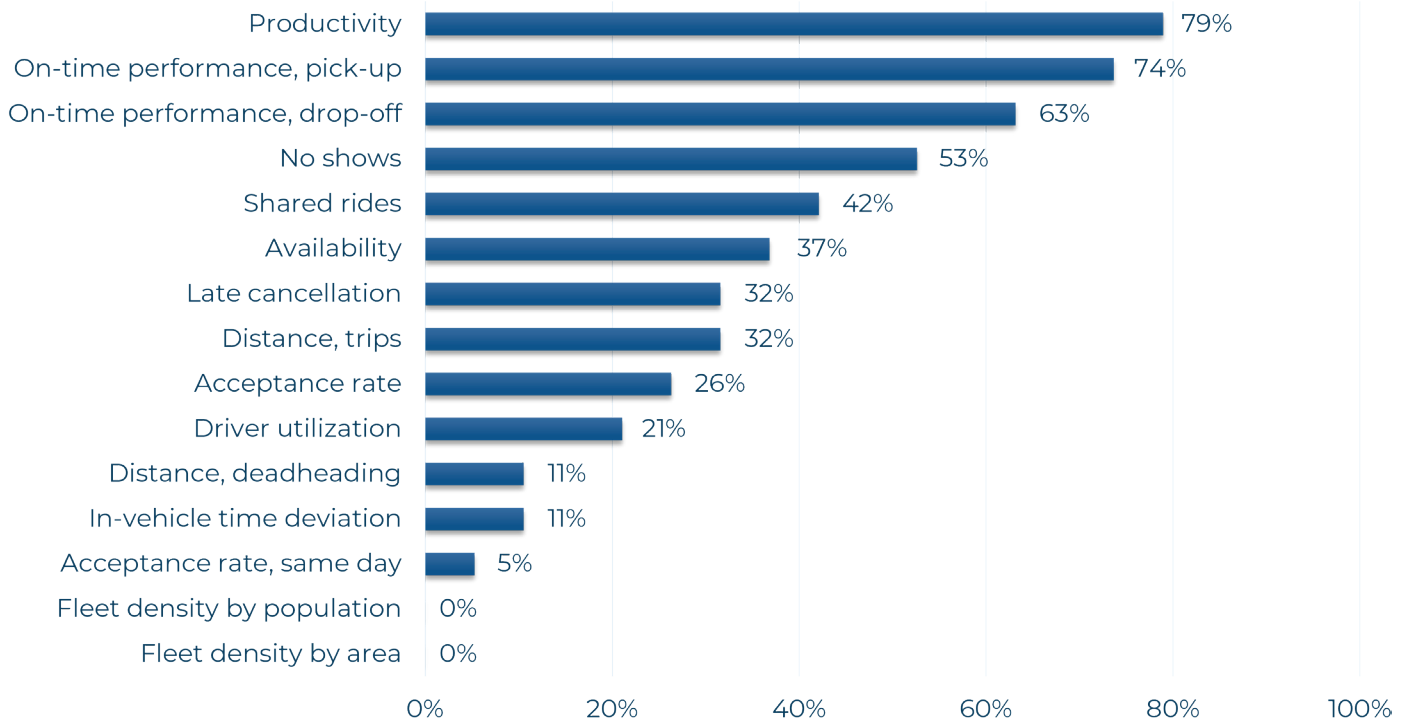


Figure 1: Top Key Performance Indicators Regularly Tracked by Transit Agencies



KPI	Alternative Name in Survey	Definition Provided in Survey
Acceptance rate	Trip accommodation	Percentage of trip requests within the accommodation window that are booked
Acceptance rate, same day	Same day trip accommodation	Percentage of same day trip requests within the accommodation window that are booked
Availability	Trip availability	Percentage of trip request searches that result in available trip options within the operator's accommodation window
Distance, trips	Average trip distance	Average distance on passenger trip
Distance, deadheading	Average deadhead distance	Average in-revenue distance when a vehicle is without a passenger
Driver utilization	No alternative title provided	Percentage of in-service passenger hours / total service hours (percentage of time operator is transporting a passenger minus in-revenue deadhead and idling time)
Fleet density by area	No alternative title provided	Average number of vehicles per square kilometre
Fleet density by population	No alternative title provided	Average number of vehicles per service area population
In-vehicle time deviation	Average in-vehicle time deviation	Time difference in direct trip versus a trip that is picking up and dropping off other passengers along the way)
Late cancellation	No alternative title provided	Percentage of trips where a passenger cancels within the operators late cancellation window.
No shows	No alternative title provided	Percentage of trips where the passenger does not show up at the schedule pick-up time
On-time performance, pick-up	Pick-up on-time performance	Percentage of pick-ups that occur within the on-time performance window specified by the operator
On-time performance, drop-off	Drop-off on-time performance	Percentage of drop-offs that occur within the on-time performance window specified by the operator
Productivity	Average number of vehicles per service vehicle hour	Average number of vehicles
Shared rides	Ride sharing	Percent of trips that are shared with multiple passengers from different bookings
Wait time (requested to scheduled)	No alternative title provided	Time between requested pick-up time and scheduled pick-up time
Wait time (scheduled to actual)	No alternative title provided	Time between scheduled pick-up time and actual pick-up time
Wait time (booking to scheduled)	No alternative title provided	Time between booking time and scheduled pick-up time (applicable in prescheduled service)
Wait time (booking to scheduled)	No alternative title provided	Time between booking time and scheduled pick-up time (applicable in prescheduled service)

Table 1: Key Performance Indicators Identified in the Survey

2.2.2 KPIs Agencies Would Like to Track

Figure 2 shows the KPIs that transit agencies are interested in tracking but are currently not clearly provided or easily able to find. There is opportunity to improve KPI tracking, particularly on the KPIs that were identified most regularly in the survey. While no metric was selected by over 50% of the respondent base, fleet density by population was the highest requested metric. Availability, acceptance rate, average deadheading distance, in-vehicle time deviation, driver utilization, and fleet density by area were also KPIs more frequently requested by agencies.

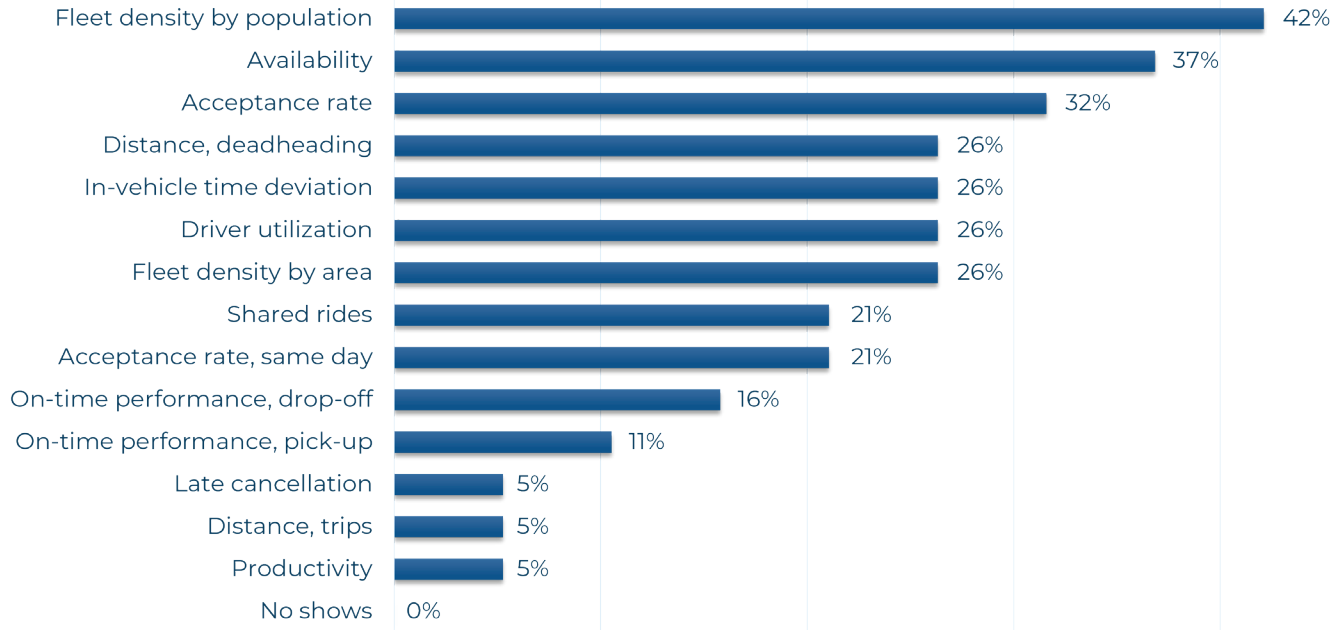


Figure 2: Top Key Performance Indicators Transit Agencies Would Like to Track

2.2.3 KPIs Agencies Want to Compare

Figure 3 shows the KPIs that transit agencies most want to compare with other agencies. Highly requested KPIs through this category would be critical for any shared dashboard. Driver utilization, productivity, and pick-up on-time performance were identified as the most desired KPIs for comparison with other agencies by respondents, with more than half of respondents including it in their list. Drop-off on-time performance, no shows, shared rides, acceptance rate, and availability were also identified as KPIs of higher importance for comparison.

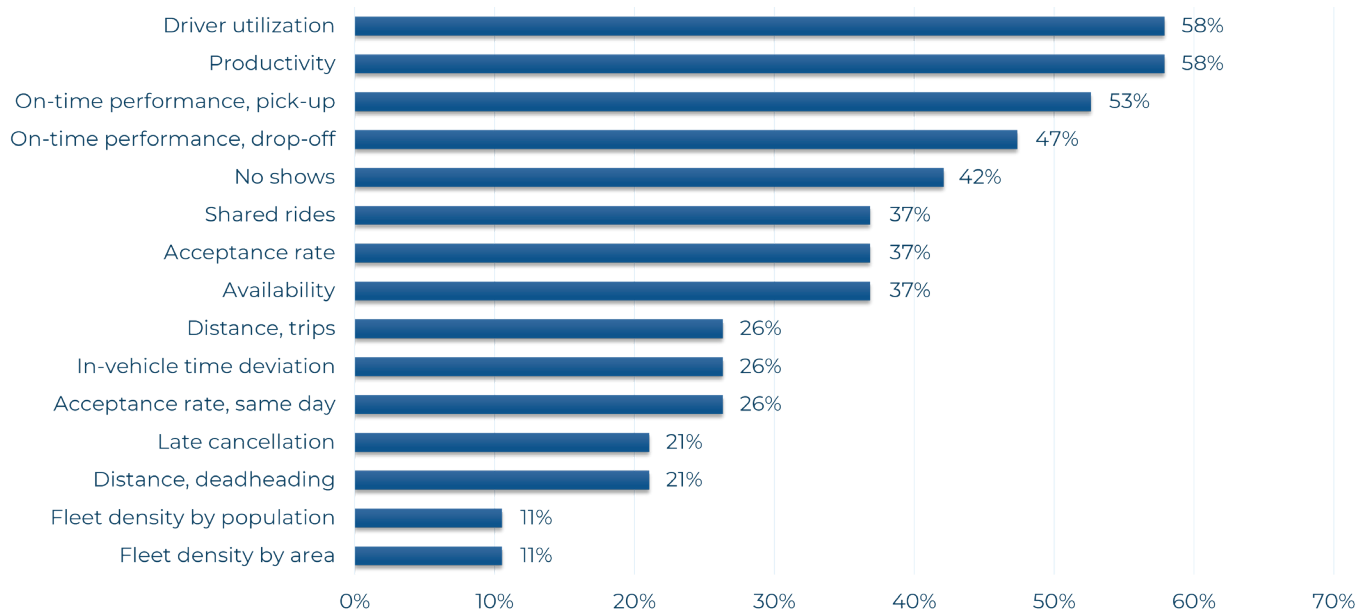


Figure 3: Top Key Performance Indicators Transit Agencies Want to Compare

2.2.4 Wait Time for Pick-Ups

An example for the need for standard definitions is provided below related to how pick-up times are defined, and how those related to wait time. The survey presented four different steps in the booking process that related to wait times for pick-ups:

- **Booking time:** When a passenger is opening an app/calling an agent to book service
- **Requested pick-up time:** When a passenger would like to be picked up
- **Scheduled pick-up time:** When a passenger is told they will be picked up, or when they are offered a time for pick-up
- **Actual pick-up time:** When a passenger is actually picked up

Respondents were asked to rank three measurements of wait time based on which they found most valuable to track internally or compare with other agencies. **Figure 4** depicts the ranking provided by respondents for key wait time metrics related to pick-up time in the survey. Generally, time between requested pick-up time and scheduled pick-up time was considered more valuable, then time between scheduled pick-up time and actual pick-up time. While the former metric is generally more preferred across the respondent base, there are differing views as to which metric is most useful. An additional option (time between requested pick-up time and actual pick-up time) may also be a valid consideration as agencies look to share statistics. There may be a need to find a standard definition (or pair of definitions, if desired) to enable better comparison.

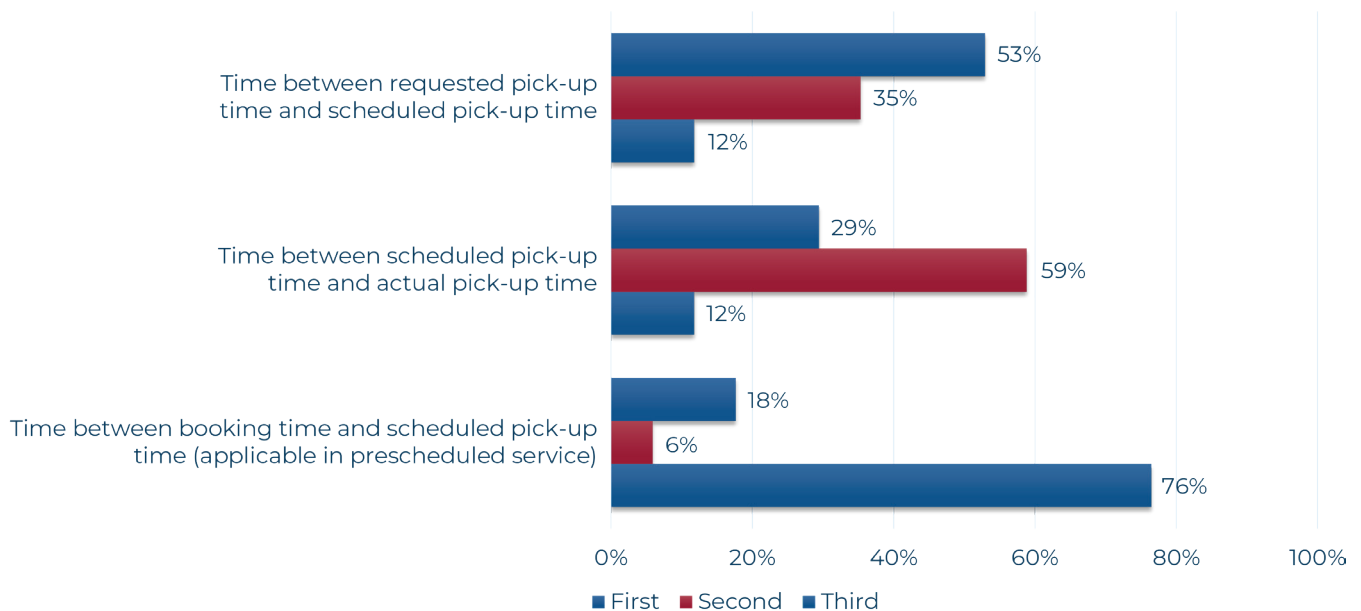


Figure 4: Ranking of Key Wait Time Metrics Related to Pick-Up Time



From the survey, Dillon conducted a further investigation into comparisons between on-demand KPIs used by various different on-demand technology providers. Selected KPIs were based on the level of interest for each KPI, based on the survey results in the preceding sections of this report. Dillon requested data from agencies that were willing to share their on-demand KPIs through the survey. Eight agencies across three on-demand technology providers provided a full set of relevant KPIs. **Table 2** illustrates the KPIs that were selected for further investigation, whether they are tracked by all providers, and whether the definition is consistent across the three providers. It should be noted that through the investigation, some KPIs that agencies reported being unable to track were found to be provided to the agencies by the providers. In these cases, opportunities may be identified for on-demand technology providers to clarify reporting of specific KPIs to transit agencies.

One key piece of information that was not included in the document were the thresholds for how specific KPIs are measured. As an example, while there is a definition of 'Acceptance Rate' in most definitions, the threshold of what defines an acceptable trip was not included in the definition. A transit system which considers an 'acceptable trip' within 30 minutes of the requested pick-up time would have a very different 'acceptance rate' than a transit agency that considers an 'accepted trip' within 2 hours of the requested pick-up time. Where these thresholds are important to understand are noted below and should be a focus for future discussion.



KPI	Trackable	Consistent	Differences in Definitions
Distance, trips	All agencies	Yes	All agencies are provided average trip distance, generally from passenger pick-up to drop-off using the road distance of the route.
Shared rides	All agencies	Yes	All agencies are provided a statistic indicating the percentage of trips that shared a ride with a passenger from another trip booking.
No shows	All agencies	Yes, minor differences	No shows are reported either as a percentage of completed rides, or as an absolute number. No thresholds for what defines a 'no show' were included in the documentation, which make this difficult to compare further.
Productivity	All agencies	Yes, minor differences	All agencies are provided completed rides divided by revenue vehicle hours. The calculation method for revenue vehicle hours could be interpreted slightly differently between providers but are generally similar.
Wait time (requested to scheduled)	All agencies	No	All providers identify the difference between the requested pick-up time and either the scheduled pick-up time or the actual pick-up time. Two of the providers default to scheduled pick-up time as the comparator timepoint. One provider will provide a different metric depending on the service's operating method.
In-vehicle time deviation	Some agencies (indirectly)	Yes	Providers tend to provide the direct trip duration, which measures the duration assuming no deviations, and the actual trip duration, which measures how long the trip actually took. The difference between these metrics would provide the additional time per passenger.
Acceptance rate	Some agencies	No	Definitions are inconsistent between all technology providers. Agencies are provided with statistics identifying either accepted rides as a percentage, users that accepted rides as a percentage, or are not clearly provided the KPI. No thresholds for what defines an acceptable trips (e.g. 'within 1 hour of the requested pick-up time') were included in the documentation, which make this difficult to compare further.
Availability	Some agencies	No	Definitions are inconsistent between all technology providers. Agencies are provided with passenger or search-level statistics identifying either successful searches or failed searches, or are not clearly provided the KPI. No thresholds for what defines a 'successful search' were included in the documentation, which make this difficult to compare further.
Distance, deadheading	Some agencies	No	Definitions are inconsistent between all technology providers. Agencies are provided combinations of revenue distance, distance with or without riders, or no clear distance-based measurement from which deadheading could be isolated.
Driver utilization	Some agencies	No	Definitions are inconsistent between all technology providers. Agencies are provided with KPIs considering revenue hours, deadhead hours, and/or a comparison of revenue hours against rides or in-service hours.
On-time performance, pick-up	Some agencies	No	Definitions are inconsistent between all technology providers. Providers either offer percent of trips completed within a provided pick-up window, generalized on-time performance conflated with drop-off time, or other varying KPIs depending on the service. Only one provider had a standard threshold for what defines an 'on-time pick-up window' in the documentation, which makes this difficult to compare further.
On-time performance, drop-off	Some agencies	No	Definitions are inconsistent between all technology providers. Providers either offer percent of trips completed within a provided drop-off window, generalized on-time performance conflated with drop-off time, or other varying KPIs depending on the service. Only one provider had a standard threshold for what defines an 'on-time drop-off window' in the documentation, which makes this difficult to compare further.
Fleet density by population	No agencies	Not applicable	This KPI is generally not provided to agencies by any of the providers. Other KPIs provided that could allow agencies to manually calculate this include hourly vehicles or maximum active vehicles, which are similarly not consistently provided across providers.

Next Steps

Based on the feedback from the On-Demand Working Group, CUTA and Dillon will identify the need to standardize and align KPIs across various transit agencies. This will be a key step in advance of developing an on-demand dashboard and adding fields to the CUTA Fact Book that would suit the needs of transit agencies that offer on-demand transit. By gathering detailed feedback from a diverse range of agencies, CUTA and Dillon can identify common challenges, priorities, and best practices.

