ARRIVAL CHARACTERISTICS OF PASSENGERS INTENDING TO USE PUBLIC TRANSPORT

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ABSTRACT

A public transport passenger trip consists of stages. Some stages are beyond control of the passenger, such as late running of the service or the travel time of the service. An intending passenger is in control of the time at which they arrive to meet (or wait for) their service; that is the number of minutes that the passenger arrives at the platform or bus stop prior to the expected arrival of their intended service.

This paper reports on observations and surveying of the arrival of intending passengers at train stations. Data collected included the arrival time of the passengers, the scheduled arrival time of the passengers' intended service, the passengers' expectation of when their intended service would arrive, the passengers' frequency of service use, and passengers' reporting of the level of anxiety they experience for missing their intended service.

The research investigates how people structure their time around a public transport passenger trip and demonstrates what intending passengers consider a "reasonable" waiting time based on recorded behaviours. The research findings are important to the scheduling of public transport services, implications of variability in public transport service reliability, and public transport performance measurement.

1. INTRODUCTION

The time that intending public transport passengers spend waiting for their service is used as a performance measure, is known to strongly affect perceptions of level of service, and can be priced within the economic cost of travel.

Naturally, when a public transport service runs behind schedule, passengers still intending to use that service will incur some unexpected waiting time that is largely beyond the control of those passengers. This study is not focussed on the waiting time caused by late-running of services.

If an intending public transport passenger has no knowledge of the schedule of their intended service, their arrival at the platform or bus stop will be somewhat random relative to the service's scheduled arrival time, within the constraints of the service frequency. This study is not focussed on this type of waiting time cause.

This study is focussed on the extent of waiting time that intending passengers can and do manage. It is proposed, and observed, that when a passenger has an expectation of the arrival time of their intended public transport service, the passenger will manage their activities to arrive at the platform or bus stop prior to that expected time of intended service arrival. It is unlikely that the passenger will plan to arrive at the platform or bus stop at *exactly* the same time as their intended service is

expected; rather it is likely that the passenger will plan to arrive *earlier* and then wait a short time for their intended service. This study focuses on that "arrive to wait" quantity of time and characteristics of the "arrive to wait". Comprehensive and repeated literature searches for existing investigation of this "arrive to wait" type behaviour have identified little neither equivalent nor similar.

2. METHODOLOGY

Information on the arrival characteristics of passengers intending to use public transport was collected via observations and surveying. At study locations it was critical that the arrival of all intending passengers could be monitored. The layout of some local train platforms made these most viable for the study. Other public transport modes, such as bus, were considered but not included in this study. Thus, it is acknowledged that the arrival characteristics of passengers intending to use buses, or other public transport modes, may differ from those of passengers intending to use trains. It is also acknowledged the study cannot factor for the influence of service characteristics, such as service reliability or service frequency.

Selection of the observation and survey distribution locations and times also factored the likely journey origins of intending passengers. For those study locations and times selected, it was thought that the majority of intending passengers would have commenced their journey at home, and it was assumed that this journey origin would lend itself to the greatest amount of planning or regularity. It eventuated that 92 percent of postcard survey participants arrived at the train platform from the origin of home.

Observations and survey distribution were undertaken on six days in early 2009. The observations informed the veracity of the survey sample. Observations monitored the whole train platform and events were logged to the nearest minute. The time that each train arrived and departed the train platform was recorded, and the time that an intending passenger arrived at the train platform was recorded. Where a train platform served two directions of train travel, the intending passenger's direction of travel was also recorded, so that each passenger's arrival could be related to the scheduled and observed arrival of their train service.

Intending passengers were approached as soon as they arrived on the train platform and their study participation requested. Participants were asked what they thought the time was and this was logged against the survey-distributor's recording of the actual "time of survey distribution". Participants were given a postcard-style survey to complete as they progressed their journey and then to return by mail.

It was important that the distribution of the "arrive to wait" time from the observations aligned with the distribution of the "arrive to wait" time from the sample of returned postcards. Each observed passenger's train platform arrival time was converted to an "arrive to wait" time being the number of minutes until the next scheduled train arrival. From each returned postcard, the "arrive to wait" time was calculated. These two "arrive to wait" sources were compared, as illustrated in Figure 1. The correlation between the distribution of the "arrive to wait" time from passenger observations and the distribution from the postcard returns is greater than 95 percent and so the postcard returns is considered an adequately representative sampling.

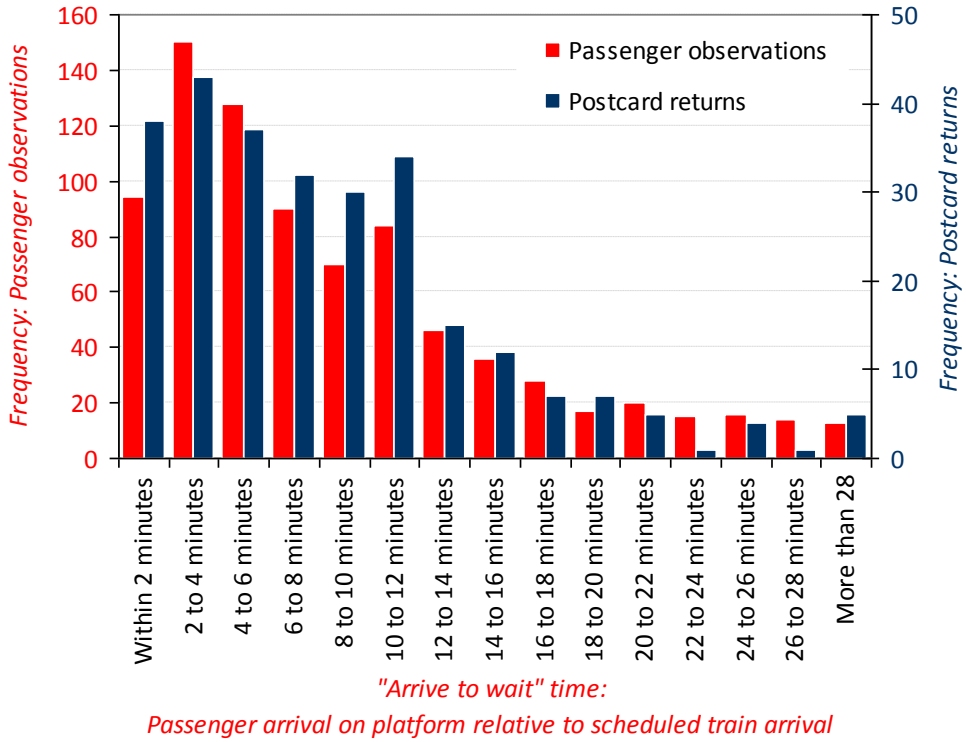

Figure 1 Comparison of the distribution of the "arrive to wait" time from passenger observations and the distribution from the postcard returns

The postcard-style survey showed participants an example journey:

I was at **home**. I left at **10:13**.
To know the time, I used **my watch**.

I **walked** to the train station. I got to the train station at **10:20**.
To know the time, I used **the station clock**.

My train was scheduled for **10:23**. I thought my train would arrive at **10:23**.
If I did not catch that train, the next train I could use was scheduled for **10:43**.

My train arrived at **10:23**.
I got on the train.

I got off the train at **10:48**. Then I **walked**.
To know the time, I used **my watch**.

I was going to **meet a friend**. I arrived at **10:53**.
I needed to be there at **11:00**. I felt I arrived **on time**.

With prompts, participants were guided to provide equivalent information about their journey. Participants were also asked about their regularity of using the train platform where they received their survey postcard, their feelings of anxiety about missing their train, their perceptions of the trains running to schedule, and some demographic information.

3. RESULTS AND ANALYSIS

Observations were made of the "arrive to wait" characteristics of 821 intending passengers and 271 completed postcard surveys were received.

An assumption underlying this study is that intending passengers know what the time is with some degree of accuracy. Analysis started with investigating this assumption. On the train platform, when a survey was distributed to an intending passenger, they were asked what they thought the time was. The survey distributor recorded this time on the postcard survey and also recorded the time known by the surveyor, which was calibrated against internet sources immediately prior to distributing surveys on the train platform. When the completed postcard survey was received back from the participant, the time differences between each participant's estimation of the time and the surveyor's calibrated time were inspected and are summarised on Figure 2.

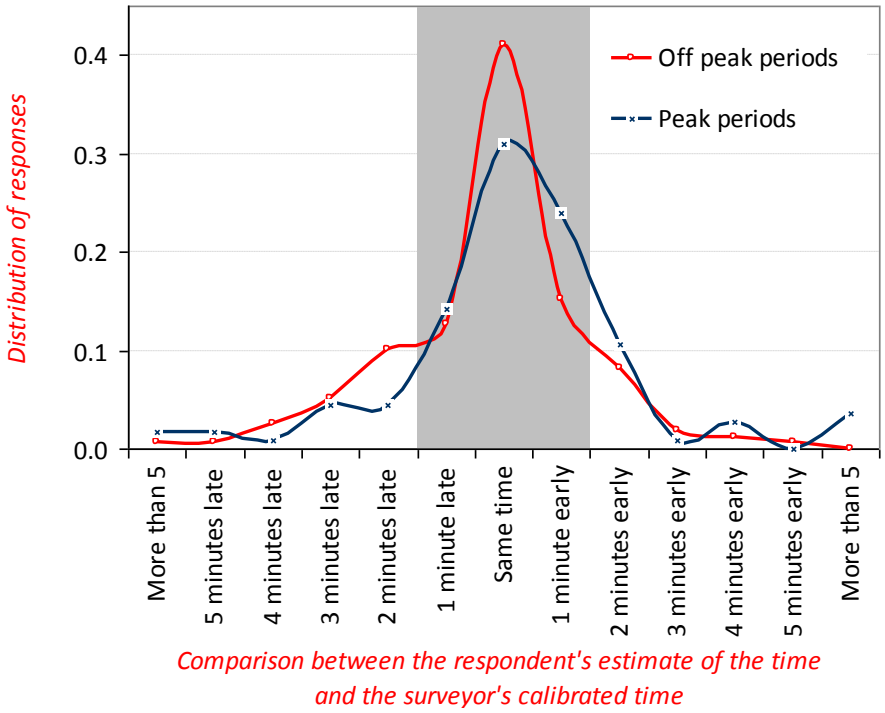

Figure 2 Intending passengers' estimations of the time compared with the surveyor's calibrated time

The time estimation of 69 percent of intending passengers was within one minute of the time known by the surveyor. This accuracy of timekeeping was constant between both the sample group of intending passengers travelling during off peak periods and the sample group of those travelling during peak periods.

For some context of likely timekeeping consistency and reliability, throughout the postcard survey, participants were asked what device or method they used to know or estimate the time. At the train platform when waiting for their intended train, about one quarter of participants reported using their mobile telephone to know the time and approximately 42 percent used their watch. There was not a clock on every train platform where postcard surveys were distributed, but where a clock was on the train platform almost one third of participants reported using that clock.

At the most aggregate level, this study was to establish the "arrive to wait" time, and this can be done through the observations of passengers arriving onto the train platform. Figure 3 shows the "arrive to wait" time observed of intending passengers, split into those travelling during peak periods and those travelling during off-peak periods. Clearly, the "arrive to wait" time during peak periods is less than the "arrive

to wait" time during off-peak periods. With scheduled peak period service frequency being greater than off-peak service frequency, the maximum potential "arrive to wait" time during peak periods is less than that of off-peak periods, and this affects the calculations of the "arrive to wait" time. Within this constraint, the median "arrive to wait" time during peak periods is 4 minutes, and the median off-peak "arrive to wait" time is between 9 minutes; the average "arrive to wait" time during peak periods is 4.5 minutes, and the average off-peak "arrive to wait" time is 9.9 minutes.

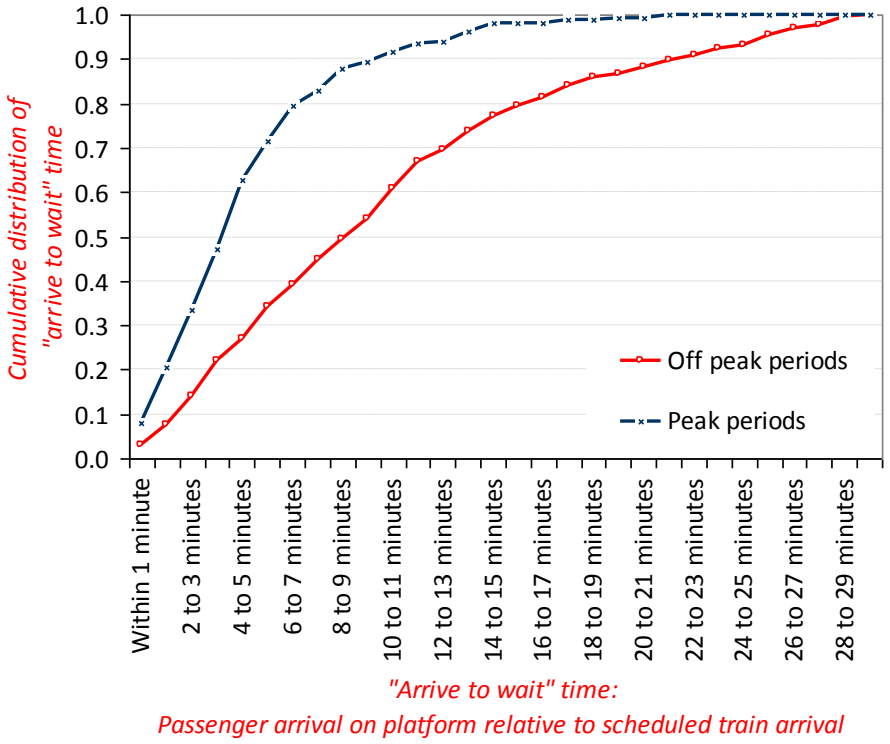

Figure 3 Cumulative distribution of "arrive to wait" time from passenger observations

The postcard survey allowed inspection of the correlation between regularity of travel and "arrive to wait" time. Participants who reported in their postcard survey that they used the train platform three or more times in an average week were classified as "regular" users of that train platform. The median "arrive to wait" time of regular users was 6 minutes, the average being 7.0 minutes. The median "arrive to wait" time of non-regular users was 8 minutes, the average being 9.5 minutes.

The postcard survey participants were asked how many minutes they would wait for a train and also asked how many minutes they considered as a reasonable wait for a train. The average number of minutes that participants reported they would wait for a train was 14.4 minutes and the average number of minutes participants reported as a reasonable wait for a train was 11.1 minutes. Noting that the correlation between these two sets is approximately 0.6, within those extents of reliability, participants reported that they would wait or are waiting 1.3 to 1.4 times as long as they consider a reasonable wait.

As shown in Figure 4, the postcard survey asked participants to rate how often they feel anxious that they might miss their intended train and asked participants to rate how punctual the trains were. These ratings and the relationship between these

ratings were inspected, and also these ratings were paired with the "arrive to wait" time of the participants.

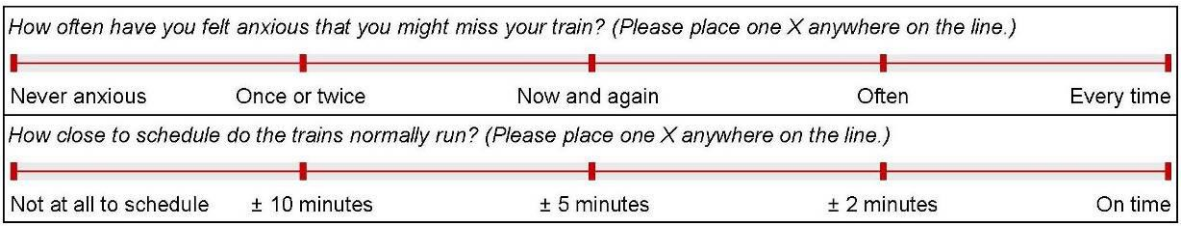

Figure 4 A section of the postcard survey

On average, participants feel anxious "now and again" that they might miss their train. Figure 5 shows cumulative distributions of the ratings of anxiety feelings. The dark blue plotted line is calculated from the group of participants who reported they had in the past year missed a train they had been specifically aiming to use; and the red plotted line is calculated from the group who reported they had not missed any such train in the past year. The separation of the two plotted lines on Figure 5 suggests that past experience of missing an intended train generally increases the prevalence of anxiety about missing another train.

Segmenting the participants via regularity of travel showed no difference between the distribution of anxiety responses from regular users and the distribution of anxiety responses from irregular users.

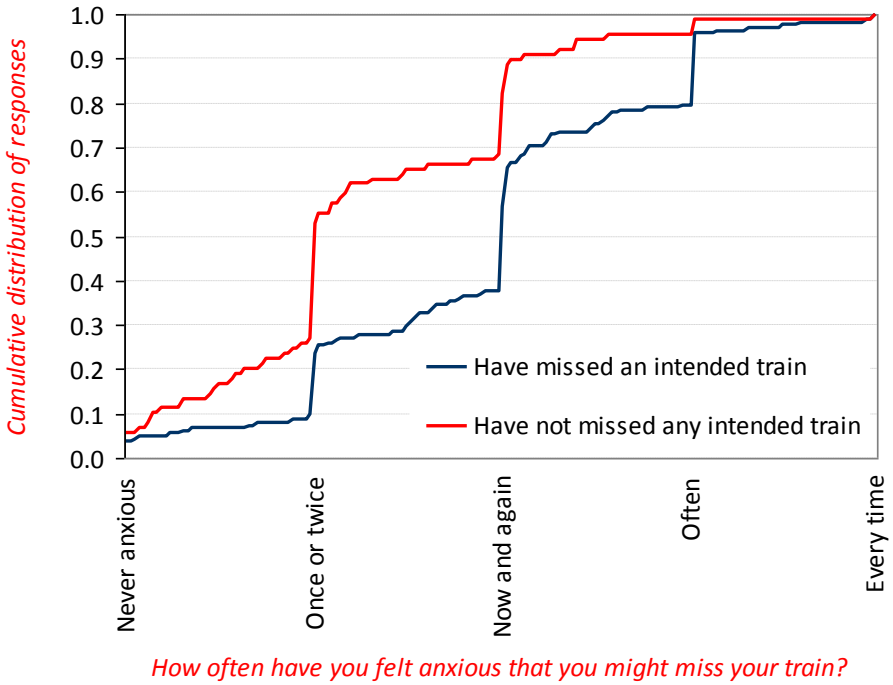

Figure 5 Cumulative distribution of experiences of anxiety about missing intended train

On average, participants rated trains normally running within two minutes of the schedule. There was only a very small negligible correlation between participants' ratings of frequency of anxiety and ratings of train punctuality. This held between both regular and irregular users and also between both those who have and those

who have not missed a train that they were aiming to use. There was also only a negligible correlation between "arrive to wait" time and either of ratings of frequency of anxiety or ratings of train punctuality.

The purpose of many trips is to arrive at a destination. The time of arrival at destination is flexible for some trips but constrained for others. By example, when aiming to attend an appointment the arrival at destination is likely time constrained but it is likely that arrival at a destination for general shopping activities is not time-critical. Figure 6 shows the section of the postcard survey that asked participants for their destination arrival time, the time they needed to arrive at their destination, and a simple assessment of their timeliness. 200 postcard survey participants completed all three of those questions. Other participants either did not complete all three of the questions or reported that they had no *needed* time of arrival at their destination.

Figure 6 A section of the postcard survey

Of the sample group of 200, 25 percent felt they arrived "early", 58 percent "on time", and 18 percent felt they arrived "late". Figure 7 shows participants' time of arrival at their destination with their rating of "early", "on time", or "late".

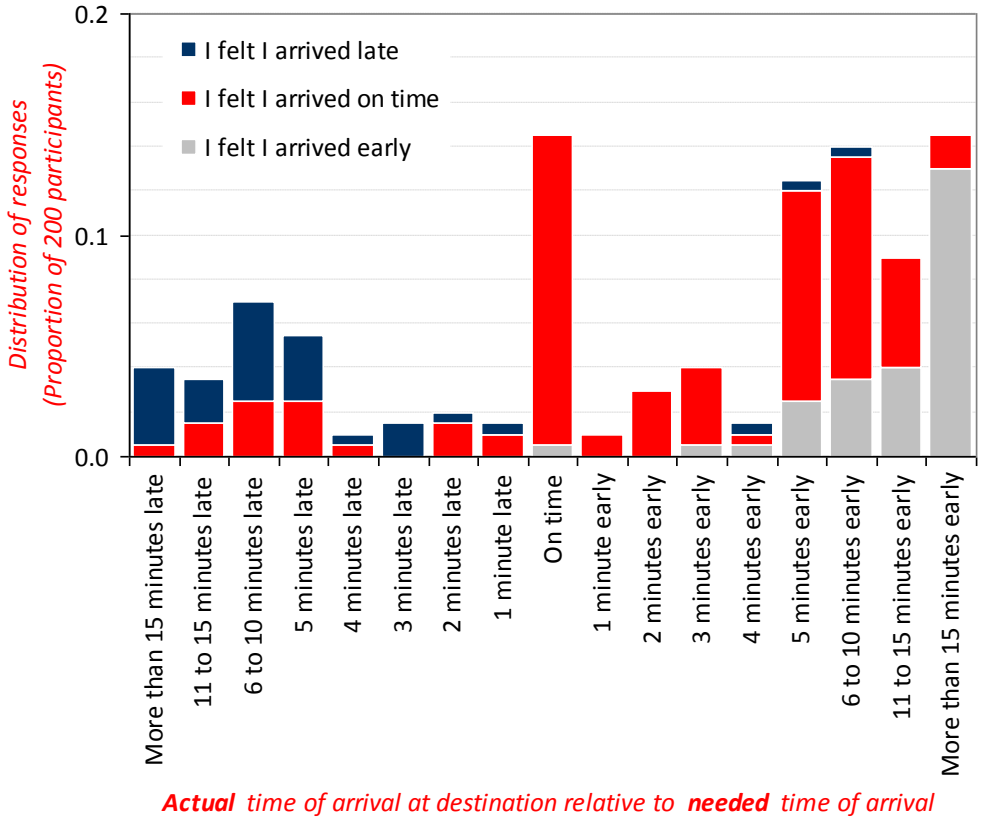

Figure 7 Participants' time of arrival at their destination and their perception of their timeliness. (Presented as proportions of the 200 respondents completing this section of the survey.)

One observation from Figure 7 is of the role of individuals' perceptions in their assessment of the timeliness of their arrival at their destination. For example, when some participants arrived at their destination five minutes after the time they needed to arrive they still felt "on time" whereas some other participants felt "late". Although the destination type was gathered, it is recognised that full context for the journey and the assessment of criticality of timeliness was not gathered. The same categories as shown Figure 6 were plotted from just those participants who reported they were going to work (being 122 respondents) and the observations and relationships appeared as above from the full sample group of 200.

4. DISCUSSION

The observed median "arrive to wait" time of intending passengers during peak periods was 4 minutes and the observed average was 4.5 minutes. These times are considered as demonstrative of the waiting times that intending passengers select for themselves. Such "arrive to wait" times can be given context and relevance when compared to the "arrive to wait" times that are scheduled between services timetabled as connecting.

By example, Figure 8 shows sections from two bus timetables where the routes include interchange between the bus service and the train service. The first train-bus connection shows the train arriving at the station at 06:23 and the connecting bus arriving at the station at 06:31, scheduling in an 8 minute waiting time. The timetables

show a number of connection times around ten to fourteen minutes, some of less duration, and one of 23 minutes.

Similarly, Figure 9 shows a section from a bus timetable where the route interchanges with a ferry. Not allowing for time to walk between the ferry and the bus, each scheduled connection effectively provides a 15 minute "arrive to wait" time. This obviously compares unfavourably with the scale of "arrive to wait" times that intending passengers are observed to select for themselves.

	To Wainuiomata	Monday to Friday AM							Every 30 minutes at these mins. past hour 9am until 3pm	
CONNECTING TRAIN TO WATERLOO	Lower Hutt Queensgate	6.25	6.45	7.05	7.30	7.55	8.25	8.55	.25	.55
	Waterloo – Train Arrives	6.23	–	7.00	7.26	7.47	8.27	8.55	.25	.55
	Waterloo Station	6.31	6.51	7.11	7.36	8.01	8.31	9.01	.31	.01

	To Lower Hutt	Monday to Friday AM										
CONNECTING TRAIN TO WELLINGTON	Waterloo Station	6.17	6.37	6.38	6.58	7.07	7.18	7.38	7.47	7.58	8.17	8.18
	Waterloo – Train Departs	**6.24**	**6.44**	6.48	**7.04**	7.14	**7.24**	**7.42**	7.54	**8.04**	**8.24**	**8.24**
	Lower Hutt Queensgate	6.23	6.43	6.44	7.04	7.13	7.24	7.44	7.53	8.04	8.23	8.24

	To Maungaraki	Monday to Friday AM								Every 30 minute past hour 9
CONNECTING TRAIN FOR WELLINGTON	Waterloo Station	–	6.14	6.54	7.24	7.54	8.14	8.24	8.49	.19
	Waterloo – Train Departs	–	6.28	**7.04**	7.28	**8.04**	**8.24**	8.32	8.55	.25
CONNECTING TRAIN FOR WELLINGTON	**Petone Station**	6.25	6.42	7.25	7.55	8.25	8.45	8.55	9.20	.50
	Petone – Train Departs	6.36	6.56	7.36	8.02	8.33	8.58	9.03	9.33	.03

	To Kelson	Monday to Friday AM						Every 30 minutes at these mins. past hour 9am until 3pm	
CONNECTING TRAIN FOR PETONE	Petone – Train Arrives	6.15	6.52	7.18	7.50	8.17	8.47	.17	.47
	Petone Station	6.25	6.55	7.25	7.55	8.28	8.58	.28	.58
CONNECTING TRAIN FOR WATERLOO	Waterloo – Train Arrives	6.48	7.00	7.47	8.27	8.55	9.25	.55	.25
	Waterloo Station	6.53	7.23	7.53	8.30	8.59	9.29	.59	.29

Figure 8 Samples from two bus timetables showing scheduled connection times between the bus service and the train service

from Devonport to Takapuna

MONDAY TO FRIDAY

	Ferry from Downtown (Pier 1)	Bus departs Devonport Wharf
AM	-	6.15
	6.15	6.30
	6.45	7.00
	-	7.15
	7.15	7.30
	-	7.45
	7.45	8.00
	-	8.15
	8.15	8.30
	8.45	9.00
	9.15	9.30
	10.00	10.15
	10.30	10.45
	11.00	11.15
	11.30	11.45
PM	12.00	12.15
	12.30	12.45
	1.00	1.15

Figure 9 A section of a bus timetable showing scheduled connection times between the bus service and ferry service

Another source of context for the study results comes from comparison with public transport performance measures. In 2009, the Auckland Regional Transport Authority measures punctuality as the percentage of services which commence the journey within five minutes of the timetabled start time. MAXX is the regional transport brand for Auckland, managed by the Auckland Regional Transport Authority, and their measure of rail punctuality performance is the percentage of services arriving at their final destination within 4 minutes and 59 seconds of their scheduled arrival.

The Auckland Regional Transport Authority performance measure focuses on the journey commencement and the MAXX measure focuses on the journey termination. Neither, nor the combination of both, provides any measure of punctuality throughout the journey which is what affects so many passengers who join and leave the service mid-route.

The study indicates that during peak periods more than fifty percent of intending passengers factor to "arrive to wait" five minutes prior to the service's scheduled arrival time. A service could arrive five minutes later than schedule, effectively doubling the planned "arrive to wait" time, and still achieve its performance measure. The reasonableness of this is questioned.

While acknowledging potential limitations in the sampling technique and size, still it is interesting that approximately one third of intending passengers use the clock on the train platform, where one is available. This supports the value of providing clocks at public transport stops or platforms.

There was found to be negligible correlation between reported anxiety about missing a service and perceptions of service punctuality. There was a wide spread of answers when postcard survey participants were asked how they felt about the punctuality of their destination-arrival time. Some participants felt "on time" while others under identical destination-arrival time conditions felt "late". Notwithstanding that further research could better clarify some of these issues, they highlight some of the difficulties and unpredictability in consulting passengers' perceptions of public transport service.