# Delivering a reliable and efficient bus network

This practice paper aims to present the methodology used to optimise the bus network in Auckland. The objective is to seek waste of service hours in the new network, which has recently gone live, and to find service levels which are higher than actual demand. This will demonstrate alignment to the concept of 'value for money', which is a key direction in the new Government Policy Statement on Land Transport.

The new bus network aims to deliver a superior level of service in order to be able to support the current demand and future growth in Auckland. One of the key means to achieve this is by the improved availability of frequent services in key areas of Auckland.

The provision of Public Transport service is constrained by available funds. Therefore the greater the savings that can be realised the higher the level of extra or improved service that could be provided.

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## Runtime methodology

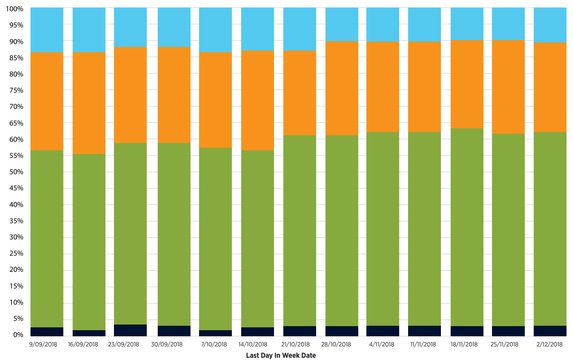
The use of percentile analytics is the most common and logical statistical method to determine realistic runtimes. The average time is unlikely to be an appropriate measure, as half the time services will be late at their final destination, which also has a knock-on effect on subsequent trips, causing exacerbated lateness throughout the whole day. We aim to set runtimes so that at least 95% of the time buses reach their final stop within 5 minutes of the scheduled arrival time.

| Stop Description | New Departure Time | Stop Sequence | Stop Profile | Stop Number | Stop Description | Current Arrival Time | New Arrival Time | Cusrent Run Time in Min | New Run Time in Min | Difference | calculated real RT based on our methodology |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Opp 15 Alexandr | 15:43:00 | 53 | Final | 6048 | Stop A Manurer | 17:08:00 | 5:01:00 PM | 85 | 78 | -7 | -10.53333333 |
| Opp 15 Alexandr | 16:03:00 | 53 | Final | 6048 | Stop A Manurer | 17:33:00 | 5:28:00 PM | 90 | 85 | -5 | -14.23166667 |
| Opp 15 Alexandr | 16:23:00 | 53 | Final | 6048 | Stop A Manurer | 17:53:00 | 5:53:00 PM | 90 | 90 | 0 | -2.475 |
| Opp 15 Alexandr | 16:45:00 | 53 | Final | 6048 | Stop A Manurer | 18:15:00 | 6:10:00 PM | 90 | 85 | -5 | -12.7 |
| Opp 15 Alexandr | 17:10:00 | 53 | Final | 6048 | Stop A Manurer | 18:35:00 | 6:35:00 PM | 85 | 85 | 0 | -5.44 |
| Opp 15 Alexandr | 17:30:00 | 53 | Final | 6048 | Stop A Manurer | 18:45:00 | 6:45:00 PM | 75 | 75 | 0 | 2.768333333 |
| Opp 15 Alexandr | 17:50:00 | 53 | Final | 6048 | Stop A Manurer | 19:05:00 | 7:00:00 PM | 75 | 70 | -5 | -14.26 |
| Opp 15 Alexandr | 18:05:00 | 53 | Final | 6048 | Stop A Manurer | 19:10:00 | 7:10:00 PM | 65 | 65 | 0 | -7.546666667 |
| Opp 15 Alexandr | 18:30:00 | 53 | Final | 6048 | Stop A Manurer | 19:25:00 | 7:25:00 PM | 55 | 55 | 0 | -5.283333333 |
| Opp 15 Alexandr | 18:50:00 | 53 | Final | 6048 | Stop A Manurer | 19:45:00 | 7:40:00 PM | 55 | 50 | -5 | -7.25 |
| Opp 15 Alexandr | 19:20:00 | 53 | Final | 6048 | Stop A Manurer | 20:10:00 | 8:10:00 PM | 50 | 50 | 0 | -1.155 |
| Opp 15 Alexandr | 19:45:00 | 53 | Final | 6048 | Stop A Manurer | 20:35:00 | 8:35:00 PM | 50 | 50 | 0 | -4.68 |
| Opp 15 Alexandr | 20:15:00 | 53 | Final | 6048 | Stop A Manurer | 21:05:00 | 9:05:00 PM | 50 | 50 | 0 | -0.626666667 |
| Opp 15 Alexandr | 21:05:00 | 53 | Final | 6048 | Stop A Manurer | 21:55:00 | 9:55:00 PM | 50 | 50 | 0 | -5.891666667 |

## Runtime Assessment

Excess runtime in a timetable is a waste of valuable resource, and can impact customer faith. In order to identify excess runtime in a timetable, we review each trip against a threshold of actual runtime compared to scheduled runtime. If the difference is more than 10 minutes (user configurable) the trip is considered to have too much runtime.

**Runtime assessment by week**




Graph shows all urban trips in the network over a three-month period

- Trips are considered to have insufficient runtime (dark blue) if they reached their final stop later than 5 minutes after their scheduled arrival time.
- Those described to be within threshold (green) arrived within +/-5 minutes.
- Trips with a surplus of 5 to 10 minutes (orange) are considered acceptable
- Trips that have a surplus of more than 10 minutes need to be adjusted (light blue).

## Value for money concept

The aim is to find a methodology to reduce service where and when there is low or no actual demand; thereby reducing cost. This will enable resources to be re-allocated to other areas of the bus network where extra service is required.

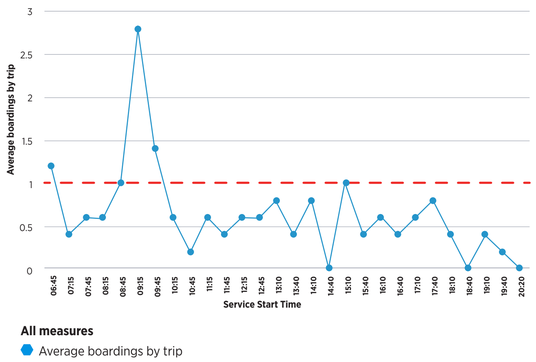
## Method

- Identify at a trip level, typical patronage, averaged over a busy month or longer.
- Identify areas, times, routes and day types where there is 'low patronage'.
- The threshold for what constitutes low patronage is user configurable.

**Average boardings by trip**

| Service Day In Week | Inbound/Outbound Trip | Service Start Time (Hh24mm) | Route Uid | Route Number | Average boardings by trip | Route Length Metres |
|---|---|---|---|---|---|---|
| Sunday | OUTBOUND | 19:10 | 39104 | 391 | 0 | 6464 |
| Sunday | OUTBOUND | 19:10 | 39218 | 392 | 0 | 7261 |
| Sunday | OUTBOUND | 19:10 | 39304 | 393 | 0 | 8007 |
| Sunday | OUTBOUND | 19:40 | 39104 | 391 | 0 | 6464 |
| Sunday | OUTBOUND | 19:40 | 39218 | 392 | 0 | 7261 |
| Sunday | OUTBOUND | 19:40 | 39304 | 393 | 1 | 8007 |
| Sunday | OUTBOUND | 20:20 | 39104 | 391 | 0 | 6464 |
| Sunday | OUTBOUND | 20:20 | 39218 | 392 | 1 | 7261 |
| Sunday | OUTBOUND | 20:20 | 39304 | 393 | 0 | 8007 |

**Average boardings by trip in a month**




## Summary & conclusion

The developed optimisation methodology is based on two key criteria:

- To find any service trips that have too much runtime and revisit the timetables for these services.
- To identify service that has low patronage and remove trips or reduce the frequency of the service.

By finding efficiencies, it is the intention to use this additional resource to add extra capacity in deficient areas of the network. The threshold for trips for too much runtime is actual runtime that has been measured at less than scheduled runtime by 10 minutes (for example) or more, and the threshold for trips to be considered for change or removal is user configurable.

Once this project is complete, journey times will be more standardised. This means a more efficient use of resource (i.e. buses and bus drivers) as under utilised time between each trip is minimised. Also, this now spare resource, can instead be re-purposed to areas where there is insufficient capacity.

The combination of these changes will increase reliability and customer experience, which are perceived as incentives to new passengers on the bus network.