



# Review PT Reliability Measures

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# Importance of Reliable Public Transport Service

- Improving quality of life
- Supporting the economy
- Encouraging mode shift and reducing congestion
- Providing accessibility
- Encouraging sustainable transport

In industrialised cities:

## Before 1920: the compact city

Walking and cycling are the dominant modes of transport. Public transport has an important role in getting people from A to B.

## 1920 - 1950

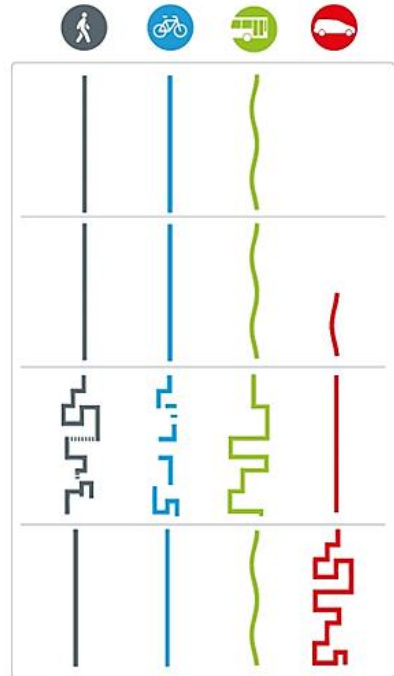
Walking, cycling and public transport are still the most common modes of travel. The car appears in the city and has to adapt to the built up structure.

## From 1950: the car-oriented city

The car is prioritised in planning. Every other mode of transport is subordinated to the car and has to adapt.

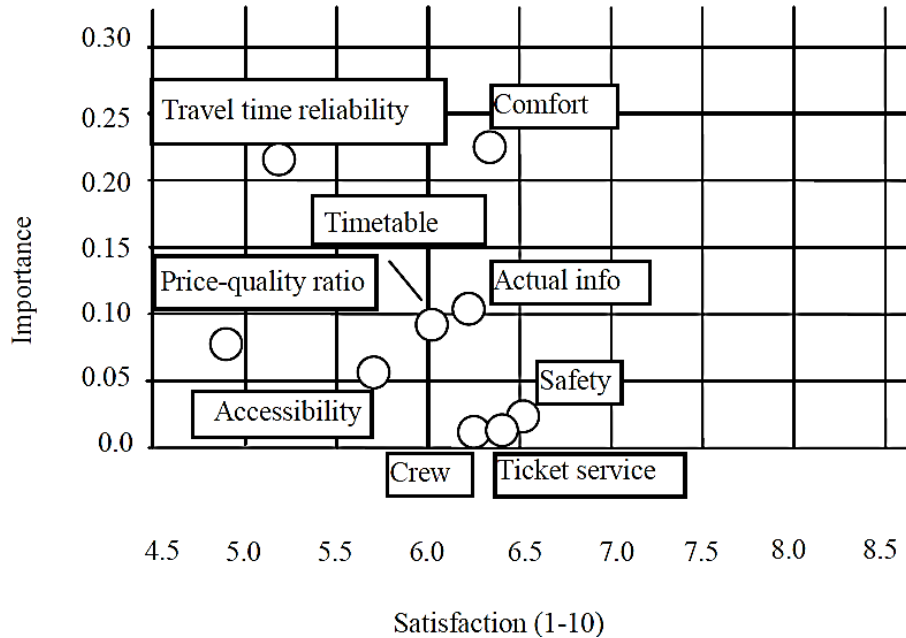
## Planning for the livable city

In order to achieve a livable environment the sustainable modes of transport need to be prioritised.

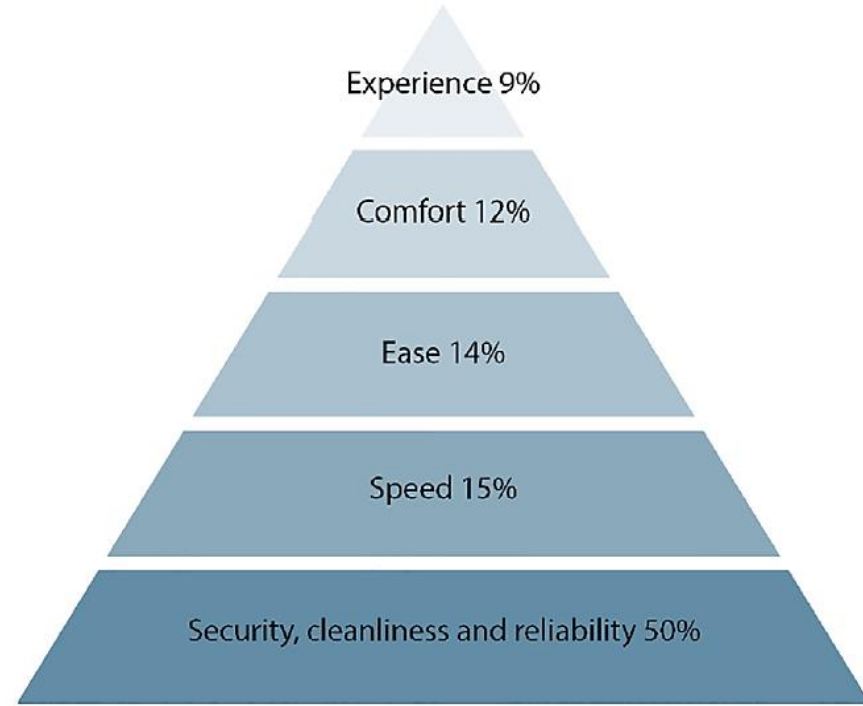


Short History of Dominant Transport Mode ([Colville-Andersen, 2018](#))

# Bus Service Quality

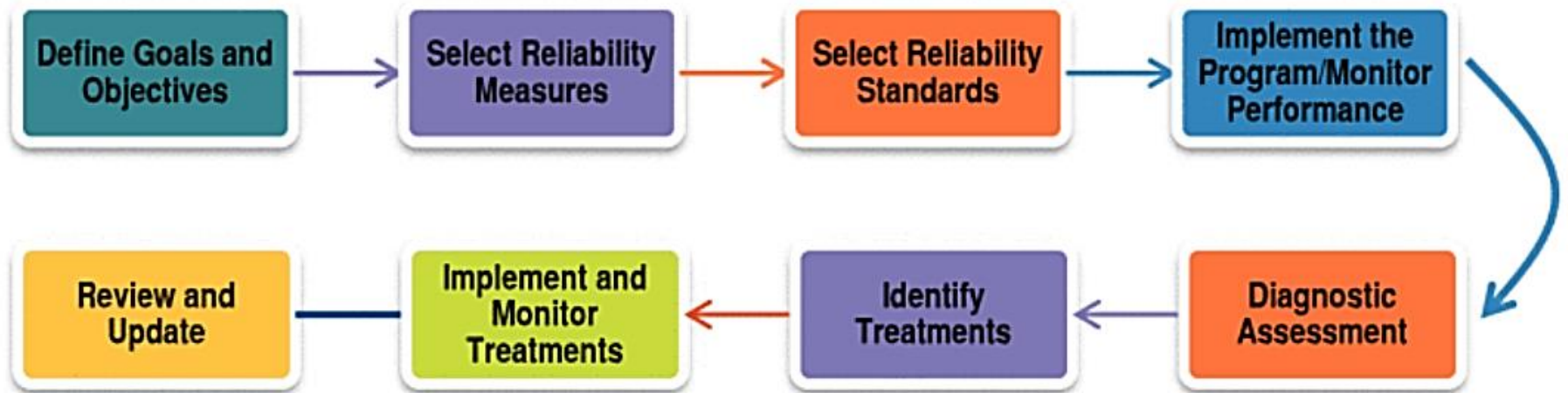


Brons (2007) studied the importance of (and satisfaction with) different quality aspects of public transport for frequent travelers.

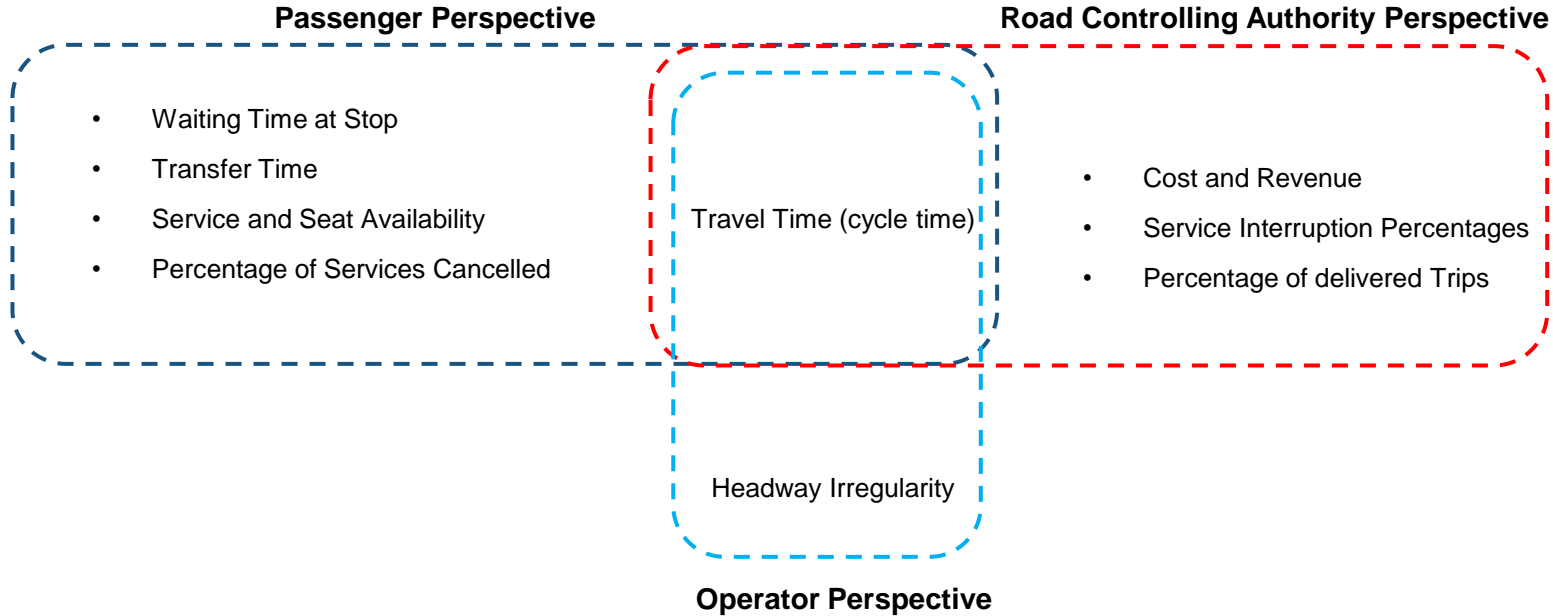


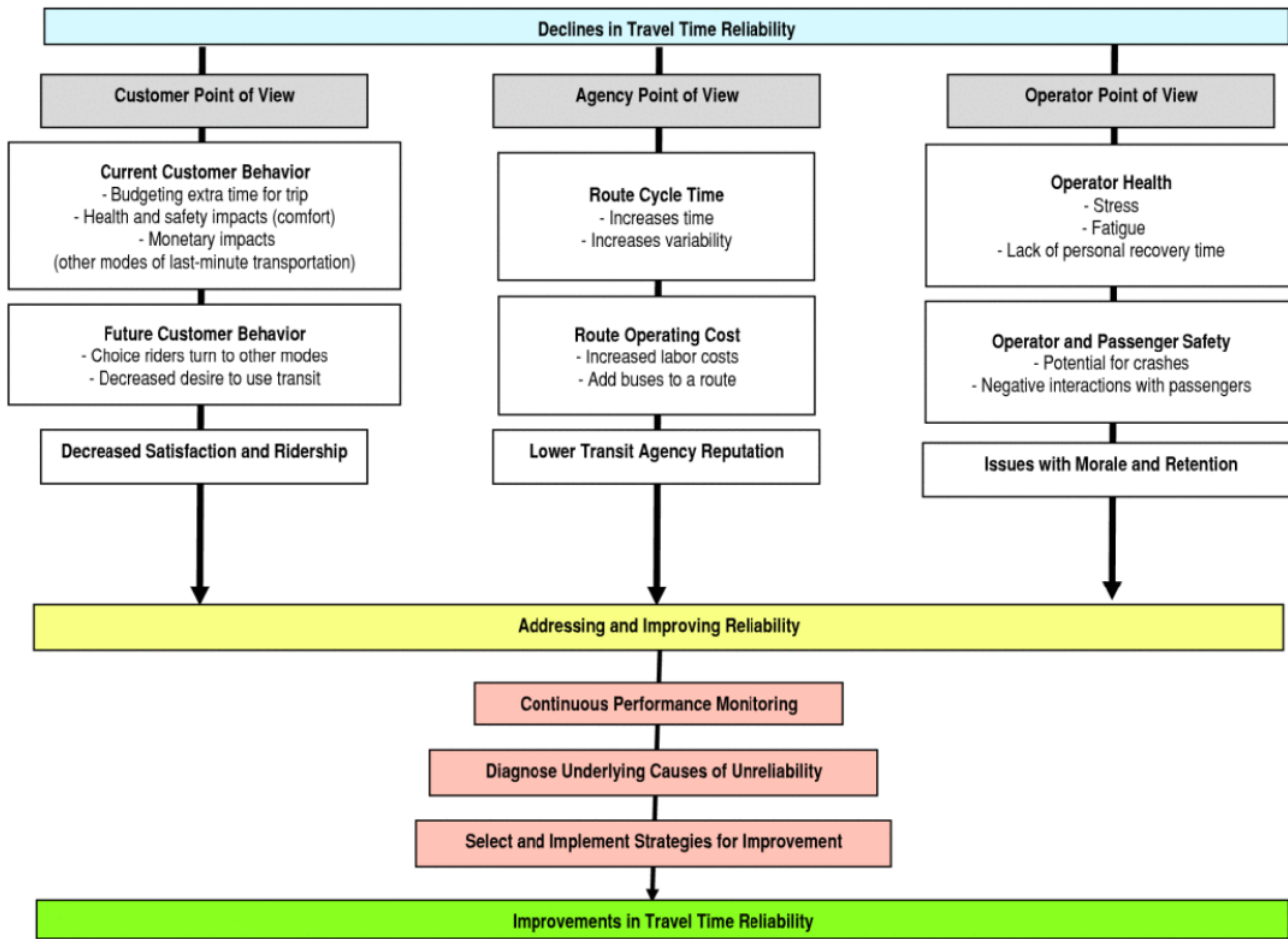
Prioritized Quality Factors of Public Transport on Pyramid of Maslow (Peek & van Hagen, 2002)

# Steps to Start And Maintain Reliability Improvement Program



# Perspectives of Service Reliability





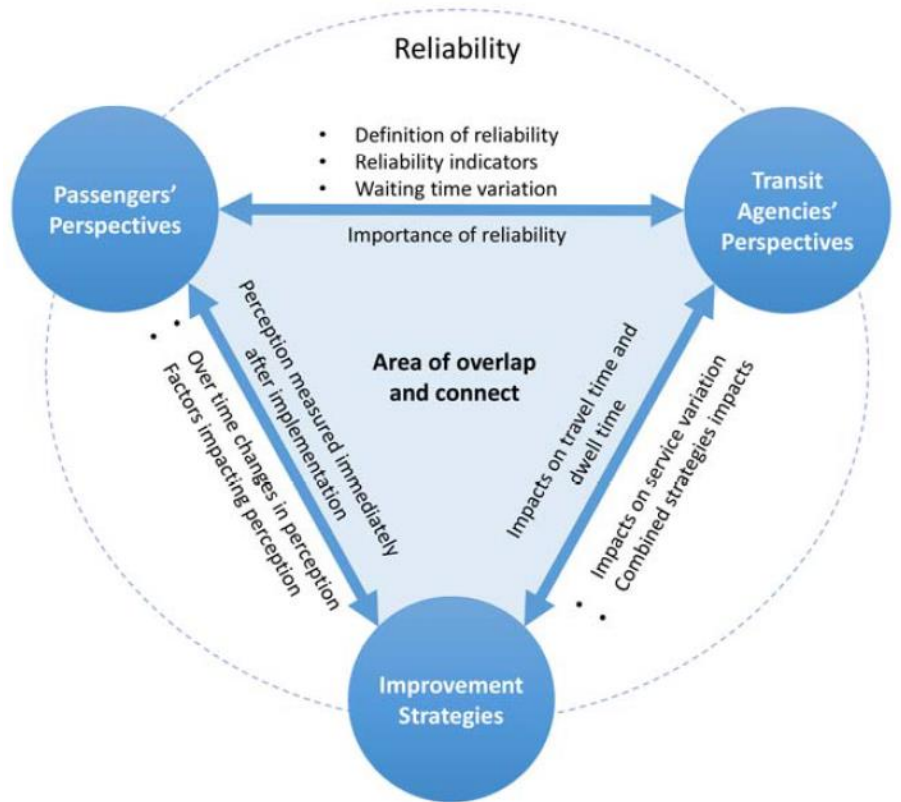


# Aspects of Reliability

- Punctuality
- Variability
- Non-operation

# Level of Application

- System Level
- Route Level
- Trip Level



# On-Time Performance Indicators

Attribute	Indicator	Indicator Definition
	% On-Time Arrival / Departure	Percentage of arriving or departing a stop up to m minutes late and n minutes early
	Odds Ratio	$\frac{(\% \text{ On - Time Arrival})}{1 - (\% \text{ On - Time Arrival})} \times 100$
On-time Performance/ Schedule Punctuality	Weighted Delay Index	$\sum_{d=1}^H dP(d)/H$
	On-Time Distribution	Distribution of the difference between actual running and scheduled times
	Percentage of the schedule Headway (PRDM)	$PRDM_{i,j} = \frac{\sum_i \left  \frac{H_{i,j}^{Sched} - H_{i,j}^{act}}{H_{i,j}^{sched}} \right }{n_{l,j}}$



# Passenger Travel Time Indicators

Attribute	Indicator	Indicator Definition
	Standard Deviation of Travel Time	$SD_{TT} = \sqrt{\frac{1}{N-1} \sum^n (TT_i - \bar{TT})^2}$
	Travel Time Variability	$TT_{90} - TT_{10}$
	Travel Time Window	$\bar{TT} + SD_{TT}$
	Coefficient of Variation of Travel Time	$SD_{TT} / \bar{TT}$
In-Vehicle Travel Time	Variability Index	$(UCL_{Peak} - LCL_{Peak}) / (UCL_{(Off\ Peak)} - UCL_{(Off\ )})$
		100%
	Extended Florida Reliability Measure	$Count_{TR_i > (1+P)\bar{TR}} / Count_{TR_i}$
	Misery Index	$(\bar{TR}_{TR_i > TR_{90}} - \bar{TR}) / \bar{TR}$
	Travel Time Distribution Skew	$(TT_{90} - TT_{50}) / (TT_{50} - TT_{10})$
	Travel Time Distribution Width	$(TT_{90} - TT_{50}) / TT_{50}$

# Headway Regularity Performance Indicators

Attribute	Indicator	Indicator Definition
	Service Regularity	% Of headways deviating within the predefined scheduled interval
	Percentage Regularity Deviation Mean	$\sum_i  (h_{i,j} - H_{i,j})/H_{i,j} /n_j$
	Headway Probability	Regularity $P\{h_{i,j} \leq H_{max_j}\}$
	Standard Deviation of Headway	$SD_H = \sqrt{\sum_{j=1}^{n_j} (h_{i,j} - \bar{h}_j)^2 / (n_j - 1)}$
Headway Regularity	Average Waiting Time	$(\bar{h}_j + SD_H^2/\bar{h}_j)/2$
	Excess Waiting Time	$(\sum_i h_{i,j}^2 / \sum_i h_{i,j} - \sum_i H_{i,j}^2 / \sum_i H_{i,j})/2$
	Coefficient of Variance of Headway	$CV_H = SD_H/\bar{h}_j \times 100$
	Headway Regularity Index	$1 - 2 \left[ \sum (h_r - \bar{h}_j) r \right] / n_j^2 \bar{h}_j$
	Irregularity Index	$1 + CV_H^2$

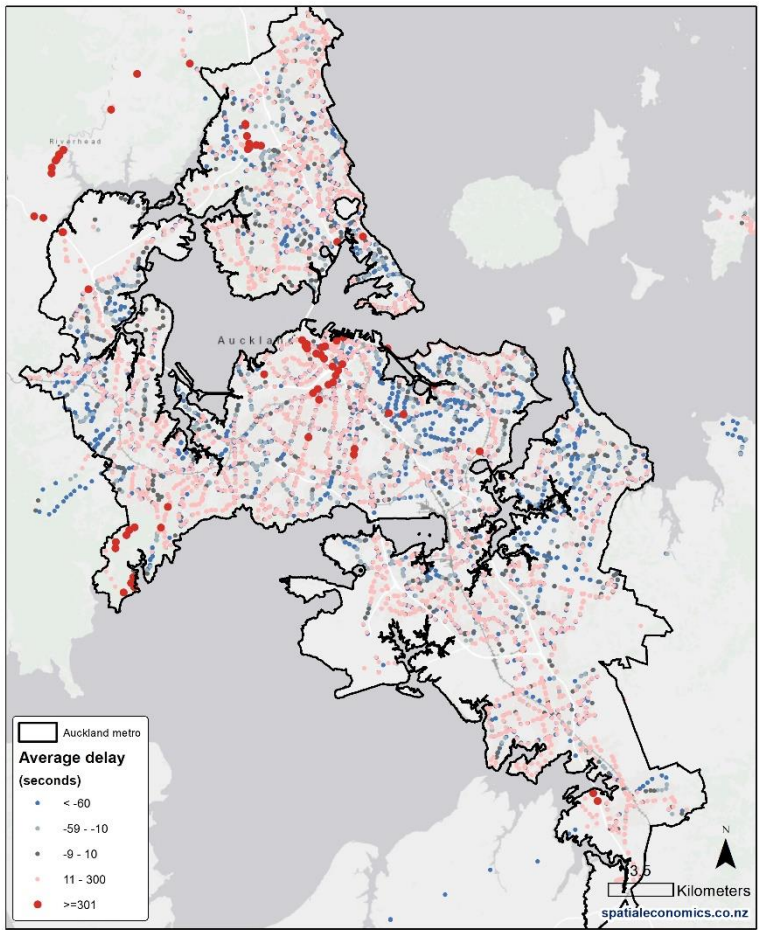
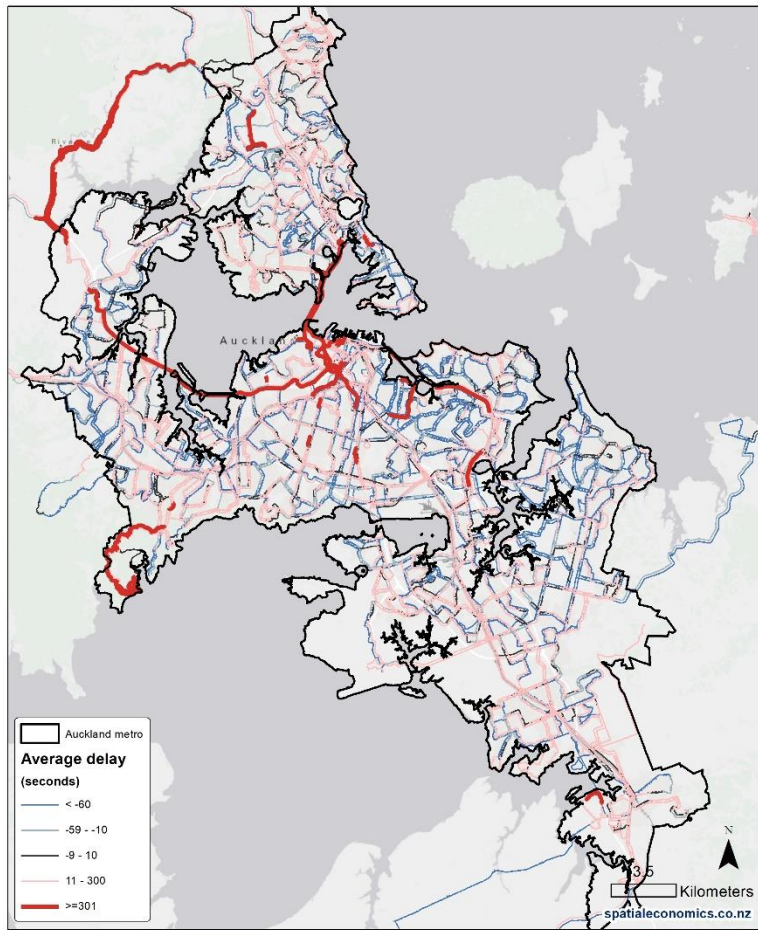
# Bus Performance Indicators in New Zealand

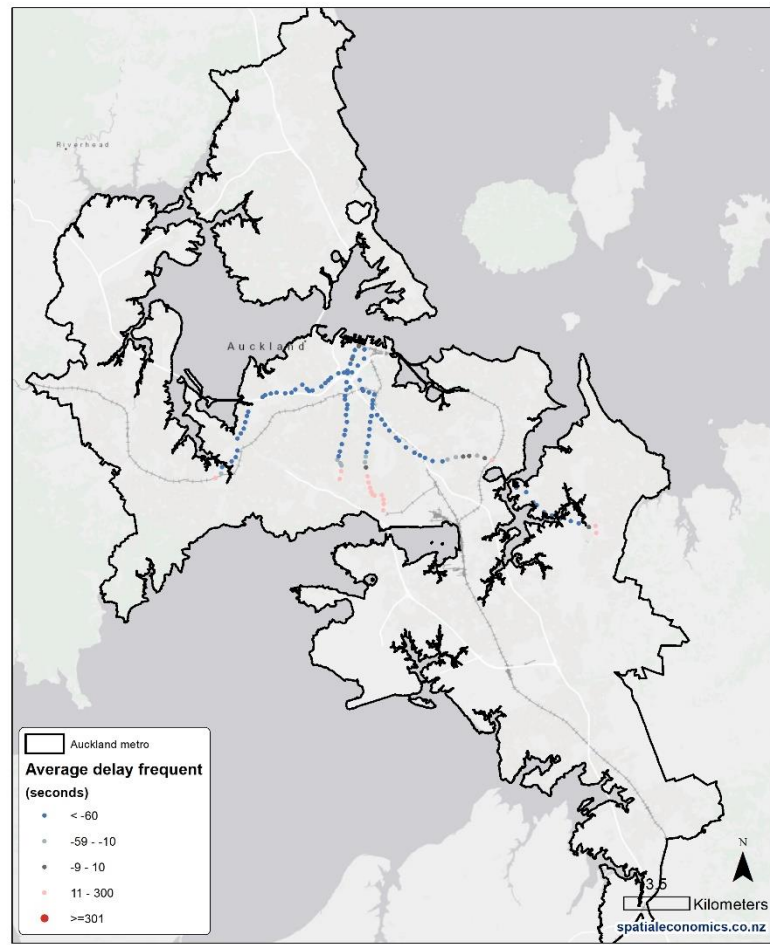
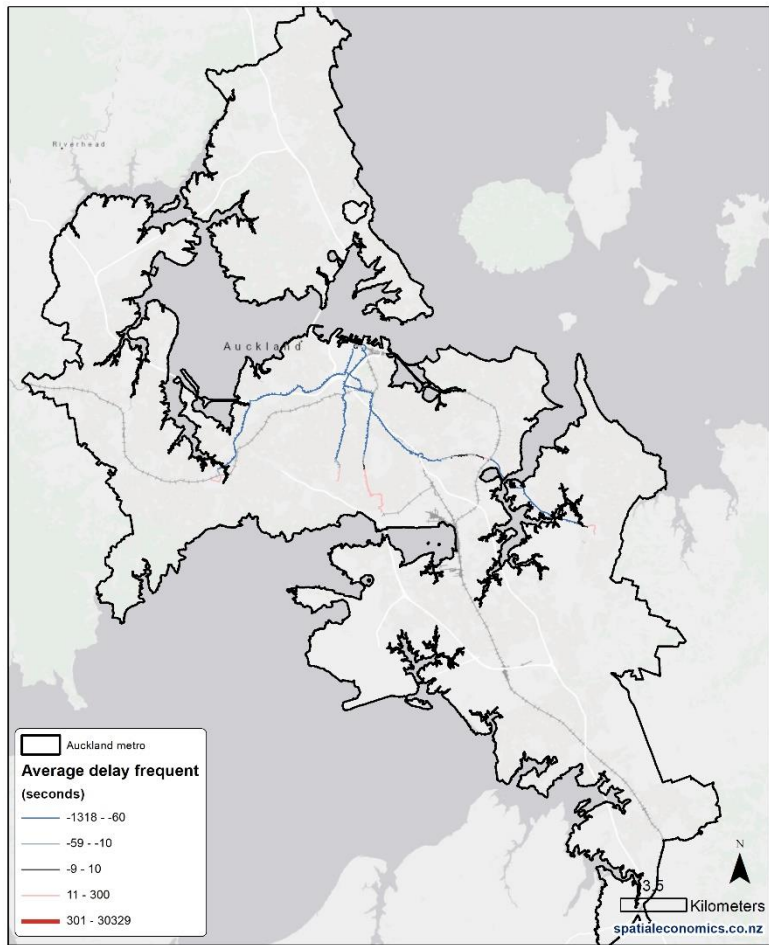
- **Punctuality**

- Rate of scheduled trips departing the first stop between 59 seconds early and 4 minutes 59 seconds late.
- Target rate of greater than 95%.

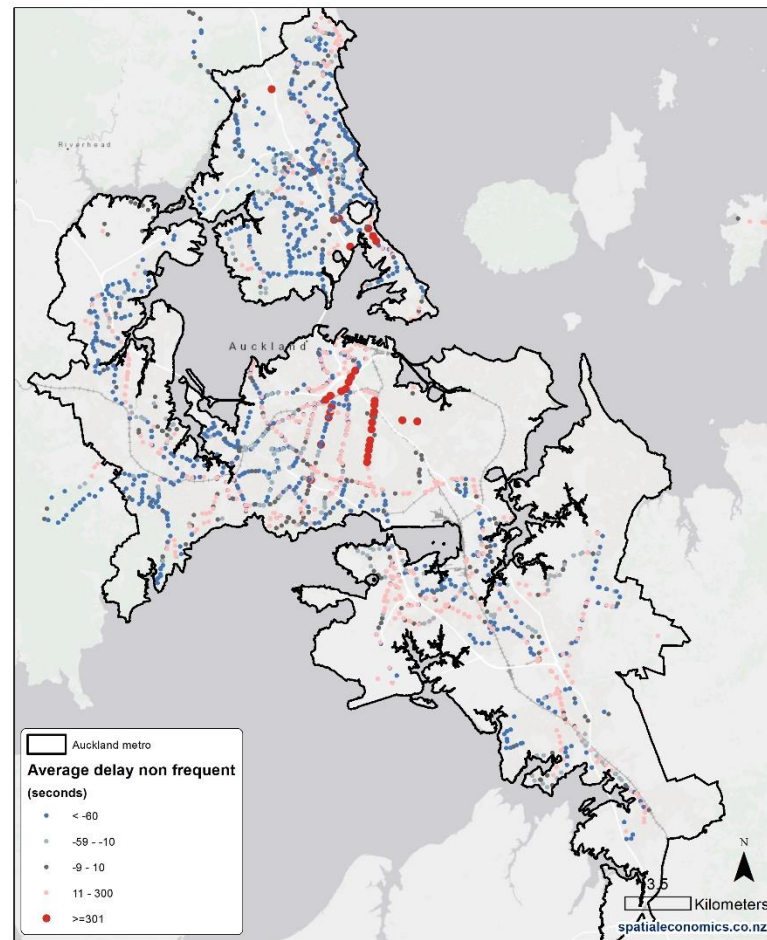
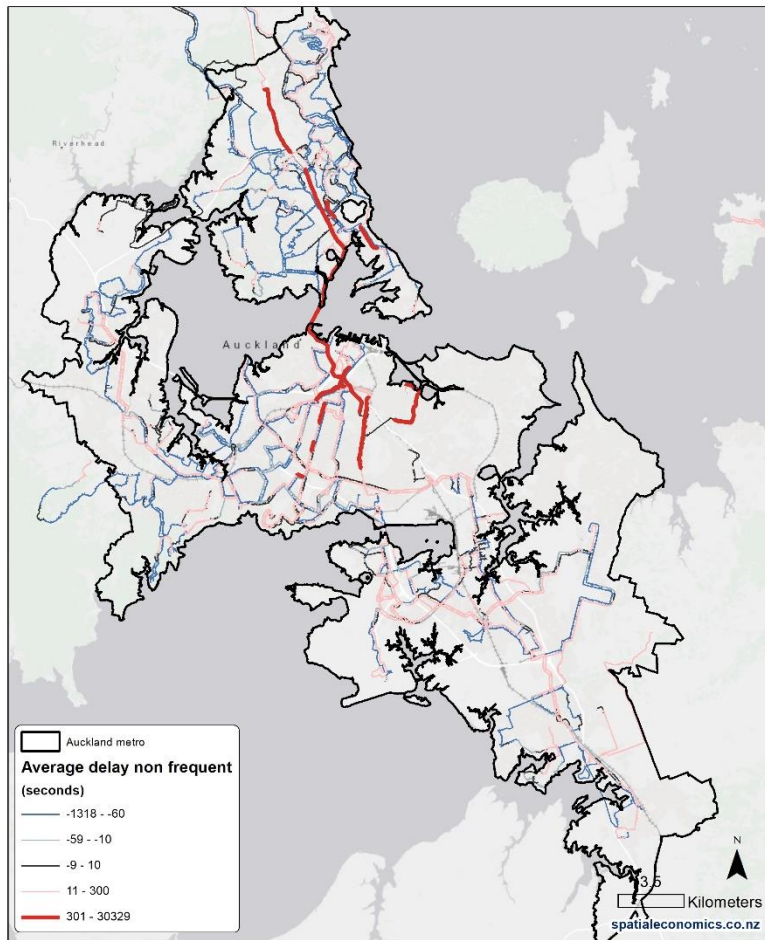
- **Reliability**

- Rate of scheduled trips departing the first stop between 59 seconds early and 9 minutes 59 seconds late.
- Target rate of greater than 98%.









# Summary

- Update the performance indicators based on the recent research
- Determine the performance indicators based on the service frequency
- Effect of cancelled services on passenger waiting time and door-to-door journey time (especially on integrated services)
- Potential in developing a live or semi-live dashboard to monitor service operation.
- Improve monitoring the network in stop, link and route scales and identify appropriate interventions or strategies to improve service reliability.



# Questions

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**Thank you**

