Feasibility Analysis
Methodology & Results

All Door Boarding
Expansion and Proposed Program
August 2017

Service Planning and Scheduling

Introduction

Today, most Metro bus routes require front-door boarding and fare verification by the operator in order to increase fare compliance. However, front-door boarding also extends dwell times at stops with high passenger activity, lengthens overall travel times and uses already scarce resources less efficiently.

Previously available on Metro Rail and Metro Orange Line, Metro recently expanded all-door boarding (ADB) to the Silver Line. Customers with valid TAP cards may enter through any door of the bus at any time. TAP card customers must validate their cards by tapping bus mobile validators (BMV) which were adjacent to every door.

The general aim of this study is to determine the feasibility of expanding the ADB at the route-level. All-door boarding policy can be implemented in three ways:

1. System-level implementation - Applying ADB policy to all the routes in Metro's bus network
2. Route-level implementation - Applying ADB policy on individual routes
3. Stop-level implementation - Applying ADB policy at individual stops

A system-level policy would allow passengers to board any bus in the network through any door. This would allow for a consistent policy across all buses, and would be easiest for passengers to understand. Conversely, it is unlikely that all routes in the network would see sufficient running-time improvements to offset installing new fare-collection machines on all buses in the system. Prior to moving towards a system-level implementation, expanding the policy at the route-level is recommended to capture the most cost-efficient implementation scenario.

This study is not intended to be a detailed alternatives analysis, but rather seeks to evaluate the long-range feasibility for the proposed expansion of all-door boarding policy and to provide guidance to be used in the decision making process.

Route Selection

In this section, the methodology used to determine which bus routes would benefit from ADB policy is explained. More specifically, this paper uses Metro bus data to develop a methodology which evaluates the performance of ADB policies at the route-level. Four quantitative methodologies are presented for selecting the routes that would perform best under route-level implementation. The list of candidate routes was filtered through the application of a 4-phase process. Each phase in the evaluation process focused the analysis on progressively fewer candidates. From this process emerged a picture of future ADB utilization and potential routes identified for service. To determine the viability of expanding the ADB program, the study considered service frequency, stop activity, and transit priorities amongst other criteria.

Phase 1: Service Frequency

Metro analyzed each route in its bus network to identify the routes with the highest potential for successful ADB service. It was determined that the best time periods of focus were the AM and PM peaks (6:00am – 9:00am and 3:00pm – 6:00pm, respectively). Since these periods have the greatest number of passenger boardings, they will also stand to benefit the most from an ADB policy. Additionally, it was decided that both travel directions on a route (inbound and outbound) should be examined separately, as some routes might have a higher frequency in one direction, but not in the other. The ideal route would maintain average peak hour headways of less than 10 minutes in both peak periods and directions.

Results of Phase 1

Based on the analysis of the transit criteria, routes highlighted in yellow demonstrated suitable service frequency and were considered viable candidates for ADB in a short timeframe. These routes were carried forward to Phase 2 of the selection process.

The table below summarizes the results of phase 1.

Phase 1: High Frequency Lines (based on average peak hour headway of less than 10 minutes in both directions)

		Line 2	Line 10	Line 14	Line 16	Line 18	Line 20	Line 30	Line 33	Line 45	Line 51	Line 53	Line 55	Line 60	Line 66	Line 78	Line 81	Line 108	Line 115	Line 152	Line 165	Line 166	Line 200	Line 204	Line 212	Line 224	Rapid 720	Rapid 745	Rapid 754	Rapid 757
AM Peak	Inbound			•	•	•		•		•	•	•	•	•	•		•	•					•		•		•	•	•	•
	Outbound	•	•	•	•		•	•	•		•			•		•	•	•	•	•	•	•	•			•	•	•	•	
PM Peak	Inbound	•	•	•	•	•	•	•			•			•		•		•		•			•				•		•	
	Outbound	•	•	•	•	•		•		•	•	•		•	•		•	•					•	•	•		•		•	•
Total		**3**	**3**	**4**	**4**	**3**	**2**	**4**	**1**	**2**	**4**	**2**	**1**	**4**	**2**	**2**	**3**	**4**	**1**	**2**	**1**	**1**	**4**	**1**	**2**	**1**	**4**	**2**	**4**	**2**

Phase 2: Passenger Activity

Two main criteria were chosen to identify which routes would excel under route-level implementation. First, for ADB to result in significant dwell-time savings, high numbers of passenger must board at each stop; as such, the best routes will have a high average number of boardings across all stops. Secondly, in order to achieve significant time savings over the course of a day, a route must have a high number of total boardings. A high total boarding count can be attained by either having many stops on each bus trip, or by having many bus trips in a given time period.

It was also necessary to determine how often routes connect with the Metro Rail network. The most suitable routes would be ones that have significant connection(s). Regional connectivity was also considered in evaluating and selecting the routes to be part of Metro's ADB network.

Results of Phase 2

The following table summarizes the results of Phase 2 analyses. A yellow highlight identifies routes with high transit demand and connects different sub-regions of Metro's service area.

Phase 2: Transit Demand and Stop Level Activity

	Line 14	Line 16	Line 30	Line 51	Line 60	Line 108	Line 200	Rapid 720	Rapid 754
Major Stops (Stops with avg. daily boardings greater than 10)		●		●				●	●
Corridor form important connection to regional fixed guide way transit system	●	●	●	●	●	●	●	●	●
High existing corridor transit demand offers opportunity for service improvement (Avg. daily boardings greater than 15,000)	●	●		●	●	●		●	●
Corridor serves large proportion of people who depend on transit	●	●	●	●		●	●	●	●
Total	**3**	**4**	**2**	**4**	**2**	**3**	**2**	**4**	**4**

Phase 3: Transit Priorities

A route with many bus stops near side of an intersection with traffic lights can eliminate savings from faster passenger boarding. If a bus stop is at a traffic light, then there is the potential for boarding-time savings to be lost when the light turns red. Thus, ADB would work best when stops are on the far side of an intersection, past the traffic light. To minimize the external factors influencing dwell time, any near side stop at a signalized intersection on a candidate line should have transit priorities. The stops with an average of 300 or more weekday boardings were identified as major stops. In addition, planned roadway improvements or current use of an exclusive or partially exclusive Right of Way (ROW) for the majority of the line is preferable.

Results of Phase 3

Based on ROW characteristics and transit signal priority utilization, it was determined that achieving travel time savings on Lines 16 and 51 would be a challenge for an ADB policy. These two routes were not carried forward for further evaluation. Based on ongoing Bus Rapid Transit (BRT) studies in the Vermont corridor, Line 754 transit service is expected to be enhanced and was carried forward as it planned to utilize the ADB policy once upgraded to a full BRT. Line 720 current ROW has no impediment for travel time savings and was also carried forward for further evaluation in Phase 4.

The table below summarizes the result of Phase 3.

Phase 3: Transit Priorities

	Line 16	Line 51	Rapid 720	Rapid 754
Major far side stop	●	●	●	●
Transit Signal Priority			●	●
Roadway configuration presents opportunity for travel time savings			●	
Planned roadway improvements offer potential for travel time savings				●
Total	**1**	**1**	**3**	**3**

Phase 4: Other Considerations

The two remaining routes were further evaluated in this phase of the study with the goal of selecting the appropriate route(s) for ADB policy. These routes were further evaluated by the following additional measures:

- Wheelchair boardings
- Cash boardings
- Vehicle assignment

Under the front-door boarding policy, this means that passengers must board buses via the front door only; the second doors of standard buses and the third doors of articulated buses are only to be used for alighting. Front-door boarding coupled with the "pay the operator" system slow boarding times.

Use of ADB, where passengers can board through any door of the bus with a valid TAP card allows for multiple passenger-boarding streams, which can not only reduce boarding time per passenger, but also reduce the total in-vehicle travel time for all passengers. Furthermore, reductions in boarding time can result in significant improvements to running times, in the overall efficiency of the bus route, and improved customer satisfaction.

With this in mind, the other factors to consider are routes with high numbers of wheelchair boardings and cash paying customers. Routes with articulated buses assigned to them were also identified as the additional door has the potential to generate additional time savings.

Results of Phase 4

Phase 4 concludes that the potential cost savings and related passenger-satisfaction improvements resulting from ADB on Lines 720 and 754 are significant, and are worth pursuing.

The table below summarizes the findings of Phase 4.

Phase 4: Customer Enhancements

	Rapid 720	Rapid 754
Wheelchair boardings	●	
Cash paying customers		●
Articulated bus assignment	●	●
Total	**2**	**2**