



# Yorcard

# Closed system, Touch On Touch Off Folder Contents

## RES741 - Page 5 Boarding Time Study

1.0 Introduction .....	12
2.0 Method of Recording .....	13
Boarding & Dwell Times	
3.0 Results & Analyses.....	14
4.0 Summary & Conclusions.....	27
5.0 Objectives.....	29
6.0 Recommendations .....	31
7.0 Appendices .....	32

## RES742 - Page 35 Equipment User Survey

1.0 Introduction .....	40
2.0 Methodology .....	41
3.0 Results & Discussion.....	42
4.0 Summary & Conclusions.....	54
5.0 Recommendations.....	57
6.0 Appendix 1 .....	58

## RES743 - Page 61 Consumer Survey

1.0 Introduction .....	68
2.0 Methodology .....	69
3.0 Results.....	73
4.0 Summary & Conclusions.....	97
5.0 Recommendations.....	101

This Folder is the fourth in a series of six folders and two reports funded by the Department of Transport, Technology and Standards Division that form the research outputs which complement the Yorcard Smart Ticketing Pilot. All folders in this series of six, comprise of a number of discrete and stand alone

reports. Each report has been written so it can be read in isolation, giving the reader a detailed view of a specific subject matter or be read in conjunction with other reports in the same folder or other folders. Consequently there is a considerable amount of common information across reports, which the

reader, if intending to read more than one report may wish to skip. There are four reports and one data book that make up this folder.

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**RES745 - Page 103**  
**End of Phase**  
**Report**

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1.0 Introduction ..... 107

2.0 Methodology & ..... 110  
    Planning Review

3.0 Analysis of Phase 4 data..... 112

4.0 Limitations & Review ..... 115  
    of Objectives

5.0 Advice for the Business Case... 116

6.0 Recommendations ..... 117

7.0 Appendices ..... 118

The complete list of folders  
are as follows :

**RES804 - Page 123**  
**Data Book Phase 4**

---

1.0 Executive Summary ..... 126

2.0 Background & Introduction ..... 128

3.0 Calendar of Events ..... 129

4.0 Results ..... 131

**Phase 1** General Reference  
and Baselining

**Phase 2** Open system, first  
observations : Touch On only

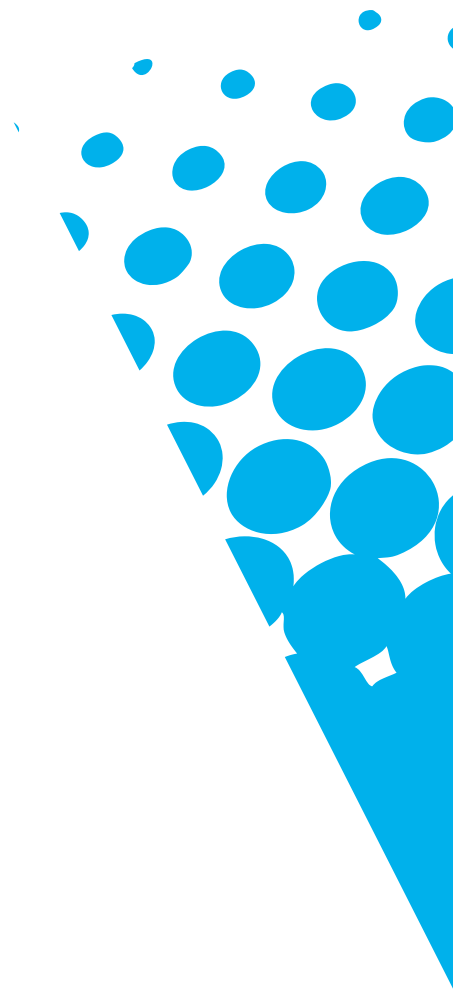
**Phase 3** Open system, full  
operational system : Touch On Only

**Phase 4** Closed system,  
Touch On Touch Off

**Phase 5** Additional  
Management data

**Phase 6** Citizen Card

**Phase 7** Reports: Research Final  
Report and Best Practice Report





Yorkcar

# Contents

## 1.0 Introduction

## 2.0 Method of Recording Boarding and Dwell Times

## 3.0 Results and Analysis

---

Introduction.....	12	Method of Recording.....	13	3.1 Summary of Analysis.....	14
		Boarding & Dwell Times		3.2 Sample Size.....	14
				3.3 Ticket Type Regression Analysis..	15
				3.4 Bus Stop Dwell Time .....	19
				3.5 Bus Stop Boarding .....	21
				and Alighting Time	
				3.6 Boarding Time .....	22
				3.7 Alighting Time.....	23
				3.8 Boarding and Alighting.....	24
				Time Comparison Phase 1 & 4	

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## 4.0 Summary and Conclusions

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4.1 Regression Analyses.....	27
4.2 Dwell Time Analyses .....	27
4.3 Limitations .....	28

## 5.0 Objectives

---

Objectives .....	29
------------------	----

## 6.0 Recommendations

---

Recommendations .....	31
-----------------------	----

## 7.0 Appendices

---

Appendix 1 .....	32
Appendix 2 .....	33

# Glossary

**Alighting Passengers** - These are passengers who are getting off the bus. They are also referred to as Alighters.

**Alighting Time (1) (A(1))** - Time taken for alighting passengers to disembark from the bus (measure from when the first passenger steps off the bus to when the doors close). This is used to measure the Alighting Time for **one alighting passenger**.

**Alighting Time (2) (A(2))** - Time taken for **2 alighting passengers or more** to disembark from the bus (measured from when the first passenger steps off the bus to when the last passenger steps off the bus).

**Boarding Passengers** - These are passengers who are getting onto the bus. They are also referred to as Boarders.

**Boarding Time (1) (B(1))** - Time taken for boarding passengers to carry out their boarding transaction with the driver (measured from when the first passenger steps onto the bus to when the doors close). This is used to measure the Boarding Time for **one Boarding Passenger**.

**Boarding Time (2) (B(2))** - Time taken for **2 Boarding Passengers or more** to carry out their boarding transaction with the driver (measured from when the first passenger steps onto the bus to when the last passenger steps onto the bus).

**Bus Stop Boarding/Alighting Time (B/A Time)** - Time taken for the driver to operate the doors and to allow passengers to load and alight at the stop (measured from doors opening to doors closing).

**Bus Journey Time** - Total service time between defined points and linked to Pilot Acceptance Criteria 2, Reduced Journey Times.

**Bus Running Time** - Journey Time – Bus Stop Dwell Time.

**Bus Stop Dead Time** - Time at bus stop attributable to operation of doors and pulling in and out of the stop.

**Bus Stop Dwell Time** - This is the total time that the bus spends at the bus stop, or: **Bus Stop Dead Time + Bus Stop Boarding/Alighting Time + Bus Stop Recovery Time** (measured from bus stopping at a boarding point to bus leaving the boarding point).

**Bus Stop Recovery Time** - Estimate of time spent at stop for the purposes of adhering to schedule / regulate the service.

**Co-efficient (Regression Analysis)**- The additional time added to the overall Dwell Time, due to a single transaction of each ticket type.

**Correlation co-efficient** - A measure of the strength of the relationship between two sets of data (reported using R-squared values)

**Customer Ticket Types** -

**Adult Cash:** any transaction where cash is handed to the driver by users aged 17 and over with no smartcard involve.

**Adult smart cash:** Any transaction where cash is handed to the driver by a smartcard user aged 17 and over

**Child cash:** any transaction where cash is handed to the driver by users aged 16 and under with no smartcard involved.

**Child smart cash:** any payment of 40p using a smartcard.

- this method requires the passenger to pay the driver as they board the bus. A ticket is issued for this transaction if a smartcard is NOT used. If they have a smartcard (MegaTravel or Student 16-18 card), did the following:

1. touch pass on validator. wait for green light and audible beep
2. show card to driver (photo identification)
3. give driver 40p

**Non-cash:** any use of a period ticket as a 'flash pass' by an adult or a child with a free child pass- this method requires the passenger to show their pass to the driver as they board the bus only. If a bus does not have a smartcard reader, the smartcard could be used as a flash pass.

**Smartcards:** adult or child smartcard use with no cash payment to the driver and with or without proving identity – this method requires the passenger to touch their pass as they board the bus. During ToTo the passenger is also required to touch their pass as they alight the bus.

- The only adult cash smartcard was the Pay as you Go card.

1. touch pass on validator, wait for green light and audible beep.
2. No ticket is issued
3. This does NOT require the pass to be shown to the driver.
4. The customer was required to touch on AND touch off.

- Period product for Adult (example TravelMaster, Firstweek Red etc)

5. touch pass on validator, wait for green light and audible beep.
6. No ticket is issued

- Concessionary – ENCTS

1. touch pass on validator, wait for green light and audible beep
2. show card to driver (photo identification)
3. No ticket is issued

- Zero Fare (child travel to school/home)

1. touch pass on validator, wait for green light and audible beep
2. show card to driver (photo identification)
3. No ticket is issued



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**Flash pass** - Passengers who must show their smartcard or paper ticket to the driver to gain access to the service.

**No Alighting Passengers** - Times calculated when no passengers alighted a bus at the stop and there were only boarding passengers.

**No Boarding Passengers** - Times calculated when no passengers boarded a bus at the stop under observation and there were only alighting passengers.

**No Other Factors** - Data, which have Other Factors recorded and have been removed from the overall dataset when calculating Times.

**Other Factors** - Factors observed and noted by the surveyors when collecting the data, which may have had an affect on the times calculated for this and subsequent phases. These are defined as either scheduling factors, such as driver change over, or passenger factors, such as passengers boarding with a buggy or wheelchair.

**Pay as you GO (PayG) card** - This is the only adult cash smartcard. Cash is loaded on to the smartcard at the TIC and users must touch their card to the reader when boarding and alighting to ensure that the right fare is charged to the card. When the cash on the card has run out, more cash can be loaded onto the card.

**Pilot Acceptance Criteria** - A number of targets and measurements that have been set prior to the collection of data that will inform business cases and future development of the Yorcard project.

**Touch on and Pay** - Passengers using a smartcard and then paying cash

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**Touch on Touch off (ToTo)** - This is referred to as ToTo in the report and refers to the process the customer (only compulsory for Pay as you Go customers, for all other smart customers, it was voluntary) must undertake during Phase 4. That is to swipe their card both when boarding and alighting. For clarity the touch on and touch off machines are two different machines. There is only one door and therefore the 'touch on' scanner is placed in the saloonplatform entrance near beside the driver's cab (on the left of the door as the passengers boards) and the 'touch off' scanner is located within the saloon placed on the opposite side of the bus (to the right of the door as the passengers boards).

*A diagram explaining the times listed in the glossary above can be found in Appendix 1 (see Figure a).*

# Executive Summary

The Yorcard Project is intended to deliver a multi-modal, multi-operator public transport smartcard scheme to be trialled on certain buses in Sheffield and on the local train service between Sheffield and Doncaster and intermediate stations.

This report presents the findings from the Phase 4 Boarding Time Study. This is the final Boarding Time Study of the research element of the Yorcard project and the purpose of which is to demonstrate that an off-bus ticket type survey methodology will allow for a regression analysis to be conducted using different ticket types to explain the difference in dwell times between the phases. In addition, this phase introduced the process of Touch on Touch off (ToTo) and this report will analyse and cross check the impact this process has had on both the overall Boarding Time and the Alighting Time. At the time of this study there was only one other operation in the UK, outside the pilot area, which had Touch on Touch off smart bus operations.

This study has determined a ticket type regression to compare and contrast with the results from previous phases of this research project. It found that as in Phase 3, there was a large variation in the Dwell Times in Phase 4 (standard deviation = 44.73 sec). Following some analysis, which has resulted in the removal of some outlier data, it was found that every alighting passenger adds 1.34 sec onto the overall dwell time, a figure comparable to that found in Phase 3 (1.98 sec), although it has not been possible to account for the difference between passengers who touched-off when alighting as there were not enough ToTo occurrences (n = 151) captured during the data collection.

With respect to smart-tickets versus standard tickets the regression analysis has shown that for cash-based transactions, Touch-on smartcard operations do appear to reduce the Dwell Time. For 'Adult Cash' tickets, this reduction in time is around 3 sec whilst for 'Child Cash' tickets, the reduction is around 1 second. For 'Flash Pass' tickets, the regression analysis indicates that smartcards increase the Dwell Time compared to standard ticketing.

This could be due to the fact that standard flash passes need to be shown to the driver, whilst smart flash passes need to be touched on the scanner and then shown to the driver.

This report documents these results of the comparison of the components of the Dwell Time and demonstrates the impact of this work upon the Yorcard and Department for Transport (DfT) objectives, and the final business case.

It was found that overall Dwell Time per bus has decreased from Phase 1 slightly and the standard deviation shows that the overall variability in the data set has reduced notably, however, Dwell Time per bus in Phase 4 does not differ significantly from that in Phase 1. The statistical results indicate that the Dwell Time per passenger in Phase 4 differs significantly from that in Phase 1 and the time was increased by 2.04sec. The average number of passengers per bus has not changed; therefore, the time each passenger takes to board and alight has increased.

The summary of the results for all the phases are shown in the Summary Table of Statistics, which enables direct comparison.

## Summary Table of Statistics

Table 1. Number of observations for Boarding and Alighting passengers and Buses per phase \* - Phase 4 includes 151 Touch-on and Touch-off operations.

Total		Boarding Passengers	Alighting Passengers	Buses Observed
With Other Factors	Phase 1	2944	2936	1049
Without Other Factors	Phase 1	2625	2640	965
	Phase 2	2500	3086	1212
	Phase 3	3698	3790	936
	Phase 4	2309	3758	1185

Measurement Description		Data with Other Factors	Data without Other Factors			
		PHASE 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4
		Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)
Bus Stop Dwell Time:	per bus	34.25	28.66	40.77	47.00	32.30
		(72.52)	(68.06)	(60.69)	(50.20)	(44.33)
	per boarding and alighting passenger	8.29	7.08	12.35	7.20	9.12
		(13.67)	(9.98)	(26.69)	(11.66)	(19.92)
Bus Stop Boarding/ Alighting Time:	per bus	29.29	23.78	33.14	42.90	29.13
		(45.12)	(34.95)	(51.95)	(48.10)	(42.73)
	per boarding and alighting passenger	6.98	5.76	9.08	5.85	7.98
		(13.01)	(9.22)	(13.33)	(10.30)	(19.17)
Boarding Time (1) [when only one passenger boards]:	per bus	13.62	10.47	19.81	15.30	14.81
		(30.56)	(23.82)	(36.71)	(36.60)	(32.53)
	per boarding passenger [no alighting passengers – see section 3.5]	11.77	9.51	17.71	11.60	9.08
		(25.59)	(19.21)	(32.07)	(13.30)	(6.06)
Boarding Time (2) [when 2 or more passengers board]:	per bus	21.91	19.79	25.88	36.10	21.37
		(39.30)	(37.63)	(50.96)	(36.06)	(31.53)
	per boarding passenger [no alighting passengers – see section 3.5]	3.27	2.91	4.90	3.85	3.81
		(4.38)	(2.37)	(6.82)	(3.34)	(3.46)
Alighting Time (1) [when only one passenger alights]:	per bus	11.36	9.34	14.04	28.60	14.26
		(10.30)	(6.32)	(15.65)	(37.28)	(22.49)
	per alighting passenger [no boarding passengers]	8.97	7.57	4.62	7.75	9.59
		(4.55)	(1.83)	(1.44)	(11.32)	(11.53)
Alighting Time (2) [when 2 or more passengers board]:	per bus	20.32	18.95	9.00	19.97	7.44
		(12.05)	(10.76)	(10.24)	(10.36)	(6.40)
	per alighting passenger [no boarding passengers]	2.65	2.44	1.38	2.70	1.24
		(1.90)	(0.76)	(0.71)	(1.39)	(0.62)

Table 2. Summary of the boarding/alighting/bus dwell times.

Definitions of all terms in Table 1 and 2 can be found in the Glossary Section. All results have been calculated without the inclusion of Other Factors (see Glossary for definition).

# Introduction

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This report presents the results from the Phase 4 Boarding Time Study. As with the Phase 1 report, this document will address both the relevant Yorcard and DfT objectives, and the Pilot Acceptance Criteria in the conclusion. As this is the final phase in which Boarding Time is studied, this report ties together the results from the previous 3 phases and interprets the differences that the introduction of smartcards has had on Boarding Time.

# Method of Recording Boarding & Dwell Times

The methodology used to collect this final data set was a combination of the methodologies used in phases 2 and 3. The slight alteration is in the number of ticket types that were collected by surveyor 3, which was reduced from Phase 2 to Phase 3 to enable a more robust data set to be collected. In this phase, surveyor 3 will also collect ticket data about smartcard users. This is detailed below as each surveyor collects the following information:

## 1st Surveyor

- Start the stopwatch when the bus has come to a halt
- Press the lap counter when the doors are open
- Press the lap counter when the first passenger boards the bus
- Press the lap counter when the last passenger boards the bus
- Press the lap counter when the doors close
- Press the lap counter when the bus departs
- Record each time in a matrix and reset the stopwatch

## 2nd Surveyor

- Start the stopwatch when the bus has come to a halt
- Press the lap counter when the doors are open
- Press the lap counter when the first passenger alights the bus
- Press the lap counter when the last passenger alights the bus
- Press the lap counter when the doors close
- Press the lap counter when the bus departs
- Record each time in a matrix and reset the stopwatch
- Record the number of passenger alighting
  - o Smartcard
  - o Non-smartcard

## 3rd Surveyor

- Record details of the boarding/alighting event including:
  - o Bus ID
  - o Time of observation
  - o Day of week
  - o Operator
  - o Route number
  - o Vehicle Type
  - o Ticket type as:
    - Adult/Cash/non-smartcard;
    - Adult/Cash/smartcard<sup>1</sup>;
    - Child/Cash/non-smartcard;
    - Child/Cash/smartcard;
    - Flash Pass/non-smartcard; and
    - Smartcard

The data collection for this study was carried out over a period of approximately 7 days in September 2009. The bus stops chosen were mainly city centre locations to ensure that the maximum number of alighting passengers using a Yorcard when alighting could be captured. In addition to this, in order to again maximise the touch-off data a further day of data collection was introduced. During this data collection, passengers with smartcards were asked to participate by boarding and alighting at set bus stops. The data was then captured by the surveyors as detailed above and is referred to as the ToTo study.

<sup>1</sup> includes concessionaries travelling before 9:00am who swipe their card and pay cash.

# Results & Analysis

## 3.1 Summary of Analysis

The results presented in this section are, firstly, the ticket type regression, followed by the statistical analysis of the data collected which has been carried out to ensure that the sample is similar to that which has been collected in Phase 1 on the pilot corridor.

## 3.2 Sample Size

The boarding time study for Phase 4 was carried out in 2 stages: over a period of approximately 7 days in early September 2009 for the standard boarding time observations and 1 day on 22nd September 2009 for the ToTo study. Due to the change of focus from Phase 2, the observations of alighting passengers became more important than boarding passengers for this phase. Among the 1294 buses observed, 99 were noted with Other Factors by the surveyors and 10 with missing information, therefore, were excluded from the analyses that follow.

A sample size of 3000 alighting passengers, required by Yorcard, has been met (see Table 3 – all tables contain information after Other Factors and missing information has been removed), however only 151 of these observations were of passengers touching off. In total, 1294 buses have been observed at 16 bus stops in a variety of locations from inner city to suburbs along the main corridor of the pilot scheme (please see Appendix 1 for the list of boarding/alighting points and an overview of their locations). This cleaning process leads to 8.3% of data being rejected. This accounts for 1185 observed buses, 2309 boarding passengers and 3758 alighting passengers collected during the following times and days (see Table 3).

	Boarders	Alighters
Mon-Fri 07:30-09:30	81	710
Mon-Fri 10:00-13:00	664	1035
Mon-Fri 15:00-18:00	486	579
Weekends	475	708
ToTo Study (Tue. 0830-1130 and 1330-1700)	603	726
<b>Total</b>	<b>2309</b>	<b>3758<sup>2</sup></b>

Table 3. Summary of the number of boarding/alighting passengers observed.

<sup>2</sup>151 of these alighting passengers Touched off when alighting

### 3.3 Ticket Type Regression Analysis

The Proof of Concept Report<sup>3</sup> demonstrated how regression analysis (Ordinary Least Squares) could be successfully applied to explain dwell times based upon individual ticket type data. Whilst the Proof of Concept used ticket type data collected on-vehicle to show that such an approach can be applied to the Yorcard scheme, the results from the Phase 3 Boarding Time Study have demonstrated how OLS regression analysis could also be used to analyse the data collected using the off-vehicle methodology adopted in this work. To provide consistency between the Phases, it is important to repeat this methodology with Phase 4 Boarding Time Study data collected and presented in this report.

The individual ticket types collected for Phase 4 Boarding Time Study and used in the regression analysis were as follows:

- Adult/Cash/non-smartcard (Adult Cash);
- Adult/Cash/smartcard (Adult Smart Cash);
- Child/Cash/non-smartcard (Child Cash);
- Child/Cash/smartcard (Child Smart Cash);
- Flash Pass/non-smartcard (Flash Pass); and
- Flash Pass/smartcard (Smart Flash Pass).

As the individual ticket types are primarily associated with the boarding time, it was important to include 'alighting passengers' and 'vehicle types' in the regression analysis as these are additional variables which could have an effect on the overall Dwell Time.

<sup>3</sup>Phase 1: Proof of concept: Explanation of Dwell Time by ticket type using OLS Regression, Version 1, January 2008

In previous phases there was no need to distinguish between alighting passengers but in Phase 4 there is a need to try to distinguish between alighting passengers who touched-off with their smartcards and those passengers who alighted without touching-off.

An initial regression analysis was conducted using all available ticket types, alighting passengers (touch-off and no touch-off) and Vehicle Type D (Double Deck vehicles) as variables. However, the result of this regression was inconclusive as there were four variables whose co-efficients were not significant at the 5% level, and only 19.2% of the variation in Dwell Time was being explained by these variables. A subsequent 'Best Subsets' regression analysis indicated that the maximum level of Dwell Time variation which could be explained by any particular combination of the variables (using the dataset in question) was 19.3%.

In Phase 3, it was shown that there was a large variation in the Dwell Times (standard deviation = 50.19 sec), and this was also the case in Phase 4 (standard deviation = 44.73 sec).

Plotting the Dwell Time versus the total number of Boarding and Alighting passengers for each individual observation illustrates the variation in the dataset for Phase 4 (Figure 1). The correlation co-efficient (R-squared value on the graph, a measure of the strength of the relation between two sets of data) of 0.0565 indicates a very weak positive relationship between dwell time and the number of boarding/alighting passengers.

To try and improve this analysis, a boxplot analysis of the Dwell Times was conducted to identify the limit beyond which observations could be considered as an outlier. This indicated that any observations with a Dwell Time greater than 70 sec could be considered as an outlier (those points to the right of the red line in Figure 1), however this does not take into account for those observations where there were a high number of boarders and/or alighters, where a higher dwell time is perhaps to be expected. As some of these observations did not have associated 'Other Factors' which could have increased the Dwell Time, it was not possible to identify whether these should be included or otherwise.

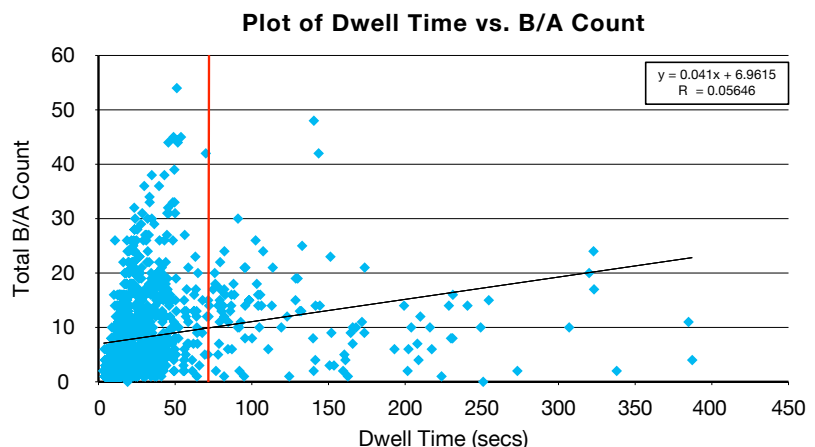


Figure 1 - Plot of Dwell Time and the Number of Boarding and Alighting Passengers

Nevertheless, to investigate whether removal of the outliers produced a better result, a second regression analysis was conducted on a reduced dataset, derived by removing any observations with a Dwell Time greater than 70 seconds. This resulted in 113 of the 1188 (9.5%) original observations being excluded from the further analysis.

This second analysis did produce an improved result, as all variables except for 'Alighting Touch-Off' had co-efficients which were significant at the 5% level. As a result, the alighting passengers were combined into a single variable and the regression recalculated, which produced a wholly significant result:

**Dwell Time (sec) = 8.32 + (7.36 Adult Cash) + (4.47 Adult Smart Cash) + (5.91 Child Cash) + (4.77 Child Smart Cash) + (3.38 Flash Pass) + (5.20 Smart Flash Pass) + (1.34 Total Alighters) + (1.68 Vehicle Type 'D')**

The result of this regression analysis suggests that from the observed sample of passengers, if all other variables (for example, each individual ticket type, alighting time, bus stop dead time and recovery time) remain constant, an extra transaction for each ticket type would increase the boarding time by the following (see Table 4)

The final regression analysis obtained from data obtained during the Touch on Touch off trial period, is based upon 416 individual 'Adult Cash' transactions, 37 individual 'Adult Smart Cash' transactions, 62 'Child Cash' transactions, 32 'Child Smart Cash' transactions, 504 'Flash Pass' tickets and 573 'Smart Flash Pass' tickets, so the final figures can be said to be based upon a representative sample of bus users in this study, and therefore, with the current dataset, the findings are robust.

Ticket Type	Boarding Time Per Passenger (sec)
Adult Cash	7.36
Adult Smart Cash	4.47
Child Cash	5.91
Child Smart Cash	4.77
Flash Pass	3.38
Smart Flash Pass	5.20

Table 4: Results of Regression Analysis for each Ticket Type recorded from data obtained when Touch on Touch off systems were in operation (Dwell Time < 70 sec)

The analysis also suggests that every alighting passenger adds 1.34 seconds onto the overall dwell time, a figure comparable to that found in Phase 3 (1.98 seconds), although it has not been possible to account for the difference between passengers who touched-off when alighting as there were not enough ToTo occurrences captured during the data collection.

It also indicates that there is a statistically significant difference between the vehicle types, Double Deck vehicles adding 1.68 seconds onto the overall dwell time compared to Single Deck vehicles. In Phase 3, it was found that Double Deck vehicles added an extra 8.97 seconds compared to Single Deck vehicles, so this reduction in additional time could provide some evidence that smartcards do improve boarding/alighting operations, by reducing the variability of boarding/alighting times.

63.0% of the variation in the Dwell Time is explained by the variables used in this regression analysis (having adjusted for the number of degrees of freedom), although a strict caveat must be applied to this finding, as a result of removing the outliers. An F-test demonstrates that this is significantly different from 0 and so the regression equation used is therefore explaining the variation in the times based upon the variables used.

One additional factor that had not been considered thus far was the one day where SYPTTE employees travelled on buses between two particular stops whilst in possession of a Yorcard, touching-on as they boarded and touching-off when they alighted on a regular basis. This day was essentially a laboratory-based experiment and so the observations from this particular day were isolated and an additional OLS regression analysis was conducted. One factor that could not be accounted for here was the vehicle type, as all routes travelled on during this day were operated by Single Deck vehicles only.

The resulting regression equation is as follows:

**Dwell Time (sec) = 9.40 + (7.40 Adult Cash) + (4.42 Adult Smart Cash) + (6.23 Child Cash) + (5.42 Child Smart Cash) + (4.00 Flash Pass) + (4.39 Smart Flash Pass) + (0.867 Total Alighters)**

This analysis produced a significant result, as all variables had co-efficients which were significant at the 5% level, except for 'Adult Smart Cash' which was significant at the 10% level.



The result of this regression analysis suggests that from the observed sample of passengers on this one day, if all other variables (for example, each individual ticket type, alighting time, bus stop dead time and recovery time) remain constant, an extra transaction for each ticket type would increase the boarding time by the following (see Table 5). For comparison, the increase in boarding time from the whole sample is also provided here:

Ticket Type	Boarding Time Per Passenger (sec)	
	22nd September	Whole Sample
Adult Cash	7.40	7.36
Adult Smart Cash	4.42	4.47
Child Cash	6.23	5.91
Child Smart Cash	5.42	4.77
Flash Pass	4.00	3.38
Smart Flash Pass	4.39	5.20

Plotting the Dwell Time versus the total number of Boarding and Alighting passengers for each individual observation on this day illustrates the stronger positive relationship between the two variables (Figure 2) for this subset of the dataset. The correlation co-efficient (R-squared value on the graph, a measure of the strength of the relation between two sets of data) of 0.4695 indicates this moderate positive relationship between Dwell Time and the number of Boarding/Alighting passengers.

Table 5: Results of Regression Analysis for each Ticket Type (22nd September Observations)

With respect to smart-tickets versus standard tickets the regression analysis has shown that for cash-based transactions, Touch-on smartcard operations do appear to reduce the Dwell Time. For 'Adult Cash' tickets, this reduction in Dwell Time is around 3 seconds whilst for 'Child Cash' tickets, the reduction is around 1 second.

For 'Flash Pass' tickets, the regression analysis indicates that smartcards increase the Dwell Time compared to standard ticketing. This is most likely due to the fact that standard flash passes need to be shown to the driver, whilst smart flash passes need to be touched on the scanner and then shown to the driver.

66.3% of the variation in the Dwell Time is explained by the variables used in this additional regression analysis (having adjusted for the number of degrees of freedom). An F-test demonstrates that this is significantly different from 0 and so the regression equation used is therefore explaining the variation in the times based upon the variables used.

Overall, it can be said that the regression analyses conducted for Phase 4 have shown that the ticket type data (and other variables) can be used in predicting the overall dwell time, but it is important to understand that the data collected in this work has shown there is great variation in the actual Dwell Time measurements.

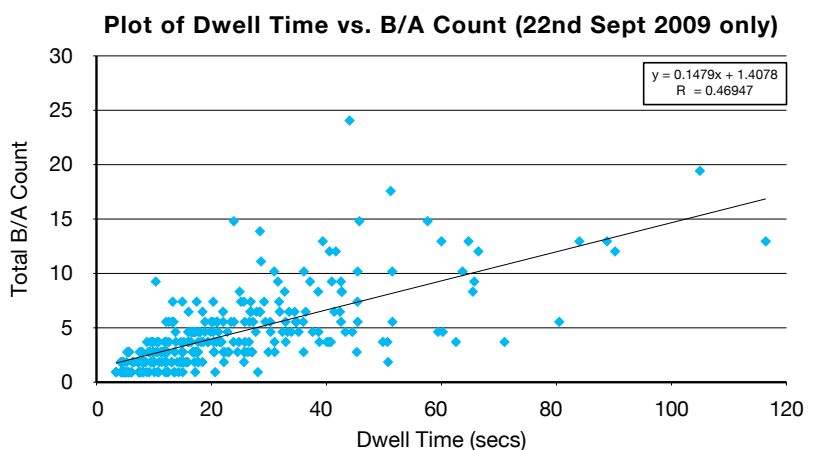


Figure 2 - Plot of Dwell Time and the Number of Boarding and Alighting Passengers (22nd September 2009 only)

Table 6 presents a comparison of the individual ticket type co-efficients calculated by each regression analysis from the different Phases, which also indicates a reduction in the time for cash-based transactions:

Ticket Type	Boarding Time Per Passenger (sec)		
	Phase 2	Phase 3	Phase 4
Adult Cash	8.51	7.15	7.36
Adult Smart Cash	N/A	N/A	4.47
Child Cash	6.99	2.79	5.91
Child Smart Cash	N/A	N/A	4.77
Flash Pass	2.93	4.19	3.38
Smart Flash Pass	N/A	N/A	5.20

Table 6: Comparison of Ticket Type Co-efficients across the Phases. For Phase 2 and 3 Regression Results please see Appendix 2.

### 3.4 Bus Stop Dwell Time

Boarding time analysis has revealed that the overall Dwell Time per bus is 32.30sec with a standard deviation of 44.33 (see Table 2). This has decreased from Phase 1 slightly and the standard deviation shows that the overall variability in the data set has reduced notably.

Disaggregating the Dwell Time identifies the overall Dwell Time per bus (see Table 7 and Figure 3). Figure 3 shows that the majority of bus stops have comparable dwell times; however, as happened in the previous phases, there are a number of stops which have much higher dwell times due to volume of passengers and operational factors that are common to these stops. These stops are 10, 12 and 13 in this phase and relate respectively to stops 12, 16 and 17 in Phase 1. (These stops are bus operator timing points.) The Dwell time per bus at these 3 stops is 110.44sec with a standard deviation of 94.65, which is much larger than the overall Dwell Time per bus (see Table 8). Data collected at these stops have significantly affected the overall Dwell Time per bus and Boarding/Alighting time per bus.

The average number of boarding/alighting passengers per bus in Phase 4 is 5 which is the same as that in Phase 1. Comparison of the overall **Dwell Time per bus** between Phase 4 and Phase 1 is carried out. The statistical results indicate that the Dwell Time per bus in Phase 4 does not differ significantly from that in Phase 1 at a 5% level ( $p=0.136$ , see Table 10). Comparison of the **Dwell Time per passenger** between Phase 4 and Phase 1 is carried out. The statistical results indicate that the Dwell Time per passenger in Phase 4 differs significantly from that in Phase 1 at the 5% level ( $p=0.004$ , see Table 10). The time was increased by 2.04sec.

Results from both comparisons suggest that in Phase 4, passengers took longer time to board/alight the bus than those in Phase 1. According to the regression analyses, this may be due to the flash pass, both smart and non-smart. All the other ticket types have reduced.

Stop	No. of Observations	Average Dwell Time	Standard Deviation	Median
1	228	<b>22.28</b>	<b>13.98</b>	<b>18.65</b>
2	161	10.83	8.58	7.52
3	27	19.16	21.76	12.01
4	34	16.43	12.30	12.27
5	23	16.18	13.04	9.64
6	28	16.67	8.13	14.06
7	33	21.77	14.97	16.49
8	23	14.15	13.07	8.27
9	158	20.75	14.03	17.27
10	27	88.04	72.75	61.92
11	28	32.34	39.26	18.43
12	9	124.80	68.01	153.58
13	70	115.80	104.24	84.54
14	174	51.30	41.71	39.35
15	71	25.77	19.46	21.08
16	91	21.42	18.61	15.52

Table 7. Dwell Time Statistics per Stop (Seconds)

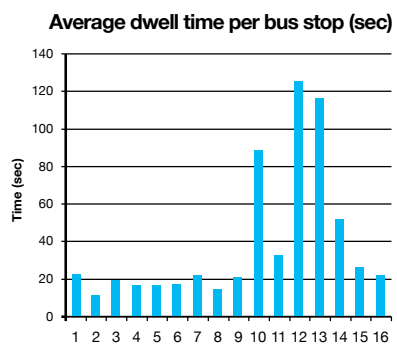


Figure 3. Dwell Time per Bus Stop Location Identifier

Item	All bus stops, total no. of observed buses: 1185		Bus stops 10, 12 and 13, total no. of observed buses: 106	
	total	per bus	total	per bus
Boarding	2309	1.9	348	3.3
Alighting	3578	3.0	267	2.5
<b>Total</b>	<b>5887</b>	<b>5.0</b>	<b>615</b>	<b>5.8</b>
Dwell time (seconds)	per bus	SD	per bus	SD
	32.30	44.33	110.44	94.65
	per passenger	SD	per passenger	SD
	9.12	19.92	20.3	19.28
B/A time (seconds)	per bus	SD	per bus	SD
	29.13	42.73	99.38	94.03
	per passenger	SD	per passenger	SD
	7.98	19.17	17.16	17.2

Table 8. Comparison between the overall results and those from bus stop 10, 12 and 13

### 3.5 Bus Stop Boarding/Alighting Time

Bus Stop Boarding/Alighting Time (B/A Time) is the impact that boarding and alighting passengers have on the overall length of the B/A Time. As a result the B/A Time has been calculated per bus, per boarding/alighting passenger, per alighting passenger when there are no boarders and per boarding passenger when there are no alighters. The results are presented in Table 9.

The B/A Time per bus was 29.13sec with a standard deviation of 42.73. Table 9 gives descriptive statistics for the B/A Time. Divided by the total number of passengers, including both boarding and alighting, the B/A Time per passenger is 7.98sec and a standard deviation of 19.17.

285 buses were observed with **no alighters** and these data were used to establish the B/A Time per boarding passenger which is increased to 10.18 with a standard deviation of 6.64. 438 buses were observed with **no boarders** and these data were used to establish the B/A Time per alighting passenger which is reduced to 4.65sec with a standard deviation of 7.20.

It can be seen that the B/A Time per boarding passenger is significantly lower than the B/A Time per alighting passenger. This demonstrates that the reduction of B/A Time is more dependent upon boarding passengers than alighting passengers. See the next section for the Boarding Time reporting and analysis and Section 3.7 for the Alighting Time reporting and analysis.

	Average B/A Time (sec)	Average B/A Time (no boarders)	Average B/A Time (no alighters)	Per Boarding and Alighting Passenger (sec)	Per Alighting Passenger (no boarders) (sec)	Per Boarding Passenger (no alighters) (sec)
Mean	29.13	17.22	29.04	7.98	4.65	10.18
No observations	1185	438	285	1185	438	285
Standard Deviation	42.73	36.42	39.71	19.17	7.20	6.64
Minimum	1.18	1.18	3.44	1.10	1.10	2.71
Quartile 1	8.40	5.20	9.07	2.72	2.10	6.05
Median	15.32	8.45	14.95	4.30	2.85	8.25
Quartile 3	31.26	14.11	33.49	7.15	4.25	11.73
Maximum	382.75	316.14	320.91	334.06	62.17	44.67
Skewness	4.08	5.51	3.64	10.34	5.27	2.24

Table 9: Statistics for Boarding/Alighting Time (B/A Time)

### 3.6 Boarding Time

Boarding Time (1) [B(1)] allows for the analysis of the Boarding Time when only one passenger has boarded, thus all the calculations for B(1) are for 1 boarder only and in this case there are 306 observations. Table 10 shows the statistics for the B(1). The overall average B(1) was found to be 14.81sec with a standard deviation of 32.53. B(1) is also a meaningful calculation when only 1 passenger boards and there are no passengers alighting. There are 136 observations of buses when one passenger boarded and no passengers alighted (see Table 10). The Average B(1) Time when there was no alighters is 9.08sec with a standard deviation of 6.06. Compared to Phases 1, both mean values have increased, which may again suggest that passengers using smartcards are taking longer time to board. When compared to Phase 2, both have decreased significantly, which suggests that smartcard users are more familiar with the new technology. Regular ad-hoc monitoring of the boarding process indicates that increased user familiarity with the system has speeded up boarding/alighting from Phase 2.

The definition of Boarding Time (2) [B(2)] removes any analysis of times that are taken when only one passenger boards and so the calculations here are based upon data collected for multiple boarders.

There are 430 observations with 2 or more passengers boarding. The overall average B(2) was 36.33sec with a standard deviation of 36.88, and B(2) per passenger was 8.15sec with a standard deviation of 5.94 (see Table 11). Compared to the Phase 1 B(2) results, all the B(2) means have increased.

B(2) is also calculated when passengers only board. There are 281 observations of buses when no passengers alight. The average B(2) per bus was 32.67sec with a standard deviation of 28.68 and the B(2) per boarding passenger was 7.67sec with a standard deviation of 5.44.

It can be seen that B(2) per boarding passenger (when there were no alighters) was slightly lower than the B(2) per passenger (with alighting passengers), as it was in Phases 1. This suggests that alighting has much less effect on B(2) than boarding.

	Average B(1) Time (N=306)	Average B(1) Time when there was no Alighters (N=136)
	Phase 4	Phase 4
Mean	14.81	9.08
Standard Deviation	32.53	6.06
Minimum	1.03	1.03
Quartile 1	5.26	4.82
Median	7.74	7.40
Quartile 3	12.56	11.47
Maximum	368.21	32.98
Skewness	7.28	1.76

Table 10: Statistics for Boarding Time (1)

	Average B(2) Time	Average B(2) Time (no Alighters) (sec)	B(2) per Boarding Passenger (sec)	B(2) per Boarding Passenger (no Alighters) (sec)
Mean	36.33	32.67	8.15	7.67
Standard Deviation	36.88	28.68	5.94	5.44
Minimum	4.98	4.98	1.55	1.55
Quartile 1	14.58	14.18	4.83	4.65
Median	24.03	22.85	6.37	5.97
Quartile 3	41.01	39.52	9.16	9.05
Maximum	317.91	219.59	43.96	43.96
Skewness	3.08	2.43	2.96	3.30

Table 11: Statistics for Boarding Time (2)

### 3.7 Alighting Time

Alighting Time (1) [A(1)] analyses the Alighting Time when only one passenger has alighted. There are 238 observations of this case. The overall average A (1) was 19.92sec with a standard deviation of 39.12 (see Table 12).

A special case of A(1) is when only 1 passenger alights and there are no passengers boarding. There are 118 observations out of 238 are in this case. The mean value of A(1) with no boarders is 2.86sec with a standard deviation of 1.31 (see Table 12), which demonstrates the impact that boarding passengers have on A(1).

The definition of Alighting Time (2) [A(2)] eliminates any analysis of times that are taken when only one passenger alights and so the calculations here are based upon data collected for multiple alighters. It is useful for analysing the effect of 2 or more alighting passengers on the Dwell Time and the average boarding time.

There are 650 observations with 2 or more passengers alighting. The overall average A(2), is 7.44sec with a standard deviation of 6.40, and A(2) per alighting passenger was 1.33sec with a standard deviation of 0.70(see Table 13).

A(2) is also calculated when there are only alighting passengers. There are 318 observations out of 650 of this case. The average A(2) was 7.03sec with a standard deviation of 5.88 and the A(2) per alighting passenger was 1.24sec with a standard deviation of 0.62 seconds (see Table 13). Table 13 demonstrates that, as opposed to A(1), A(2) is not massively effected by boarding passengers, suggesting that A(2) must be fairly independent of boarding passengers.

A(1)	Average A (1) Time (sec)	Average A (1) Time (no Boarders) (sec)
Mean	14.26	9.59
	228	123
Standard Deviation	22.49	11.53
Minimum	0.63	0.91
Quartile 1	2.39	2.25
Median	4.30	3.58
Quartile 3	17.78	12.34
Maximum	195.81	45.94
Skewness	3.96	1.69

Table 12: Statistics for Alighting Time (1) [A(1)]

A(2)	Average A(2) Time (sec) (N=650)	Average A(2) Time (no Boarders) (sec) (N=318)	A(2) per Alighting Passenger (sec) (N=650)	A(2) per Alighting Passenger (no Boarders) (sec) (N=318)
Mean	7.44	7.03	1.33	1.24
Standard Deviation	6.40	5.88	0.70	0.62
Minimum	0.38	0.22	0.19	0.22
Quartile 1	2.77	2.51	0.94	0.89
Median	5.32	5.20	1.17	1.14
Quartile 3	9.97	9.74	1.52	1.42
Maximum	40.80	31.32	5.18	5.18
Skewness	1.61	1.47	2.44	2.52

Table 13: Statistics for Alighting Time (2) [A(2)]

## 3.8 Boarding and Alighting Time Comparison - Phase 1 and Phase 4

To examine the changes of the boarding and alighting (B/A) times from phase 1 (non smart-tickets and passes) to phase 4 (ToTo implementation), 2-sample t-tests were carried out using the data collected from phase 1 and phase 4.

### Boarding/Alighting Time (B/A time) per bus test

The test aimed to examine the null hypothesis that the Boarding/Alighting Time (B/A time) per bus in Phase 4 does not differ from that in Phase 1. The statistical results indicate that the B/A time per bus of Phase 4 is significantly different from that in Phase 1 at a 5% level ( $p=0.002$ , see Table 14). The time has increased by 5.35sec in Phase 4.

### B/A time per Passenger Test (include both boarding and alighting)

The test was to examine the null hypothesis that the B/A time per passenger of phase 4 does not differ from the B/A time per passenger of phase 1. The statistical results of the 2-sample t-test indicate that the average B/A time per passenger in Phase 4 is significantly higher than the mean of the B/A time per passenger in phase 1 at a 5% level ( $p=0.001$ , see Table 14). The time was increased by 3.77sec in Phase 4.

The average number of passengers boarding/alighting per bus in Phase 4 was 5, which is approximately the same as that in Phase 1. This suggests that the increase was not caused by the number of passengers boarding/alighting but by the time taken by per passenger boarding or alighting, which could relate to both smartcards but equally the location chosen.

### B/A time per Boarding Passenger Test (when there were no passengers alighting)

This test aimed to examine the null hypothesis that the B/A time per boarding passenger in phase 4 does not differ from the B/A time per boarding passenger in phase 1, when there were no passengers alighting. The statistical results of the test indicate that the average B/A time per boarding passenger in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.02$ , see Table 14). The average time per boarding passenger in phase 4 increased by 1.25sec compared to the time taken in phase 1.

### B/A time per Alighting Passenger Test (when there were no passengers boarding)

This test was to examine the null hypothesis that the B/A time per alighting passenger in phase 4 does not differ from the B/A time per alighting passenger in phase 1, when there were no passengers boarding. The statistical results indicate that the average B/A time per alighting passenger is significantly higher in phase 4 than in phase 1 at a 5% level ( $p=0.000$ , see Table 14). The average time per alighting passenger in phase 4 increased by 1.73sec compared to the time taken in phase 1, which is larger than the difference of the B/A time per boarding passenger.

### B (1) per bus test

This test aimed to examine the null hypothesis that the B (1) per bus in phase 4 does not differ from that in phase 1. The statistical results indicate that the B(1) per bus in phase 4 does not differ from that in phase 1 at a 5% level ( $p=0.078$ , see Table 14).

### B (1) per boarding passenger (when no passenger alighting) test

This test aimed to examine the null hypothesis that the B (1) per boarding passenger (when no passenger alighting) in phase 4 does not differ from that in phase 1. The statistical results indicate that the B(1) per boarding passenger (when no passenger alighting) in phase 4 does not differ from that in phase 1 at a 5% level ( $p=0.133$ , see Table 14).

### B (2) per bus test

This test aimed to examine the null hypothesis that the B (2) per bus in phase 4 does not differ from that in phase 1. The statistical results indicate that the B(2) per bus in phase 4 is not significantly different from that in phase 1 at a 5% level ( $p=0.501$ , see Table 14) although the time has increased by 1.58 sec in Phase 4.

### B (2) per boarding passenger (when no passenger alighting) test

This test aimed to examine the null hypothesis that the B (2) per boarding passenger (when no passenger alighting) in phase 4 does not differ from that in phase 1. The statistical results indicate that the B(2) per boarding passenger (when no passenger alighting) in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.003$ , see Table 14) and has increased by 0.90sec.

### A (1) per bus test

This test aimed to examine the null hypothesis that the A (1) per bus in phase 4 does not differ from that in phase 1. The statistical results indicate that the A(1) per bus in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.003$ , see Table 14). The time has increased by 4.92 sec in Phase 4.



**A (1) per alighting passenger (when no passenger boarding) test**

This test aimed to examine the null hypothesis that the A (1) per alighting passenger (when no passenger boarding) in phase 4 does not differ from that in phase 1. The statistical results indicate that the A(1) per alighting passenger (when no passenger boarding) in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.000$ , see Table 14). The time has increased by 2.02 sec in Phase 4.

**A (2) per bus test**

This test aimed to examine the null hypothesis that the A (2) per bus in phase 4 does not differ from that in phase 1. The statistical results indicate that the A(2) per bus in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.000$ , see Table 14). The time has decreased by 11.54 sec in Phase 4.

**A (2) per alighting passenger (when no passenger boarding) test**

This test aimed to examine the null hypothesis that the A (2) per alighting passenger (when no passenger boarding) in phase 4 does not differ from that in phase 1. The statistical results indicate that the A(2) per boarding passenger (when no passenger alighting) in phase 4 is significantly different from that in phase 1 at a 5% level ( $p=0.000$ , see Table 14). The time has decreased by 1.20 sec in Phase 4.

Two-Sample t-tests	Mean difference between Phase 4 and Phase 1*	P-Value
1. Dwell Time per bus	-	P=0.136
2. Dwell Time per passenger	2.04 sec	P=0.004**
3. B/A Time per bus	5.35 sec	P=0.002**
4. B/A Time per passenger	3.77 sec	P=0.001**
5. B/A Time per boarding passenger (when no passenger alighting)	1.25 sec	P=0.000**
6. B/A Time per alighting passenger (when no passenger boarding)	1.73 sec	P=0.02**
5. B (1) per bus	-	P=0.078
6. B (1) per boarding passenger (when no passengers alighting)	-	P=0.133
7. B(2) per bus	-	P=0.501
8. B(2) per boarding passenger (when no passengers alighting)	0.90 sec	P=0.003**
9. A (1) per bus	4.92 sec	P=0.003**
10. A (1) per alighting passenger (when no passengers boarding)	2.02 sec	P=0.000**
11. A (2) per bus	-11.54 sec	P=0.000**
12. A (2) per alighting passenger (when no passengers boarding)	-1.20 sec	P=0.000**

Table 14: The summary of hypothesis tests.

\*Mean difference is given only when it is statically significant.

\*\*Mean difference is statistically significant at the 5% level.

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### Summary

In summary, the outcomes of the 2-sample t-tests suggest that Dwell Time per passenger and B/A Times (per bus, per passenger, per boarding passenger and per alighting passenger) have increased significantly when compared to those in phase 1 at the 5% level. The change is mainly reflected by the increase of time taken by each passenger boarding as well as alighting. Possible reasons for such changes are listed below and the supporting information can be found in regression analysis:

1. The smartcard system requires the user to touch their card on the validator **before** they show their photo to the driver, an additional step to the previous system which takes extra time (approximately 2.5 seconds – see the Regression in Phase 2 Boarding Time Study report for details). This has slowed passengers boarding.
2. The smartcard system requires the user to touch their card on the reader before they alight from the buses, an additional step to the previous system which could take extra time and potentially slowed passengers alighting. Additional ad-hoc monitoring of PAYGo users showed that other passengers congregating near the touch-off reader (blocking access to the reader) may have had an impact on the overall alighting process. Over time, this delay may be reduced as passengers become familiar with overall ToTo process. However with only 151 alighting passengers touching off throughout the data collection period of this Phase, it is not possible to say whether it has had any impact on the alighting time.

# Summary & Conclusions

## 4.1 Regression Analyses

The ticket type data collected in Phase 4 enabled a ticket type regression analysis to be carried out. The results are summarised as follows:

- In Phase 3, it was shown that there was a large variation in the Dwell Times (standard deviation = 50.19 sec), and this was also the case in Phase 4 (standard deviation = 44.73 sec).
- When looking at the dataset as a whole, the analysis suggests that every alighting passenger adds 1.34 sec onto the overall dwell time, a figure comparable to that found in Phase 3 (1.98 sec), although it has not been possible to account for the difference between passengers who touched-off when alighting as there were not enough ToTo occurrences captured during the data collection.
- With respect to smart-tickets versus standard tickets the regression analysis has shown that for cash-based transactions, Touch-on smartcard operations do appear to reduce the Dwell Time. For 'Adult Cash' tickets, this reduction in time is around 3 sec whilst for 'Child Cash' tickets, the reduction is around 1 second.
- For 'Flash Pass' tickets, the regression analysis indicates that smartcards increase the Dwell Time compared to standard ticketing. This could be due to the fact that standard flash passes need to be shown to the driver, whilst smart flash passes need to be touched on the scanner and then shown to the driver.

## 4.2 Dwell Time Analyses

Rigorous analyses of the components which make up and begin to explain the Dwell Time have been carried out and compared with the Phase 1 baselining results. The summary of Dwell Time results are as follows:

- Overall Dwell Time per bus has decreased from Phase 1 slightly and the standard deviation shows that the overall variability in the data set has reduced notably, however, Dwell Time per bus in Phase 4 does not differ significantly from that in Phase 1.
- The statistical results indicate that the Dwell Time per passenger in Phase 4 differs significantly from that in Phase 1 and the time was increased by 2.04sec. The average number of passengers per bus has not increased; therefore, the time each passenger takes to board and alight has increased.
- When Boarding and Alighting Time is analysed firstly with no alighters and then with no boarders, it was found that boarding passengers increased and alighting passengers decrease the time per bus in comparison with Phase 1. This demonstrates that the reduction of B/A Time is more dependent upon boarding passengers than alighting passengers.
- When 1 passenger boards the time per passenger has decreased. However, when multiple passengers board the time per passenger has increased significantly compared to Phase 1. This could be the result of many different factors, such as the city centre location. According to the Regression only the flash pass ticket types have really increased in time.

- When only 1 passenger alights, there is a significant increase in time from when there are passengers boarding compared to no passengers boarding. However, where there are multiple alighting passengers, the number of boarding passengers seems to have little effect on the alighting time.
- The only time which appears to have improved in this phase in comparison with Phase 1 is the alighting times, both alighting time (2) per bus and per alighting passenger (when no passengers board) have significantly decreased.

## 4.3 Limitations

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- The limitations of this study relate to the number of cards in circulation. As only 151 passengers were recorded alighting using the Touch off technique, this limited the analysis both for the Dwell Time components and the Regression
- Because there were not enough cards in circulation, this off bus methodology is limited as it was difficult to capture smartcards in use during ToTo.

# Objectives

The objectives which were relevant to this study and first highlighted and discussed in Phase 1 are as follows.

#### **Relevant DfT Objectives:**

- Analysing the bus boarding times (b(1))

#### **Relevant Yorcard Objectives:**

- Reducing the barriers to the use of public transport
- Reducing delays and improving reliability
- Informing the Business Case

#### **These have been realised through:**

- measuring the payment collection process before and during the on/on and on/off trialling;
- monitoring ticket transaction time reductions throughout all the phases;
- enabling the monitoring of journey time reductions throughout the phases by monitoring the changes in Dwell Time at bus stops; and
- obtaining results that will feed into the business case.

Each of these objectives will be addressed below in light of the boarding time research carried out between Phase 1 and 4:

#### **Analysing the Bus Boarding Time (DfT b.(1))**

The studies carried and documented in the Board Time Study reports, have demonstrated a full analysis of Bus Boarding Time. As the trial was envisaged to be a full roll out of smartcards in the Sheffield region, an off bus methodology was chosen as it was seen to be the least interfering for passengers as they board and alight. It also offered the opportunity to see transactions taking place between the driver and passenger, without other passengers obstructing views, which may have been the case for an on-board methodology.

By collecting data about boarding passengers, such as, numbers, the time the first passenger steps on the bus to the last, and the ticket types used, it has been possible to estimate the additional time each passenger adds to overall Dwell Time, depending upon the ticket type used and this was observed across each of the phases.

#### **Reducing Barriers to the Use of Public Transport**

It was first highlighted in Phase 1 that there could be a number of ways that the new technology could have an impact upon the barriers to using public transport. Ideally, reducing the Dwell Time at bus stops would help to reduce the barriers and in terms of this study, it was important to analyse the current Bus Stop Dwell Time and its component times in order to monitor how smartcard ticketing could impact upon Bus Journey Times.

It has not been possible to detect an overall reduction in Dwell Time as a result of, for example, reduced boarding times, as there were not enough cards in circulation and the study has shown that Dwell Time is the component of many different aspects, each of which can have a big impact upon the time, for example, scheduling, deadtime, passengers boarding with heavy shopping, etc. Therefore, the positive impact of smartcards on reducing barriers to travel is more likely to be observed through the attitudinal surveys carried out and reported in the Consumer Survey reports. This can be seen in perceived reduced driver-passenger time (a positive for both passengers and drivers), and ease of use of the technology, however, many of these opinions are based upon theory rather than experience.

#### **Reducing Delays and Improving Reliability**

This objective relates closely to the main DfT strategic objective to improve the punctuality and reliability of public transport. As with the previous objective, it has been difficult to prove that this pilot has had any impact upon both reducing delays and/or improving reliability as a result of the introduction of smartcard ticketing because of there is a large number of variables which make up Dwell time. However, the regression has shown that using a smartcard does seem to be quicker than paying with cash. In addition, both drivers and customers (see Equipment User and Consumer Study reports for full details) can see the potential benefit and impact that smartcards could have on this.

#### **Business Case**

For this Boarding Time study, the regression offers the most evidence of an economic case for smartcards. It has shown that in some cases smart ticketing is quicker than paying cash. The study has not been able to demonstrate that Dwell Time has reduced over time through the phases, and this is due to a number of different reasons.

Firstly, Dwell Time is composite of many different factors, it can depend upon which stop is observed (for example, if the stop is extremely popular), the type of bus (for example, Double Decker buses have longer dwell times than Single Decker buses. This is likely to be due to a combination of more passengers and the fact that passengers must walk up/down stairs requiring the driver to wait longer at stops), the weather, the time of day, etc. It can also be affected by the ticket type, however, over a number of days, stops and buses the impact is diluted by all the other components.

---

Secondly, the number of cards in circulation was insufficient to observe smartcard usage in high levels. With this in mind and in hindsight, it would have been advantageous to carry out a laboratory test and controlled data collection in order to control the other variables and to observe only the variation in the ticket types.

Thirdly, the technology was not always reliable on the buses, which had an impact upon the data collection by reducing the number of smartcards used during trials, potentially increasing dwell time as drivers had to explain that the technology was not working and damaging overall perception both of drivers and customers.

In terms of Touch-on Touch-off this study has been inconclusive as there were only 151 observations made of this. However, the regression has shown that when only looking at these cases, there has been little impact on the Dwell Time. ToTo has been discussed more in the Equipment user and Consumer Studies as the impact is more in terms of perception and acceptability rather than on time.

# Recommendations

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Recommendations for future work, including methodology and ways of working will be discussed in greater detail in the Phase 7 final reports.

# Appendix 1

## Appendix 1 - Bus stops used

*Note: northbound/westbound – away from city centre, southbound/eastbound – towards city centre*

Bus Stop Numbers and Locations	Description of Location	Direction of Travel
Crimicar Lane / Castlewood Road	Suburbs	Eastbound
Crookes Road / Lydgate Lane	University	Eastbound
Fulwood Road / Ranmoor Park Lane	School	Eastbound
Glossop Road / Newbould Lane	Hospital	Eastbound
Glossop Road / Hallamshire Hospital	Hospital	Eastbound
Glossop Road / Hallamshire Hospital	Hospital	Westbound
Leopold Street / Town Hall	City Centre	Eastbound
Northfield Road / Eastfield Road (Northfield Av)	Suburbs	Eastbound
Sheffield City centre, Church Street	City Centre	Westbound
Sheffield Interchange	City Centre Bus station	Westbound
Sheffield, Flat Street	City Centre	Westbound
West Street / Rockingham Street	City Centre	Westbound
Western Bank Brook/ Children's Hospital	Hospital	Eastbound
Western Bank Brook / Favelle Road	University	Westbound
Western Bank Brook / Sheffield University	University and Hospital	Westbound
Whitham Road / Broomhill	Outskirts of city centre	Eastbound

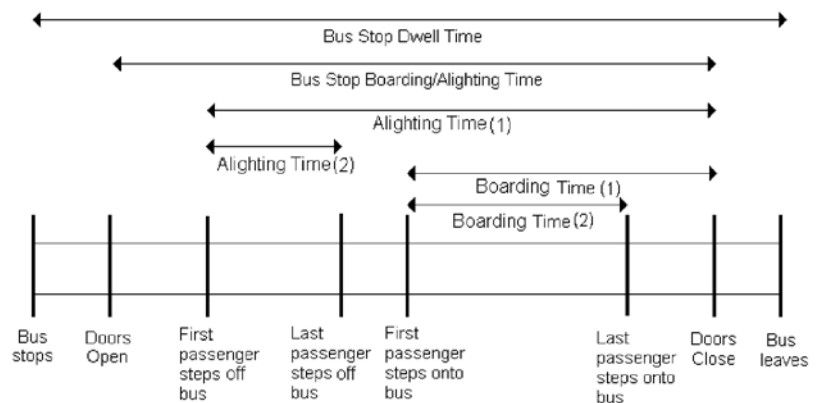


Figure A: Diagram of Bus Dwell Time components measured in this report (see Glossary for all definitions)



# Appendix 2

## Appendix 2 - Phase 2 and 3 Regression Results

### Phase 2 BTS Ticket Types

Adult Cash =  
(Adult/Cash/non-smartcard)  
+ (Adult/Cash/smartcard)

Child Cash =  
(Child/Cash/non-smartcard)  
+ (Child/Cash/smartcard)

Non-Cash Tickets =  
(Adult/Non-Cash/non-smartcard)  
+ (Child/Non-Cash/non-smartcard)

Smartcards =  
(Adult/Non-Cash/smartcard)  
+ (Child/Non-Cash/smartcard)

Concessions =  
(Concessions)

Ticket Type	Boarding Time Per Passenger (sec)
Adult Cash	8.51
Child Cash	6.99
Non-Cash	2.93
Smartcard	5.55
Concessions	7.27

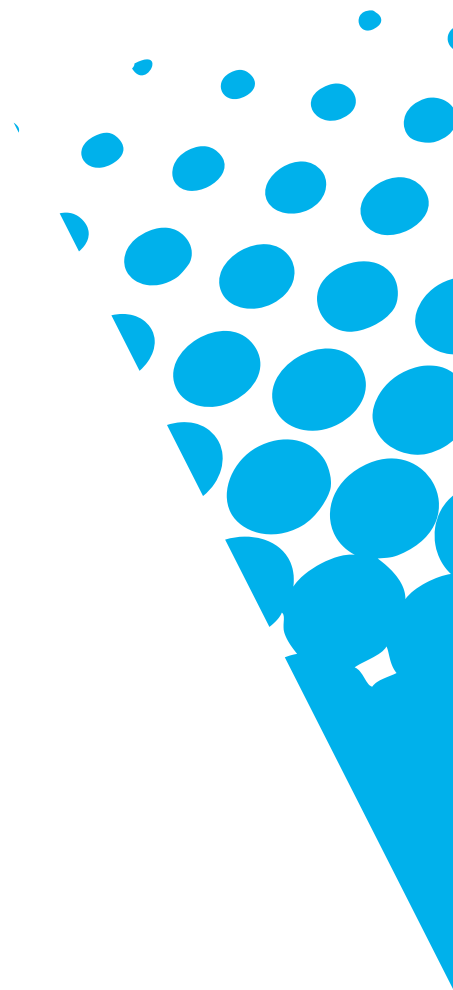
### Phase 3 (Control) BTS Ticket Types

Adult Cash

Child Cash

Flash Pass (including Concessionary  
and pre-paid period tickets)

Ticket Type	Boarding Time Per Passenger (sec)
Adult Cash	7.15
Child Cash	2.79
Flash Pass	4.19





Your car

# Contents

## 1.0 Introduction

## 2.0 Methodology

## 3.0 Results and Discussion

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Introduction.....	40	Methodology.....	41	3.1 Overview.....	42
				3.2 Bus Drivers.....	42
				3.3 Travel Information Centres .....	52

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**4.0 Summary and Conclusions**

**5.0 Recommendations**

**6.0 Appendix 1**

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4.1 Summary of Results.....	54	Recommendations .....	57	Appendix 1.....	58
4.2 Limitations .....	55				
4.3 Objectives.....	55				

# Glossary

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**ETM** - Electronic Ticket Machine

**Touch-on** - Passengers scan their smartcard when boarding the bus, showing their photocard to the driver once validated by the reader

**Touch-off** - Passengers scan their smartcard on a separate reader when alighting from the bus, to calculate the required fare for their journey

**Validator**- In this report a machine located at the entrance/exit of a bus which reads smartcards. Customers present their Yorcard to the validator for it to read and either grant access or deny it. This is also referred to by drivers and customers as the “scanner”.

# Executive Summary

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The Yorcard Project is intended to deliver a multi-modal, multi-operator public transport smartcard scheme to be trialled on certain buses in Sheffield and on the local train service between Sheffield and Doncaster and intermediate stations. This report presents the findings from the Phase 4 Equipment User Surveys. The surveys were carried out as self-administered questionnaires in Sheffield by the bus drivers from two of the three participating operators (one of the operators did not take part in phase 4), and by the staff at participating SYPT Travel Information Centres (TIC). The aim was to create a profile of equipment users who have been affected by the introduction of Yorcard to determine their opinion of the new equipment and compare it to the responses given in Phase 1, which was the period prior to the installation of smartcard technology, and Phase 2, when only Touch-on smartcard ticketing operations were active.

The key findings from this Phase 4 study are presented below:

- 42% of drivers felt the Phase 4 equipment had not made their job easier; however, a similar proportion (38%) felt that it had made their job easier.
- Drivers did feel that the equipment was easy for customers to use, and that the equipment (ETM and validators) was well placed within the vehicle.
- Over half the drivers felt that the bus smartcard validator used during Phase 4 was unreliable and had not made the boarding process quicker.
- The greatest risk to safety and security was thought to be carrying cash on the bus and the greatest impact to improve safety and security was thought to be less cash-handling.

- Compared to Phase 1, the number of drivers stating that they experienced fraudulent paper ticket use has increased whilst the fraudulent use of smartcards has decreased.
- TIC employees felt that both of their key tasks when using the ticketing equipment were 'neither time consuming nor quick', but the logging-in process could be simplified.
- Concessionary passes posed a problem for TIC employees, all but one participant stating that they regularly encounter problems when collecting information for issuing concessionary passes.
- Identifying the customer in the system was deemed to be the most time consuming task for the TIC employees when issuing passes.
- Most TIC employees felt that taking payment for smart-tickets and passes was 'neither time consuming nor quick'. People paying by 'chip and pin' was the most time consuming of tasks.
- It was felt that the general payment and issuing process could be simplified by providing more than one smartcard machine per TIC.

As in the previous phases there were certain aspects of smartcard technology that could have an impact upon the equipment users. These were the issuing of tickets off the bus, the validation of tickets and collection of payment by the technology, and the introduction of Touch-off ticketing operations for passengers alighting from the bus. These could have an impact upon the drivers' tasks during the boarding process, passenger related delays, safety and security, and fraud. These aspects have been monitored throughout the pilot.

# Introduction

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This report will present the findings from the results of the Phase 4 Driver and TIC Surveys. Introductory details including background, objectives and Pilot Acceptance Criteria can be found in the Phase 1 Equipment User Study and the General Reference Document.

During the period of this survey, the Touch On bus smart validator equipment had a reliability of around 95%<sup>1</sup>. In 2008 the reliability had been about 70-80% and this may still have had a negative impact on the data collected. In addition, the time of data collection coincided with an industrial dispute between drivers and one of the operators. Again this may have had a negative impact upon the responses given during this phase of the research. As with the equivalent Phase 1 and Phase 2 report, this document will address both the relevant Yorcard and DfT objectives, and the Pilot Acceptance Criteria in the conclusion.

*<sup>1</sup>Reliability figures were reported daily (on weekdays) by Yorcard. This relates to on-bus surveys conducted by Yorcard at certain times of day for First and Stagecoach routes only. It was measured from a variable sample of buses fitted with new smart equipment. 95% was never deemed acceptable by Yorcard or the participating bus operators.*



# Methodology

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The data collection for Phase 4 followed the same process as in previous phases. The data were collected in this phase using a self-administered questionnaire methodology developed based upon the results and recommendations made in the Phase 1 and 2 reports (RES702 and RES722 respectively) and defined in the ETM Survey and TIC Survey documents (RES403 and RES404 respectively). Only the content of the questionnaires differ to reflect the different types of equipment used and the different business processes in the two environments.

As with Phase 1, Focus Groups with the two operators and the TIC were also carried out. These were carried out after the questionnaires had been distributed and completed, due to difficulties with arranging a suitable time. This has not had an impact upon the quality of the data collected during the focus groups. The qualitative information has been used throughout the document to provide context where relevant to the quantitative data.

# Results and Discussion

## 3.1 Overview

The Driver Surveys were distributed at operator depots. An incentive of £10 in High Street vouchers was offered to each driver, plus the opportunity to win £75 in High Street voucher was available by means of one prize draw for each operator to facilitate a high response rate. Newcastle University conducted the prize draw for each operator once their questionnaires were received.

The TIC Surveys were distributed at the three TICs which were affected by the pilot study, therefore only a limited number of participants (17) could be targeted to complete the questionnaire. The total number of driver questionnaires returned was 195, whilst 9 TIC questionnaires were returned. All questionnaires were dealt with in the same confidential manner as in previous phases to ensure commercial confidentiality was not compromised. However, only the useable responses for each question have been used in the calculations and analysis presented in this report (i.e. no answers which were missing, incorrect – multiple answers to a single choice question – or partially complete have been included). The data have been analysed in this report using Excel (Pivot Tables) and Minitab, which enabled the cross-tabulation of responses and further statistical analysis.

This document will report the findings of the key questions relating to the newly installed smartcard equipment. The questions will be assessed for significant differences compared with the results in Phase 1 (and where appropriate or necessary in the case of smartcards, Phase 2) and which will be reported where applicable. Further in-depth analysis will be carried out to determine the meaning behind certain responses and to establish where error may have crept in due to misunderstanding, question formation, or otherwise.

## 3.2 Bus Drivers

### 3.2.1 Bus Driver Questionnaire

The driver questionnaire was structured in the following order:

- Section 1 – questions regarding the driver's age group, sex, employment profile and the routes they worked on
- Section 2 – questions designed to elicit opinions of the new ETM and Validator
- Section 3 – questions designed to elicit opinions of Time Keeping
- Section 4 – questions designed to elicit opinions of Safety and Security
- Section 5 – questions designed to elicit opinions of Fraud
- Section 6 – questions designed to compare smartcard equipment and methods of ticketing operations

### 3.2.2 Sample Profile

The total number of questionnaires collected was 195, an increase in the sample size from Phases 1 and 2. A representative selection of responses was received from each of the operators; however, this cannot be discussed due to commercial sensitivities. The majority of the bus driver participants were male (184 males, 11 females), and the breakdown of ages is fairly representative of the age distribution compared with Phase 1 (Table 1).

Age	Male		Female		Total n =	
	Phase 1	Phase 4	Phase 1	Phase 4	Phase 1	Phase 4
18-24	4%	5%	0%	18%	4	11
25-34	19%	16%	0%	18%	18	31
35-44	29%	31%	100%	45%	31	62
45-59	35%	36%	0%	18%	33	69
60+	13%	12%	0%	0%	12	22

Table 1: Distribution of the Participating Bus Drivers' Ages (n = 195)

All but one participant stated how long they had been employed as a bus driver. A substantial proportion (39%) of the participants have more than 8 years experience, but nearly one-quarter (24%) of drivers had been driving buses for less than 2 years (Table 2).

### 3.2.3 New Electronic Ticket Machine and Validator

In section 2 of the questionnaire, drivers were asked to provide their opinions on the new ETM and validator. A list of 7 statements was provided and drivers were asked to assess their opinion using a 5-point Likert Scale (1: Strongly Disagree, 2: Disagree, 3: Neither, 4: Agree and 5: Strongly Agree). They were then asked about the most difficult ETM task and to indicate whether each task was time consuming or not.

#### Drivers' views on the New ETMs

Drivers were asked to state the level at which they agreed with each statement:  
 Statement 1: I think that the new equipment has made my job easier.  
 Statement 2: I think that the ticket machine is well placed in the driver's cab.  
 Statement 3: I think that the entry validator is well placed for me to deal with customers on the bus.  
 Statement 4: I think that the exit validator is well placed on the bus  
 Statement 5: I think that the new equipment helps people board the bus more quickly.  
 Statement 6: I think that the new equipment is reliable and always works as I expect it to.  
 Statement 7: I think that the new validators are easy for customers to use.

A breakdown of the responses can be found in Figure 1.

Experience (Years)	Male	Female	Male	Female	Total
Less than 2	42	4	23%	36%	24%
2-4	32	0	17%	0%	16%
4-6	15	2	8%	18%	9%
6-8	20	4	11%	36%	12%
8 or more	74	1	40%	9%	39%

Table 2: Length of Employment as a Bus Driver (n = 194)

In general, drivers agreed that the ETM and the validators were well placed within the vehicle. Few drivers felt that this equipment was badly positioned: the proportion of drivers agreeing or strongly agreeing with the placement of the ETM, the entry validator and the exit validator was 81%, 84% and 71% respectively. However, 42% of drivers felt the new ETMs had not made their job easier but this was countered by the 38% of drivers who agreed that the new ETMs had made their job easier. For the customer, 47% of drivers felt the new ETMs were easy for customers to use, but 30% disagreed with this statement.

In terms of performance and reliability, the new ETMs did not appear to speed up the boarding process (63% of drivers disagreed or strongly disagreed with this statement) and were also not reliable (58% of drivers disagreed or strongly disagreed with this statement).

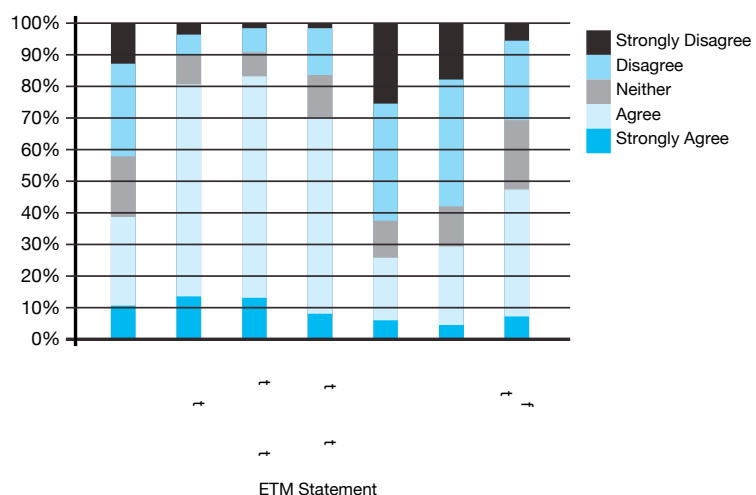


Figure 1: Breakdown of Driver opinions on each of the ETM Statements

Correlation coefficients were calculated for the further examination of drivers' views on the statements. A 2-tailed Pearson's correlation coefficient was calculated to investigate whether there was a linear relationship between a) drivers' ages and their views on the ease of using the new equipment and b) drivers' experience (in terms of the number of years they had been a bus driver) and their views on the ease of using the new equipment.

For the relationship between age and ease of use, the result shows a significant negative correlation of [-0.145] ( $p=0.043$ ) which implies that as age increases, the new equipment has actually made the job harder for drivers. An 'Individual Values' plot highlights this relationship (Figure 2), the red dots indicating the (age, rating) for each individual driver, the blue marks indicating the average rating for each of the age groups, showing the decrease in average rating as the age groups increase.

For the relationship between experience (defined as the length of time as a bus driver) and ease of use, the result also shows a significant negative correlation of [-0.377] ( $p=0.000$ ). This implies that, in a similar vein to drivers' age, as the amount of experience increases, the new equipment has actually made the job harder for drivers. Another 'Individual Values' plot highlights this second relationship (Figure 3), the red dots indicating the (age, rating) for each individual driver, the blue marks indicating the average rating for each of the age groups, showing the decrease in average rating as the experience increases.

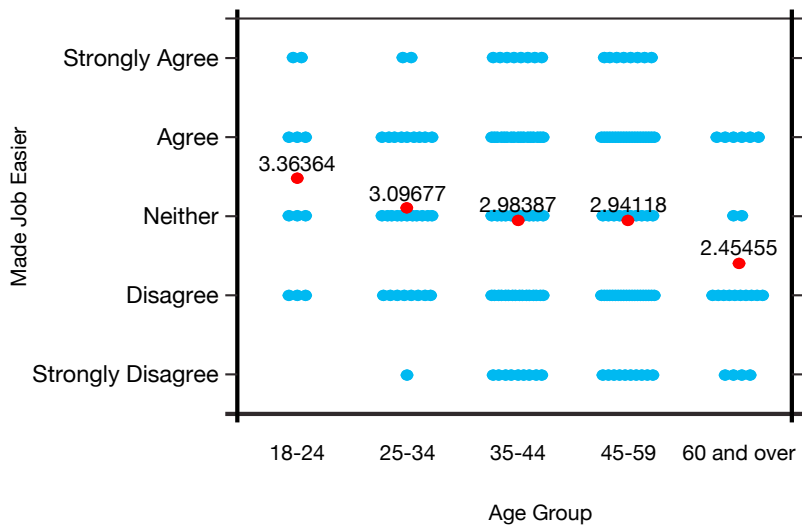


Figure 2: Relationship between Age and whether the new ETM Equipment has made Drivers' jobs easier

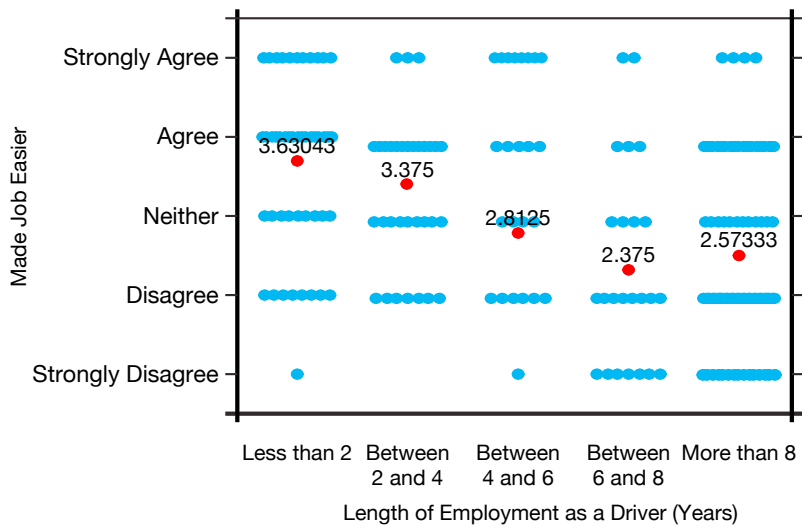


Figure 3: Relationship between Experience as a Bus Driver and whether the new ETM Equipment has made Drivers' jobs easier

### Drivers' views on the ETM tasks

The next questions asked drivers to indicate which of the 12 ETM tasks they found the most difficult to do, and whether they found each task time-consuming. (In this analysis, each task has been numbered for ease of reference and to improve the clarity of graphs where possible.)

Drivers were asked to indicate the individual ETM task which they found most difficult but 20 gave multiple answers, indicating that there are tasks considered equally difficult, but these answers could not be included in this particular analysis. A breakdown of answers by age group can be found in Appendix 1. Table 3 shows the overall breakdown of answers which shows that the most difficult task by far was 'Scrolling Menus', nearly half of all drivers stating this to be their most difficult task.

Task No.	Task	Total (n, %)	
1	Logging On	0	0%
2	Updating Fare Display	0	0%
3	Reading ETM Display	4	2%
4	Pressing Buttons	1	1%
5	Memorising Buttons	20	12%
6	Issuing Paper Tickets	2	1%
7	Issuing Paper Tickets with Wallet	25	15%
8	Changing Ticket Roll	11	6%
9	Unjamming Ticket Roll	11	6%
10	Scrolling Menus	84	49%
11	Validating Smartcards	8	5%
12	Processing Smartcards	6	3%

Table 3: Most Difficult ETM Task (n = 172)

<sup>i</sup> A correlation co-efficient defines the strength of a relationship between two variables. A perfect positive correlation has a co-efficient of +1, whilst a perfect negative correlation has a co-efficient of -1. [Source: NORUSIS, M. J. (2004) SPSS 12.0 Guide to Data Analysis New Jersey, Prentice Hall. P446]

### Drivers' view on the Time Consumption of the ETM Tasks

Drivers were also asked whether they considered each ETM task to be time-consuming. Figure 4 shows that over half of drivers considered 'issuing paper tickets with wallet' (Task 7 - 57% 'Yes', 43% 'No') and 'scrolling menus or searching tickets' (Task 10 - 77% 'Yes', 23% 'No') to be the most time consuming tasks.

Very few drivers considered 'updating the fare stage' (Task 2 - 4% 'Yes', 96% 'No') to be time consuming whilst 'reading the ETM display' and 'pressing buttons' were also regarded as not time consuming by the majority of drivers. 'Validating smartcards' and 'processing smartcard tickets' were regarded as not time consuming by the majority of drivers.

As recommended in Phase 1, drivers were asked to respond to each statement with a yes or no rather than ranking the level of time consumption to make it easier for drivers to answer. The results from Phase 1 were converted to yes or no answers (1-5 = yes, 6-10 = no) in Phase 2 to allow for comparison. Figure 5 demonstrates the comparison of the percentages of drivers who felt that the ETM tasks were time consuming between Phases 1, 2 and 4.

The analysis shows that 'Scrolling Menus or Selecting Tickets' (Task 10) was considered to be the most time consuming task in Phase 4, a much higher proportion of drivers rating this task as time consuming compared to previous phases. 'Logging on' (Task 1) and 'Issuing paper ticket with wallet' (Task 7) were tasks which were considered to be time consuming by more drivers in Phase 4 than in previous Phases.

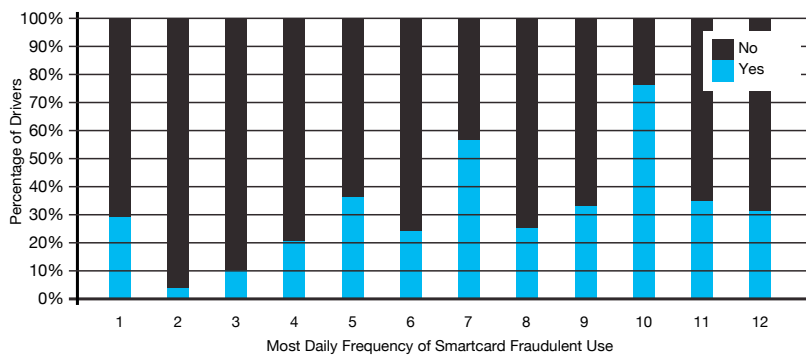


Figure 4: Driver opinions - Time consuming ETM tasks

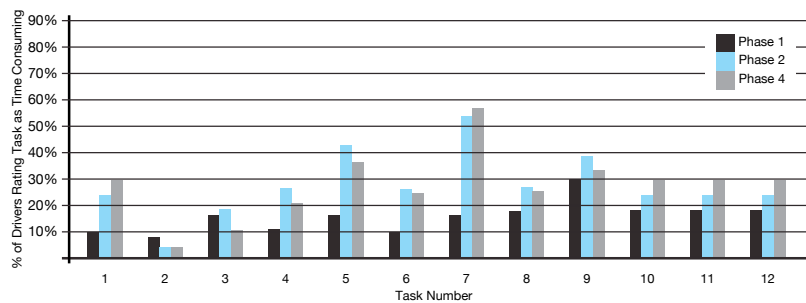


Figure 5: Comparison between Phases 1, Phase 2 and 4 of the percentage of drivers who felt that the ETM tasks were time consuming.

The majority of tasks were considered to be more time consuming in Phase 4 than in Phase 1, the only task in Phase 4 which received the fewest 'yes' answers of all phases was 'Updating the Fare Display' (Task 2), however this was the task which was considered to be the least time consuming of all tasks, across all phases.

#### Other comments about ETM tasks

Drivers were offered an opportunity to write down any other ETM tasks that they found difficult or easy to do. 84 individuals said there were other tasks which they also found to be time consuming, a summary of which follows below.

The vast majority of drivers felt the menu hierarchies were too illogical and slow to navigate:

- Not having day tickets on the same menu as weekly and monthly tickets;
- Not being able to issue a child ticket when in the season ticket menus;
- Having to 'jump' between menus to validate a single ticket;
- Time taken to read Smartcards was sometimes longer than desired;
- Issuing 'non-programmed' tickets and some special tickets, when numerous buttons had to be pressed, the sequence of which was difficult to remember;

- It was often impossible to issue multiple tickets of a specific type (e.g. student savers, company-specific special offers);
- Recording passes when many people were boarding in quick succession;
- On occasions, the menu would be so slow to change or cancel, the wrong ticket was erroneously issued.

All these issues caused frustration and delays (for drivers and passengers) particular when loadings were heavy. During the Focus Groups it was suggested that having more dedicated buttons/hotkeys for popular tickets would be a suitable solution, or the option to issue a ticket purely by entering the relevant price.

A number of drivers mentioned that they had to take time to show passengers how to use their smartcards in the correct way, particularly elderly passengers, who often tried to touch-off when there was no need for them to do so. In some instances, it was felt issuing a paper ticket (as per pre-smartcard operations) would have been quicker than showing these passengers how and where to scan their cards.

One major problem occurred when the ETM froze, often caused when individual buttons jammed. This meant the driver had to reboot the unit, which sometimes would not happen on the first attempt. If it could not be restarted during their shift, drivers then had to then explain to customers that the machine wasn't working and why, which caused conflict and frustrations.

One driver mentioned how reading ETM was occasionally difficult, due to the high reflectivity/non-reflective screen, particularly at night or in low-light conditions.

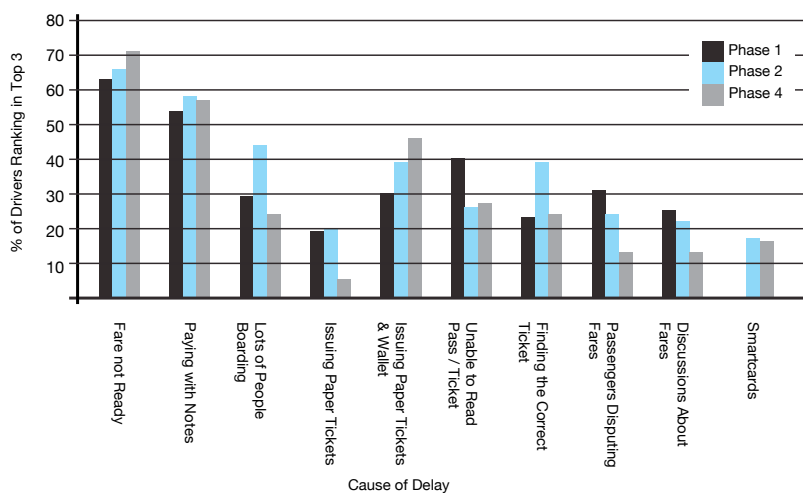


Figure 6: Top three perceived causes of delay for Phases 1, 2 and 4

### 3.2.4 Time Keeping

Drivers were asked if they found it easy to keep to the timetable (disregarding traffic delays). In Phase 1, 80% of drivers (who gave an answer to the question) said 'yes', however in Phase 2 the percentage of drivers who said 'yes' had fallen to 55%. However, in Phase 4 this question was not asked of drivers but to provide a comparison between the phases, analysis of the most common causes of delay was undertaken.

The Phase 1 survey asked drivers to rank the various factors from 1 to 10 ('1' being the most common cause of delay) whereas the Phase 2 survey asked drivers to pick their top 5 causes of delay and rank them, again with '1' being the most common cause of delay. For Phase 4, drivers were asked to rank their top 5 causes, as per Phase 2. As some drivers might perceive different causes of delay to be of equal value, and to provide a meaningful comparison between all surveys, the percentage of all drivers giving a top three rank to each cause of delay was analysed (Figure 6).

A full breakdown of the answers from Phase 4 can be found in the Appendix.

As Figure 6 shows, fare issues (customers not having their fare ready or those paying with notes) continue to be the most common causes of delay in Phase 4. 'Issuing paper tickets with a wallet' was also perceived to be a significant cause of delay in Phase 4, more drivers rating this cause in their top 3 compared to previous phases, although it is interesting to note that 'Issuing paper tickets' (i.e. without a wallet) was hardly considered to be a cause of delay, compared to the previous phases.

In Phase 4, 16% of drivers stated that smartcards are amongst the top three contributors to delays in Phase 4, 1% less than in Phase 2. However, the results from Phases 2 and 4 suggest smartcard technologies can offer a solution to the above problems by removing the need for passengers to pay with cash or require large amounts of change when paying with notes. They could also alleviate the problem of drivers having to find the right ticket, and disputes about fares also appear to have fallen between Phases 2 and 4, possibly due to smartcards.

### 3.2.5 Safety and Security

One key area in which smartcard technology could have great benefits is in the safety and security of drivers whilst at work. It was identified that 'carrying cash on the bus' was perceived to be the greatest risk by all drivers, but 'passenger confrontation over fares' was also a key issue, particularly amongst younger drivers.

To identify whether the introduction of the new ETM and smartcard validators has had any impact on perceived safety risks, a comparison was made between the ranks given by drivers in each Phase. As before, some drivers did not assign a unique rank to each of the safety risks and so the comparison is based upon the percentage of all drivers giving a top two rank to each safety risk (Table 4).

As the analysis shows, 'carrying cash on the bus' is still perceived by drivers as the greatest security risk to drivers. Cash carrying on the bus was rated by 79% of drivers as being in their top two risks, whilst carrying cash to/from the depot and on a Monday or Tuesday was also rated as a high safety issue. It must be noted here that 'Passenger Confrontation' was only rated as a risk by 3 individuals, only 1 driver rating it as their second greatest security risk.

Safety and Security Risk	% of Drivers ranking in top 2 risks		
	Phase 1	Phase 2	Phase 4
Carrying cash on the bus	70	75	79
Carrying cash to the depot	51	48	56
Carrying cash on a Monday or Tuesday	45	51	56
Passenger confrontation over fares, etc.	21	21	1

Table 4: Top Two Safety and Security Risks for Drivers, Phases 1, 2 and 4.

Remedial Action	% of Drivers ranking in top 2 risks		
	Phase 1	Phase 2	Phase 4
Less cash-handling	64	70	71
Reliable way to validate a ticket or pass	25	20	12
Not accepting payment from a large note	28	23	17

Table 5: Top Remedial Actions for Drivers, Phases 1, 2 and 4.

Drivers were then asked to state which remedial actions would have the greatest benefit to their overall safety and security (Table 5). In Phase 4, drivers were asked to only specify one action, although 4 individuals did specify multiple actions and so these responses were discounted in the calculations. Nevertheless, the results of this analysis confirms the fact that across all Phases, cash-handling has been perceived to pose the greatest risk to drivers and that the introduction of smartcards would greatly alleviate the associated problems.



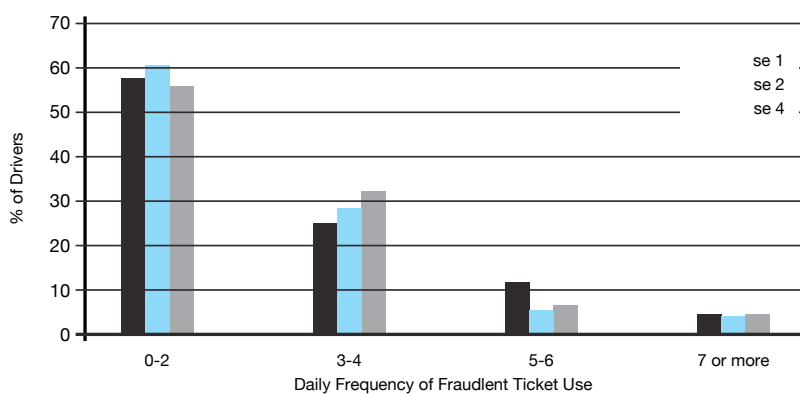


Figure 7: Frequency of fraudulent ticket use Experienced by Drivers, Phases 1, 2 and 4

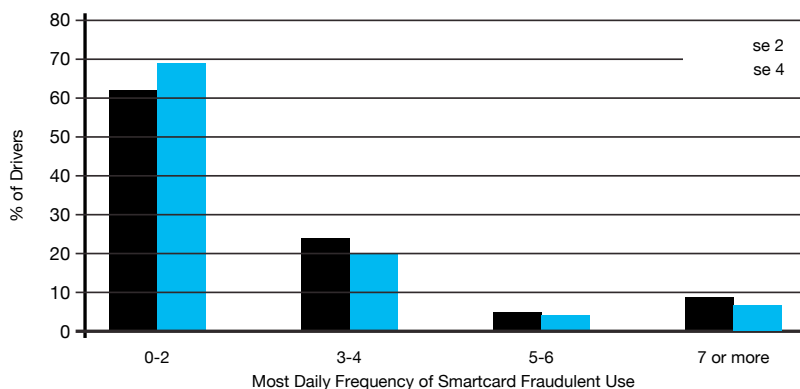


Figure 8: Frequency of fraudulent Smartcard use experienced by Drivers, Phases 2 and 4

### 3.2.6 Drivers' Views on Fraudulent Ticket Use

In addition to improving the safety and security of drivers, smartcards have the potential to reduce the level of fraudulent travel, due to the difficulties of forging a smartcard or successfully using an expired smartcard.

Drivers were initially asked how often (on a daily basis) they encountered passengers trying to use expired or fake tickets and passes. Although 5% of drivers in Phase 4 said they never encountered fraud, Figure 7 shows that the frequency of drivers encountering fraudulent ticket use has slightly increased during Phase 4. In Phase 2, 61% of drivers experienced fraud 0-2 times per day but in Phase 4 this figure had fallen to 55%. The proportion of drivers experiencing fraud 3-4 times per day had increased from 29% in Phase 2 to 32% in Phase 4. Significant fraudulent use (7 or more times per day), remained at 5%, unchanged from Phases 1 and 2.

Calculating the weighted averages for each phase confirms the finding that fraudulent ticket use has increased slightly. On average, drivers questioned in Phase 1 experienced fraud 2.5 times per day, in Phase 2 this figure decreased slightly to 2.3 times per day, before increasing in Phase 4 to 2.6 times per day.

Drivers were also asked to state how often they encountered fraudulent smartcard use, again on a daily basis. There were no smartcards in operation during Phase 1, so a direct comparison was not possible with this phase; however this question was posed to drivers in Phase 2, so a suitable comparison can be made here (Figure 8).

This analysis reveals a fall in smartcard fraudulent use between Phase 2 and Phase 4. Encouragingly, 33% of drivers questioned in Phase 4 said they never encountered invalid tickets or passes when a smartcard was used, whilst the proportion of drivers who encountered significant levels of fraudulent smartcard user (7 or more times per day) had fallen from 9% in Phase 2 to 7% in Phase 4. Calculating the weighted average indicates that fraudulent smartcard use has indeed decreased from 2.4 times per day in Phase 2, to 2.0 times per day in Phase 4, although a Mann-Whitney U test (on the median of each set of responses, having converted each response into a frequency value ; see Table 10 in Appendix 1) indicates this is not a significant decrease.

Comparing fraudulent use of paper tickets and smartcards, the most significant finding is that 7% of drivers stated that they experienced fraudulent use of smartcards '7 or more times per day' compared to only 5% of drivers with respect to tickets and passes, a similar finding to that in Phase 2. This suggests that the new ETM and smartcard readers have had a positive impact on the detection of fraud, as more drivers are now able to detect when invalid smartcards are being used. As before, it must be noted that this result does not account for faulty equipment, valid cards being used erroneously or other possible factors in which a valid card might register as invalid.

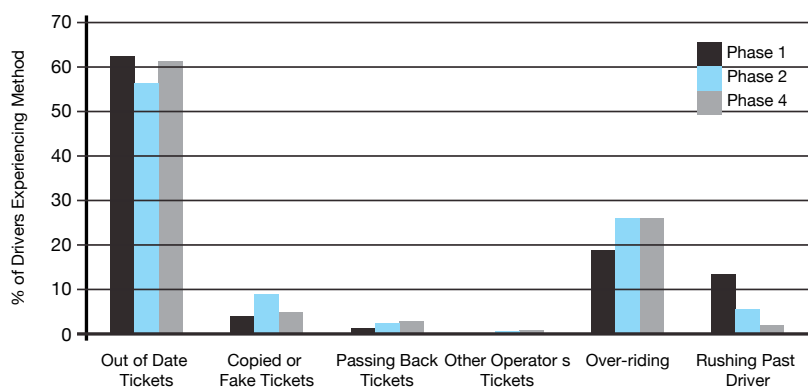


Figure 9: Methods of fraudulent paper ticket use, Phases 1, 2 and 4

Smartcard Method	Phase 2 (%)	Phase 4 (%)	Ticket/Pass Method	Phase 2 (%)	Phase 4 (%)
Printed dates on Smartcard have expired	31	N/A	Out of date ticket	56	61
Paper counterpart does not match Smartcard	17	25	Copied or fake ticket	9	5
Smartcards passed back for others to use	8	10	Ticket passed back for others to use	2	3
Invalid Smartcard	45	41	-	-	-

Table 6: Comparison of Fraudulent Ticket Methods between Smartcards and Tickets/Passes

#### Methods of Fraudulent Use

As well as asking how often drivers encountered fraudulent ticket use, they were also asked which method of fraud they believed to be the most common amongst passengers. Figure 9 shows the comparison between the various phases for paper tickets and passes (i.e. excluding smartcards).

From this, it is clear that the use of expired tickets continued to be the most common method used in Phase 4, followed by over-riding (travelling further than is permitted by the fare paid or travel pass).

The previous analysis suggested that drivers were becoming more aware of over-riding and the use of fake tickets in Phase 2; whilst awareness of over-riding remained at the same level as reported in Phase 2, it appears that the use (or awareness of use) of fake tickets has fallen in Phase 4. For smartcards, the given methods for fraudulent use differed slightly from those for the tickets/passes, so a general comparison with the ticket/passes was only possible for three out of the four methods.

The comparisons shown in table 6 suggests little has changed between Phases 2 and 4, and there still is a difference in how attempts are made to use smartcards fraudulently. Unfortunately, expired smartcards were not specifically asked about in Phase 4, so a comparison cannot be made, although 5% more of drivers stated that the frequency of out of date tickets had increased. Mismatching smartcard and paper counterparts had increased also in Phase 4, whilst copied or fake tickets had fallen. However, there was an increase in the proportion of drivers noticing both passed back tickets and smartcards.

Overall, the driver responses indicate that the smartcard technologies have played a role in reducing fraudulent travel, which is particularly important given the finding that the frequency of fraudulent paper ticketing use has increased between Phases 2 and 4.

**3.2.7 Comparing Smartcard Equipment**

In Phase 4, both Touch-on and Touch-off ticketing operations were active, and so a new final section was introduced into the driver questionnaire to gain an insight into the opinions of the various methods of ticketing. 77% of drivers said they had driven buses where one validator was only used for boarding the bus.

Proportion of Users Who Touch-off	Percentage of Drivers
All or nearly all (~100%)	39%
About 3 out of 4 (~75%)	10%
About half (~50%)	11%
About 1 in 4 or less (~25%)	39%

Table 7: Proportion of Users Who Remember to Touch-off When Alighting

Statement	Preferred Method of Operation			
	Touch-on only	Touch-on and off	Before Smart-cards	Does not matter
Quicker to get people on and off the bus	39%	12%	38%	11%
Equipment is easier to use	30%	14%	41%	15%
Equipment is more reliable	20%	10%	42%	28%
Easier for the passenger	40%	14%	35%	11%
Feel safer doing my job as a driver	19%	14%	19%	48%
Generally easier for me as a driver	27%	16%	34%	23%

Table 8: Comparison of Drivers' Preferred Ticketing Operations

One issue that was continuously raised and questioned in the Phase 4 Consumer Focus Groups was the difficulties of Touching-off and what would happen if people forgot to do so. Drivers were asked what proportion of users they thought actually remembered to touch-off when alighting. Table 7 shows the breakdown of results, revealing an unclear picture - 39% of drivers thought most users touched-off whilst 39% of drivers also believed that only around 1 in 4 or fewer users remembered to touch-off when alighting from a bus.

Finally, drivers were asked to state which method of operation (Touch-on only, Touch-on and Touch-off) was better for a range of statements, or if things were better before smartcards were introduced, or if there was no difference between operations. Table 8 presents a breakdown of these responses:

The analysis suggests that Touch-on only operations are the favoured option of drivers, as it is thought this would make the boarding and alighting process faster which would also make this process easier for the passenger. However, drivers also believe that the equipment was easier to use and was more reliable, thus making their overall job easier, before smartcards were introduced. Nevertheless, it was felt that none of the options had any significant benefit with regards to their safety when driving buses.

# 3.3 Travel Information Centres

## 3.3.1 TIC Questionnaire

The TIC questionnaire was structured in the following order:

- Section 1 – questions regarding the participant’s employment profile
- Section 2 – questions regarding the participant’s personal attributes
- Section 3 – questions designed to elicit opinions of the ticket sale process
- Section 4 – questions designed to elicit opinions of the ticket equipment
- Section 5 – questions designed to elicit opinions of the payment process

The reporting of the results will be presented in the following sections:

- Sample Profile;
- Ticket Sale Process;
- Ticket Equipment; and
- Payment Process.

The results presented will take into account the differences within the sample and between Phase 1 and Phase 4 where appropriate and of interest.

## 3.3.2 Sample Profile

There are three TICs which are affected by the pilot and therefore only a limited number of participants (17) can be targeted to carry out the questionnaire. In total, 9 completed questionnaires were collected. This results in a response rate of 53% which is much higher than that in Phase 1.

The questionnaire has allowed a certain level of insight into the TIC processes which are a significant part of the pilot delivery and has allowed the measurements to be captured and compared to the baseline results. The participants represent staff with a variety of employment status (Table 9). Both clerical staff and supervisory staff were targeted and have participated in the questionnaire.

5 worked full-time, including 1 who had been employed in the TIC for 4-6 years and 4 for more than 8 years; 4 worked part-time, including 1 had been employed for less than 2 years, 1 for 6-8 years and 2 for more than 8 years. There are 2 supervisory staff who were full-time employees, the remaining 7 were clerical staff. There are 8 females and 1 male with 1 aged between 17 and 24, 1 between 25 and 34 and 7 between 45 and 59.

## 3.3.3 Ticket Sale Process

This section was designed to elicit opinions and understanding of the ticket range and the sales process. The participants were asked questions regarding the way in which they sell the tickets.

8 out of 9 indicated that they spent time with a customer discussing tickets types ‘usually every day’ and 1 did so ‘at least once every week’. 4 participants stated that they sold the customer the tickets they asked for ‘almost every time’ or ‘most of the time’ whilst 4 stated that they would discuss the tickets available first and then recommend or let the customer to make a decision.

One participant did not provide valid responses. 6 out of 9 believed that customers were usually confused about which tickets were available. They pointed out that TravelMaster, off-peak passes, Sheffield zone or all South Yorkshire zones were the types of tickets customers tended to be confused about. As a result, there is an even-split among participants in terms of how often they felt under pressure to serve customers quickly. However, it is not clear whether or not this is related to the length of employment or their age because:

- Those who rarely felt under pressure had been employed for more than 8 years, 1 aged between 17-24 and 2 between 45-59; and
- Those who often felt under pressure had been employed for a long period of time (1 for 6-8 years, 2 for more than 6 years), all were aged between 45-59.

Work status		Length of employment (Years)					Total
		0-2	2-4	4-6	6-8	8+	
Clerical	Part-time	1	0	0	1	2	4
	Full-time	0	0	0	0	3	3
Supervisory	Full-time	0	0	1	0	1	2

Table 9. TIC Employee Sample profile (n = 9)

---

### 3.3.4 Ticket Equipment

This section asked the participants about using the Smart-ticket and pass issuing equipment on a number of tasks. The participants were first asked about their views on two tasks:

- Logging into the Yorcard retail equipment and EPOS systems;
- Entering the data for smart tickets and passes into the system.

In terms of whether or not the two tasks were time consuming, the results show that participants' views on the first task are almost the same as those on the second task. For the first task, 1 participant found it generally time consuming, 5 'neither time consuming nor quick' and 3 'fairly quick' or 'quick'. For the second task, 1 participant found it generally time consuming, 6 'neither time consuming nor quick' and 2 'fairly quick' or 'quick'. 2 out of 9 participants thought that the process of the first task could be simplified. This could be done by 'entering your password once and not twice on the log in screen', 1 participant pointed out.

Participants were then asked about their view on 3 tasks when issuing concessionary passes. 'Verifying entitlement for concessionary permits' has been seen as 'least time consuming' by 8 participants, whilst 4 thought that 'identifying the customer in eCRM/Card management system or entering a new record' was 'most time consuming' and 3 thought 'physically making up the pass' was 'most time consuming'. There are 4 participants who believed that issuing concessionary passes could be simplified by allowing 'electronically print passes'. 'Less administrative work and more up to date equipment', 'quicker search system' or 'print photo onto pass and expiry date', were other solutions suggested by participants.

All but one participant stated that when issuing concessionary passes they regularly encounter problems when collecting information for issuing concessionary passes. 8 participants had experienced 'applicants not having the right documents', 7 'applicants are not eligible', 5 'postcode or address not in system' and 4 'wrong types of photographs'. The participants' attitudes towards whether or not the process for collecting information for a concessionary pass could be simplified were rather negative. Only 1 participant thought it could be, but without indicating how to do so.

### 3.3.5 Payment Process

In general, the participants view on taking payments for smart tickets and passes were that they were not overly time consuming. Only 1 participant thought it was 'fairly time consuming' whilst 3 thought it was 'fairly quick' or 'quick'. The other 5 thought it was 'neither time consuming nor quick'.

To the majority of participants, 'people paying by chip and pin' was felt to be the most time consuming issue, 'not having enough change' was the second most time consuming whilst 'giving change for notes' was 'least time consuming'. Two participants thought the payment process could be simplified by providing more than one smartcard machine per TIC, suggested by a participant.

In terms of offering refunds or exchanges for smart tickets, only 1 participant found it 'fairly time consuming', 2 found it 'fairly quick' and the other 6 stated 'neither time consuming nor quick'. No-one thought that the process could be simplified.

# Summary and Conclusions

## 4.1 Summary of Results

To date, the data collection for this Phase 4 study has been completed within the timescales stated in the methodology. The resulting data has been entered into a database and cleaned for obvious coding errors. Overall the sample size has increased due to a rise in Driver incentives as previously recommended in Phase 1.

The results from analysis of the responses are summarised below followed by the limitations found at this stage. The analysis has highlighted where some areas could be improved, although this is the final phase of the Yorcard pilot.

The following results were found:

- 42% of drivers felt the Phase 4 equipment had not made their job easier; however, a similar proportion (38%) felt that it had made their job easier.
- There was a significant negative correlation between drivers' age and whether the new ETMs had made their job easier, and between drivers' experience and whether the new ETMs had made their job easier.
- Drivers did feel that the equipment was easy for customers to use, and that the equipment (ETM and validators) was well placed within the vehicle.
- Over half the drivers felt that the Phase 4 equipment was unreliable and had not made the boarding process quicker.
- The findings demonstrate that the performance of the new equipment has played an important role in drivers' views on the benefits of the new technology throughout the phases.

- The most difficult and most time consuming ETM task was 'Scrolling Menus', which was borne out by the drivers' opinions on the menu hierarchies which were deemed to be illogical and slow to navigate.
- With respect to smartcards, a slightly higher proportion of drivers felt the validation and processing of smartcards was more time consuming in Phase 4 than in Phase 2.
- As in Phases 1 and 2, the greatest risk to safety and security was thought to be carrying cash on the bus and the greatest impact to improve safety and security was thought to be less cash-handling.
- Compared to Phase 1, the number of drivers stating that they experienced fraudulent paper ticket use has increased. Compared to Phase 2, drivers said the fraudulent use of smartcards has decreased.
- For the TIC employees, there is an even split among participants in terms of how often they felt under pressure to serve customers quickly.
- Overall, TIC employees felt that both of their key tasks when using the ticketing equipment were 'neither time consuming nor quick', but the logging-in process could be simplified.
- Concessionary passes posed a problem for TIC employees, all but one participant stating that they regularly encounter problems when collecting information for issuing concessionary passes.
- Identifying the customer in the system was deemed to be the most time consuming task for the TIC employees when issuing passes.
- With respect to taking payment for smart-tickets and passes, most TIC employees felt that this process was 'neither time consuming nor quick' but 'people paying by chip and pin' was the most time consuming of tasks.
- It was felt that the general payment and issuing process could be simplified by providing more than one smartcard machine per TIC.

## 4.2 Limitations

Limitations have been identified. The limitations are as follows:

- A small number of TIC employees were available as the population of smart-ticketing equipment users, although 9 responses represents a 53% response rate.
- At the time of the survey, the touch on bus smart validators were running at about 95% reliability. In 2008 the reliability was 70-80% and this may have had a negative impact upon drivers' views.
- There was also a limited amount of smartcards in use during the data collection as, while ENCTS cards were in use, there were few child and adult (TravelMaster) users. Therefore, drivers may have a limited experience of smartcards at this stage.

## 4.3 Objectives

This study has met the criteria of the agreed methodology and has enabled a comparison to the findings of Phase 1 and Phase 2. In terms of the pilot acceptance criteria, this study has followed that which is recommended and overall has not shown any reduction in the measurements wished to be observed.

The effects that smartcard technology could have in the future upon the Yorcard Objectives were identified in the Phase 1 Boarding Time report as:

- Reducing the barriers to the use of public transport
- Reducing delays and improving reliability
- Reducing fraud
- Informing the business case

At this stage it is difficult to say if these objectives have been met as there has been an increase in the average Dwell Time and its component parts for this phase; however, this report has been able to offer a baseline for smartcard technology comparison with other phases, and, in conjunction with the other studies, will form a more rounded picture of the effect of Yorcard on the above qualifiers. This is also the case for the DfT objectives, which were identified as the following:

- Analysing the system performance (b(2))
- An assessment of the Operator and PTE expectations (c)

Each of the objectives will be looked at briefly below:

### **Reducing Barriers to the Use of Public Transport**

Phase 1 identified that the new technology could have an impact upon the barriers to using public transport particularly from the point of view of the sales channels. For example, drivers are often the customers' first point of contact, therefore if the equipment is easy to use then this is likely to have a positive impact upon how they deal with customers and potentially reduce perceived barriers to travel. As was potentially expected, the driver view of the equipment has not been entirely positive, which is likely to have had an impact upon the drivers' behaviour whilst working during the trial. There were fairly low levels of smartcard usage and generally drivers did not feel the equipment made their job easier. However, when the technology and the potential benefits of smartcard were discussed during the Focus Group, such as reducing cash handling, more tickets bought off-bus, reducing the amount of interaction required between driver and customer, the reaction was much more positive. Certainly from the questionnaire and the Focus group with the TIC staff, there could be many benefits, including improving customer service, which in turn would reduce the barriers to public transport, to encouraging more off-bus ticket sales. The results for this objective could also inform the DfT objective to improve accessibility of public transport.

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### **Reducing Delays and Improving Reliability**

It was identified in Phase 1 that if the new technology is easier and quicker to operate, then this could have a positive impact upon the reduction in delays and improving the overall reliability. In this report and the Phase 2 Boarding Time Study, increased delays and boarding times have been observed and through both the qualitative and quantitative research it has been observed that the drivers felt that the new technology did not make their lives easier as the ETM was more difficult and time consuming to use (compared to the old one). However, as mentioned above, when it was discussed in more detail, drivers could see the benefit in terms of time and ease of use but only if all buses had the technology (and the reliability was greatly improved) and the number of cards in circulation greatly increased.

### **Reducing Fraud of all types**

Phase 4 has shown a slight decrease in the amount of smartcard fraud experienced by drivers, which is fairly inconclusive. It is assumed that fraud may be harder with smartcards as smartcards could be more difficult to replicate or use in other fraudulent ways as the card communicates directly with the ETM and it is theoretically possible to 'hotlist' a card so that it can no longer be used. Compared to Phase 1, the number of drivers stating that they experienced fraudulent paper ticket use has increased whilst the fraudulent use of smartcards has decreased from Phase 2. The increase in the number of drivers stating that they have experience more fraudulent behaviour may be because they are more aware of it.

During the focus groups, some drivers felt that some drivers do not check for fraudulent tickets as they wish to avoid a confrontation with passengers. With more smartcards in operation, it will be harder to avoid this as the machine identifies an invalid smartcard. Therefore, while fraud may reduce, it is also important to ensure the necessary support tools are in place for drivers to ensure they have the necessary skills to interact with passengers in such circumstances.

### **Business Case**

As mentioned in the Consumer Study, the business case should be considered in terms of hard figures and statistics. However, with smartcards, a lot of the benefits are not as tangible and referred to as 'soft benefits'. In terms of understanding the soft benefits to drivers and TIC staff, this research can demonstrate insight into the perceptions of smartcards and what the equipment users think of them in theory. However, as the trial was not publicised or rolled out as fully as hoped, it has been difficult to truly analyse the benefits in practise as the pilot has had some negative impact upon both the drivers and TIC staff. The technology has been shown to be a little cumbersome, and concerns over, for example, the reliability of the technology, etc, have impacted negatively on the results.

### **Analysing the system performance (DfT b.(2))**

When analysing the overall system performance from the driver and TIC point of view, the results cannot be shown to be that positive. The technology was hampered by reliability issues in the early stages and the staggering of the uptake to the technology meant that some drivers did not get the bed-in time recommended and only took part in certain phases for a much smaller proportion of time than originally planned. This generally has meant that the system performance from the equipment user point of view is likely to be negatively influenced by the pilot itself.

### **An assessment of the Operator and PTE expectations (DfT c.)**

The opinions provided by drivers and TIC staff have been collected but this more from the equipment user point of view rather than the operator or PTE perspective. These opinions can be seen much more clearly in the Citizen card Study (Phase 6), where staff from the operators and PTEs have been interviewed.



# Recommendations

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Recommendations for future work, including methodology and ways of working will be discussed in great detail in the Phase 7 final reports

# Appendix 1

Task	18-24	25-34	35-44	45-59	60 and over	Total
Logging On	0	0	0	0	0	0
Updating Fare Display	0	0	0	0	0	0
Reading ETM Display	1	0	1	1	1	4
Pressing Buttons	0	0	0	1	0	1
Memorising Buttons	0	2	9	7	2	20
Issuing Paper Tickets	0	0	2	0	0	2
Issuing Paper Tickets with Wallet	1	4	5	9	6	25
Changing Ticket Roll	1	2	4	3	1	11
Unjamming Ticket Roll	0	3	3	4	1	11
Scrolling Menus	4	11	27	31	11	84
Validating Smartcards	2	2	1	3	0	8
Processing Smartcards	1	1	2	2	0	6

Figure 10: Perceived Causes of Delay for Drivers Questioned in Phase 4

Phase	N	Median Value
Fraud Frequency Phase 2	128	1.0000
Fraud Frequency Phase 4	189	1.5000

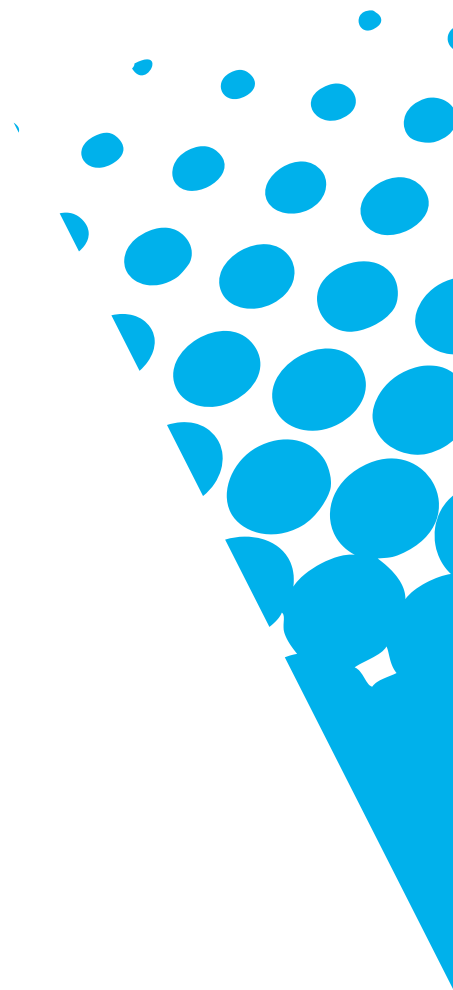
Table 10: Mann-Whitney U Test<sup>ii</sup> on the Decrease in Fraud

Point estimate for (Phase2 – Phase 4)  
is -0.0000  
95.0 Percent CI for (Phase2 – Phase 4)  
is (-0.4999,0.9997)  
W = 20995.0  
Test of (Phase2 = Phase 4) vs (Phase2 >  
Phase 4) is significant at 0.2111

**The test is significant at 0.2059  
(adjusted for ties)**

<sup>ii</sup> A Mann-Whitney U test is used for testing differences between medians when there are two groups and different subjects have been used in each group [Source: NORUSIS, M. J. (2004) SPSS 12.0 Guide to Data Analysis New Jersey, Prentice Hall. p388]







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# Contents

## 1.0 Introduction

## 2.0 Methodology

## 3.0 Results

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Introduction.....	68	2.1 Focus Groups.....	69	3.1 Introduction.....	73
		2.2 On-Street Interview with ..... non-Yorcard Users	70	3.2 Sample Profile.....	73
		2.3 Postal Questionnaire with ..... Yorcard Users	72	3.3 Ticket Types and Purchasing .....	78
				3.4 Public Transport Appeal .....	83
				3.5 Yorcard.....	86

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**4.0 Summary and Conclusions**

**5.0 Recommendations**

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4.1 Results.....	97	Recommendations .....	101
4.2 Limitations .....	99		
4.3 Objectives.....	99		

# Glossary

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**Bus-user-** A participant who predominantly uses bus transport

**Non-User** - A participant who is neither a predominant bus or train user

**Non-Yorcard User** - People interviewed on street as part of the research.

**On-street Questionnaire -**

Questionnaires carried out on-street at a variety of locations in Sheffield along the pilot corridor routes. These questionnaires were carried out as interviews. These participants are referred to non-Yorcard users throughout the report.

**Pay as you Go (PAYGo) card** - This is the only adult cash smartcard. Cash is loaded on to the smartcard at the TIC and users must touch their card to the reader when boarding and alighting to ensure that the right fare is charged to the card. When the cash on the card has run out, more cash can be loaded onto the card.

**Phase 1** - A part of the research programme that ascertained the baseline of primary data

**Pilot Acceptance Criteria** - A number of targets and measurements that have been set prior to the collection of data that will inform business cases and future development of the Yorcard project

**Postal Questionnaire** - Questionnaires sent through the post to targeted Yorcard users. These participants are referred to as Yorcard users throughout the report

**Statistically Significant** - The data is tested in SPSS to determine if there is a difference between different participant profile opinions. If there is, it must be a statistically significant difference and must have a p-value of less than 0.05 (p-values are reported in the text in brackets).

**Train-user** - A participant who predominantly uses train transport

**Yorcard users** - Yorcard users are categorised into 3 age groups:

- 16 and under - free and 40p MegaTravel concessions;
- 17 to 59 – staff, concessions and registered/commercial users;
- 60 and over are ENCTS pass holders in the pilot area

**Yorcard Working Group** - A group of bus and train operator and PTE representatives in place to oversee the production of research outputs ensuring quality and adherence to data sharing requirements

**Touch on Touch off** - This is referred to as ToTo in the report and refers to the process the customer (only compulsory for Pay as you Go customers, for all other smart customers, it was voluntary) must undertake during Phase 4. That is to swipe their card both when boarding and alighting. For clarity the touch on and touch off machines are two different machines. There is only one door and therefore the 'touch on' scanner is placed in the platform entrance near the driver's cab (on the left of the door as passengers board) and the 'touch off' scanner is located within the saloon on the opposite side of the bus (to the right of the door as passengers board).



# Executive Summary

The Yorcard Project is intended to deliver a multi-modal, multi-operator public transport smartcard scheme to be trialled on a certain corridor of buses in Sheffield and on the local train service between Sheffield and Doncaster and intermediate stations.

This report presents the findings from the Phase 4 Consumer Survey. This is the final Consumer Survey Study of the research element of the Yorcard project and the purpose of this was to understand non-Yorcard users' (including public transport users and non-public transport users) and Yorcard users' view on the existing ticketing regimes, how and why people buy certain tickets and overall the appeal of public transport (in this case bus and train).

The smartcard validators at the rail stations were switched off at the end of 2008 as rail was no longer taking part in the Yorcard trial and hence customers could not use smartcards in smart mode on trains during Phase 4. Questions on rail were therefore limited to the on-street interviews and this report analyses these.

In addition, this phase introduced the process of Touch-on Touch-off (ToTo) and this report will analyse and cross check the impact this process has had on Yorcard users.

On-street one-to-one interviews in Sheffield were used to capture opinions from non-Yorcard users, and postal questionnaires were used to capture views from Yorcard users. The sample size collected was 757 responses to the on-street questionnaire (263 non-public transport users and 494 public transport users) and 233 responses to the postal questionnaire (13 non-public transport users, 206 public transport users and 14 non-specified).

This Phase 4 study has enabled the identification of consumer opinions which can be compared with the baseline measurements, which were carried out in Phase 1 before the implementation of the Yorcard pilot. The key findings from this Phase 4 study are presented below:

## Focus Groups

- Bus users feel ticketing is complex with many different fares available and some felt that ToTo could help if it were automatic and worked properly. Many of the participants felt that Touch-on only was more appealing.
- Concessionaires felt that ToTo was an unnecessary hassle, which could ultimately be dangerous if the passenger has mobility issues as they have to touch-off when alighting from a bus (which may be travelling slowly or coming to a stop) whilst also carrying bags, shopping trolleys etc. Or the passenger relies on a walking stick, which can also have mobility implications for them when alighting.
- Rail and non-users see the benefit of ToTo where there are controlled entry and exit points but do not understand how this would work on a bus. The issue of 'Big Brother' was raised by this group and it was suggested that investment in the service rather than the ticketing technology would be more appealing.
- School children felt that the relationship and interaction with the driver needed to be improved. The main benefit of smartcards cited by the children was providing them with the ability to prove they were eligible for child fares without having to discuss with the drivers. Again Touch-on only was preferred by this group as the idea of touching off was not well understood.

- Yorcard users felt again that ticketing and fares were difficult to understand and more information about tickets and smartcards would be welcome, including how to load products onto cards. These participants could understand the merits of ToTo given the fare structure, however, felt that touch on only would be far simpler but the technology must work if it is to make public transport more appealing.

## Sample

- There are slight differences in the behaviour of the Phase 4 sample compared to the Phase 1 and 3 samples, however, overall the samples are similar, in both Phase 1 and 4, the non-Yorcard users made more journeys than the Yorcard users as more Yorcard users are concessionaires who travel less frequently than commuters.
- The main reason for bus journeys made by non-Yorcard users were work, education and shopping and by Yorcard users were work, shopping and leisure, respectively.
- The main cause of delay overall is seen to be lots of people boarding. However, under 16s stated that people not having their money ready was the main cause.
- The majority of Yorcard users who carried out the postal survey were ENCTS or PAYGo cardholders.

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### **Ticket Types and Purchasing**

- More tickets are bought on the bus by both Yorcard and non-Yorcard users than off bus sales at other retail outlets. This suggests that the Yorcard users are not necessarily using their Yorcard as it is not possible to buy a Yorcard onboard a bus or they are describing their previous ticket. Equally, if more tickets were available off bus, this could reduce the boarding time at each stop as cash-handling would be reduced.
- The majority of non-Yorcard users bought return tickets and period tickets whilst the majority of Yorcard users who were required to pay for their journey bought single tickets and/or paid 40p concessionary fares.
- For the majority of participants, the tickets they choose are dependent upon value and convenience. Therefore, as with Phase 1, if Yorcard is to appeal to consumers it is vital that the tickets they purchase are convenient to buy and to use and offer them the best value.
- For each statement about ticketing, a higher percentage of non-Yorcard users have chosen the most positive response. Yorcard users' responses are also positive but not as much as non-Yorcard users. This is likely to be because there have been some bedding-in issues with the Yorcard system, which resulted in some of the equipment being unreliable, including at the time of survey. Also, it was noted that the TravelMaster was more cumbersome to use as it also required a paper counterpart.

- Yorcard users stated their preferred location for more information about fares and tickets was at bus stops. Non-Yorcard public transport users stated they would like this information online. Also, fewer Yorcard users claimed that they did not need more information about fares and tickets than non-Yorcard users. These findings are likely to be due to the fact that the majority of Yorcard users (88.4%) are bus users whilst the split among non-Yorcard public transport users was more even between bus users and train users.

### **Public Transport Appeal**

- The majority of non-Yorcard users did not think that public transport would be more appealing to them 'if it was easier to pay for tickets'
- Just about half of non-Yorcard users aged 16 and under believed that public transport would be more appealing 'if the tickets were more secure' whilst the majority of those aged 17 and above did not think so.
- The majority of non-Yorcard users aged 16 and under thought that 'if boarding the bus could be made quicker' than they currently experience, public transport would appear to be more appealing to them, whilst the majority of those aged 17 and above did not think so.
- The majority of Yorcard users 'disagree' or 'strongly disagree' that 'if all the buses were equipped with a Touch-on Touch-off system which automatically calculates your fare' it would make public transport more appealing. In general, the younger the Yorcard users are, the more positive they are about the potential benefits of smart ticketing.

### **Yorcard**

- Compared to Phase 1, the awareness of Yorcard has increased dramatically from 5.5% to 20.2% among non-Yorcard users. The highest level of awareness of Yorcard was among bus users at 10%, with 5% of non public transport users also aware of Yorcard.
- Over three-quarters of responses in both the 22-59 and 60 and over age categories found their smartcards 'easy' or 'very easy' to use.
- Of those who had used the website, the majority found it 'easy' or 'very easy' to use. (The website provided customers with information about the Yorcard scheme but did not provide any interactive services such as loading travel credit onto their smartcard.)
- Nearly 5% of responses stated that they have had to exchange their smartcard due to a fault and the majority of users (75%) have not used the help service. Of those who have used the help service, the majority (80% for Helpline and 70% for TIC) rated it as 'good' or 'very good', which is more positive than in Phase 3.
- 12 Yorcard users (5%) had increased the number of journeys as a result of having a smartcard. This equates to an extra 0.2 journeys per week per person surveyed, which is in line with Phase 3. As the absolute number of usable responses was low, it is suggested that any business case for the introduction of smartcards should not be based solely on these figures. The main reason given for making more journeys, was 'it is really easy to use'. However, the average number of journeys made per week by Yorcard users is less than non-users both in Phase 1 and 3.

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- There were mixed responses to the statement 'the Smartcard reader Always works' and this was the only statement to also receive a notable proportion of 'strongly disagree' responses.
  - For touch-off operations, the 'Smartcard Reader Well Placed' received an equal proportion of 'Strongly Agree' and 'Agree' responses, suggesting that this reader is well placed in the vehicles.
  - Overall opinions on combining Touch-on and Touch-off were mixed, slightly more respondents stated that having both operations would make public transport travel more appealing to them. However, the majority of respondents, including PAYGo customers, when presented with a short list of options would prefer to have Touch-on only. Only those customers who had a PAYGo card, always had to Touch-on and Touch-off.
  - As with Phase 3, the majority of respondents said they would recommend smartcards to friends and family.

# Introduction

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Introductory details including background, objectives and Pilot Acceptance Criteria can be found in the General Reference Document. As with the Phase 1 report, this document will address both the relevant Yorcard and DfT objectives, and the Pilot Acceptance Criteria in the conclusion.

Again, there were some issues during the phase regarding the reliability of the equipment. As a result this may have affected some of the responses and opinions of the participants and the results captured in this Phase 4 study.

# Methodology

## 2.1 Focus Groups

This section presents the outline methodology as recommended in the approved Open System Phase – Consumer Survey Stage Plan (reference YC-IGO-RES-305). The recommendation was to use focus groups in the first instance to aid the design of a questionnaire and obtain qualitative data. The questionnaire was conducted as a combination of postal questionnaires for Yorcard users and one-to-one on-street interviews for non-Yorcard users using trained interviewers within the immediate geographical area of the pilot services.

During this Phase questions relating to ToTo were introduced to the postal questionnaire to probe Yorcard users on their experience and opinions of the ToTo process. Aside from these additions to the postal questionnaire, both questionnaires followed the same format and the questions that are used in the baseline Phase of the research were retained, except for reasonable amendments based upon recommendations from Phase 1 and 3. The details of this can be found in the Phase 1 and 3 Consumer Report.

The use of focus groups was continued for consistency and to ensure that the design process for the final questionnaire, as discussed in detail in the Phase 1 report, was complete. Seven focus groups of 6-12 participants were conducted and segmented into 5 groups as detailed below:

- Bus Users (10)
- Concessionary Pass Holders (11)
- Rail and Non-users (10)
- School children (2 separate focus groups, 24 in total)
- Yorcard users (2 separate focus groups, 16 in total)

All focus groups, apart from the School Children, were carried out in August, ahead of the on-street questionnaires. The Focus groups with school children were carried out in October as it was not possible to go into the school at the very beginning of the new academic year. This had little impact upon the design process and has enabled qualitative data to be collected about non-Yorcard users under the age of 16.

Candidates for the focus group work were canvassed at the same locations as in previous phases and the groups were run at convenient locations within the geographical pilot area. There were a mix of male and females, and different social groups. An incentive of £30 was offered to all adult participants in the focus group work.

Generally, as in other phases, the focus groups were able to confirm that the questionnaire addressed the necessary points as raised in the Pilot Acceptance Criteria and the methodology plan for this Phase. The focus groups in Phase 4 allowed for more in-depth discussion about the attractiveness of public transport, the advantages and disadvantages of Touch-on and Touch-off ticketing operations.

It also allowed for a greater understanding on the use of Yorcard and the benefits and problems currently being experienced by participants. The results from the focus groups conclude that:

Bus users found using public transport highly convenient, but current ticketing arrangements were far too complicated (different fares for different operators). These users felt that ToTo would be useful if it automatically calculates the cheapest fare and could save time “if it works properly”, but the majority of participants did not believe this was the case with the current equipment. A Touch-on only system was preferred as it was felt that having to Touch-on and Touch-off overly complicated matters, especially if they had heavy shopping, were travelling with children, or if they forgot to Touch-off.

Concessionary pass holders also found public transport highly convenient, but for these users, ticketing was generally free, a lot simpler and easy to understand as they only needed to produce their pass when boarding. With respect to ToTo operations, none of the Concessionary pass holders could see any benefits to them, particularly as they received free travel, and the procedure of Touching-off when alighting could cause delays, and may even be dangerous to those with poorer mobility issues, who were trying to Touch-off whilst the bus was in motion and managing their bags and use a walking stick to support themselves. No one from this group felt that ToTo operations would make public transport more attractive.

## 2.2 On-Street Interview with non-Yorcard users

For rail and non-public transport users, the key attributes of public transport were the flexibility of services and not having to pay for parking in City Centres. A lack of knowledge about ticketing and fares (different tickets for individual operators, level of fares, lack of knowledge as to how ticketing works) was the key disincentive to public transport use. For rail users, ToTo ticketing works where there are controlled entry and exit points (at platforms), but participants suggested this would not be as applicable to bus travel, where it would be easy to forget to Touch-off when alighting. Issues of security was also important for non-users – the “Big Brother” effect of knowing your every move – “by touching on and off, someone somewhere knows where you’ve been”. One non-user suggested that investment should be spent on improving the bus services instead of smartcard technology as paying with cash worked – “If it ain’t [sic] broke, don’t fix it!”

For school children, not having to walk everywhere was the key attraction about public transport and it gave them a sense of independence by not having to rely on their parents all the time. Most felt that services could be improved, in particular, relationships and interactions with drivers when buying tickets. Ticketing and fares were not so much of an issue, but proving their eligibility for child fares (especially those near the age limit) was difficult, with some drivers refusing to issue them with a child fare. Smartcard ticketing was appealing if it would help alleviate some of these problems by confirming electronically their entitlement to certain fares.

There were concerns with what would happen if your card was lost or stolen, and what they would need to do to get a new card issued. ToTo operations were welcomed with some caution as they would be useful in understanding fares, but having to Touch-off on a busy bus could cause delays and the question of how much they would have to pay if they forgot to Touch-off was a significant issue. Overall, Touch-on ticketing, particularly PAYGo cards, were the preferred solution.

For Yorcard users, the key attraction about public transport was the convenience compared to car travel and City Centre parking, but again, fares and ticketing were deemed to be too complicated and confusing. Better and sustained information about ticketing and smartcards would help users to understand how the system worked, how to load tickets or top-up credits on PAYGo cards, and generally what to do when the system did not work properly, especially as some users felt they did not receive enough supporting information once they had their smartcard. Yorcard users could see the benefits of ToTo ticketing given the current pricing structures between operators, but felt that a flat-fare system which only required them to Touch-on only might be a better solution. This would also alleviate the problem of having to fight their way towards the Touch-off scanner during busy periods. Encouragingly, these users saw the potential in smartcard ticketing in the future, and would recommend them to their family and friends if the scheme was available on more services. However, the current technological flaws in the equipment provided for the pilot made them less confident that public transport travel could be made more attractive.

As in Phases 2 and 3, the on-street interviews were conducted with people who did not use Yorcard and will be referred to as ‘non-Yorcard users’ for the remainder of this report. The draft questionnaire was tested using feedback from the participants of the focus groups. This test was used to identify any gaps in the questionnaire, irrelevant questions and strange wording. The questionnaire used was approved by the Yorcard Working Group.

The questionnaire was structured in the following order:

- Section A: Details the users’ personal attributes (for all)
- Section B: Questions designed to elicit the participant’s use of buses (for bus-users only)
- Section C: Questions designed to elicit the participant’s use of train (for train-users only)
- Section D: Questions regarding opinions of ticket types and purchasing (for public transport users only)
- Section E: Questions designed to elicit the participant’s use of other transport modes (for non-users only)
- Section F: Questions regarding public transport appeal (for all)
- Section G: Awareness of Yorcard

The on-street interview for Phase 4 took place over a 6-day period, including both week days and weekends, in late September 2009 at times between 8am and 7pm. Interviews with school children took place on one day in late October at a school outside of the operational period of the Yorcard pilot. All the data has now been collected, entered into a database and cleaned for data coding errors and inconsistencies.

The total number of questionnaires collected was 757. Table 1 demonstrates the segmentation of participants against the initial plan stated in the methodology document (YC-IGO-RES-305). It can be seen in Table 1 that the expected numbers of participants was attained.

Age	Type of User	Sex	The expected No. of participants	The sample
16 and under 8.20%	Bus user	M	15	16
	Bus user	F	15	18
	Non-public transport users	M	15	11
	Non-public transport users	F	15	15
<b>TOTAL &lt;16</b>			<b>60</b>	<b>60</b>
17-21 9.30%	Bus user	M	12	17
	Bus user	F	12	13
	Train user	M	12	12
	Train user	F	12	12
	Non-public transport users	M	12	12
	Non-public transport users	F	12	12
<b>TOTAL 17-21</b>			<b>72</b>	<b>78</b>
17-59 58.00%	Bus user	M	71	69
	Bus user	F	71	67
	Train user	M	71	74
	Train user	F	71	72
	Non-public transport users	M	71	76
	Non-public transport users	F	71	72
<b>TOTAL 22 - 59</b>			<b>426</b>	<b>430</b>
60+ 24.50%	Bus user	M	30	31
	Bus user	F	30	34
	Train user	M	30	29
	Train user	F	30	30
	Non-public transport users	M	30	34
	Non-public transport users	F	30	31
<b>TOTAL 60+</b>			<b>180</b>	<b>189</b>
<b>TOTAL SAMPLE</b>			<b>738</b>	<b>757</b>

Table 1: Sample of participants (non-Yorcard users) for the On-street Consumer Questionnaire (Note: participants are categorised by their dominant transport mode).

## 2.3 Postal Questionnaire with Yorcard users

Postal questionnaires were distributed to the users of Yorcard and will be referred to as 'Yorcard user' for the remainder of this report. In Phase 3 both rail and bus users were sent postal questionnaires. In Phase 4, rail did not participate in the trial and therefore, rail users have not been included in this research. The draft questionnaire was tested using feedback from the participants of the focus groups. As with the on-street questionnaire, this test was used to identify any gaps in the questionnaire, irrelevant questions and strange wording. The questionnaire used and approved by the Yorcard Working Group.

The questionnaire was structured in the following order:

Section A: Questions designed to elicit the participant's use of buses (for bus-users only)

Section B: Questions regarding opinions of ticket types and purchasing (for public transport users only)

Section C :Questions regarding public transport appeal (for all)

Section D: Questions designed to elicit the participant's experience of using Smartcards on public transport (smartcard users only)

Section E: Questions designed to elicit the participant's experience of using smartcards on buses (users who use smartcards on bus journeys only)

Section F: Details the users' personal attributes (for all)

Overall, 812 questionnaires were sent to smartcard users split into the following age brackets:

- 389 to those aged 17-59; and
- 423 to those aged 60 and older.

In total, 233 completed questionnaires were collected resulting in a response rate of 28.7%. The vast majority of participants (206) travelled by bus in the past month with only 13 did not and 9 out of 13 were concessions. 14 participants did not specify whether they travelled by bus in the past month. People aged 60 and older are eligible for free bus travel. Almost half of the respondents were aged 60 and above. Table 2 demonstrates the segmentation of participants.

Age	Type of User	Sex	The sample
17-21	Bus user	M	6
	Bus user	F	6
	non-bus user	M	0
	non-bus user	F	0
<b>TOTAL 17 - 21</b>			<b>12</b>
22-59	Bus user	M	38
	Bus user	F	57
	non-bus user	M	2
	non-bus user	F	2
<b>TOTAL 22-59</b>			<b>99</b>
60+	Bus user	M	52
	Bus user	F	47
	non-bus user	M	2
	non-bus user	F	7
<b>TOTAL 60+</b>			<b>108</b>
<b>Non-specified</b>			<b>14</b>
<b>TOTAL SAMPLE</b>			<b>233</b>

Table 2: Sample of participants for the Postal Consumer Questionnaire



# Results

## 3.1 Introduction

The reporting of the results will be presented in the following sections: Sample Profile; Ticket Types and Purchasing; Public Transport Appeal; and Yorcard. Sample size will present the profile of the participants; age, sex, postcode, occupation and type of transport used. The Ticket Types and Purchasing, and public transport appeal sections will present the resulting responses taking into account the differences in the sample for each question. The Yorcard section will be presented in a similar manner. However, only Yorcard users have answered the user experience questions (sections D, E and F in the postal questionnaire). This section also presents the awareness of Yorcard by non-Yorcard users.

## 3.2 Sample Profile

Among the 757 on-street questionnaires completed by non-Yorcard users, there were 50.5% male and 49.5% female. Among the 233 postal questionnaires completed by Yorcard users, there were 45.5% male, 51.1% female and 3.4% did not specify. The age distribution for 16 and under, 17-21, 22-59 and 60+ is displayed in Table 3 which demonstrates that the sample of non-Yorcard users is reasonably representative of the population distribution in Sheffield whilst the sample of Yorcard users contains a lower percentage of people aged 60+ but a higher percentage of people aged 17-59, which is not a representative of the population of Yorcard users in Sheffield. The sample of Yorcard users contains a slightly lower percentage of people aged 60+ and a slightly higher percentage of people aged 17-59, which is about a representative of the population of Yorcard users in Sheffield for people aged 17 and over.

Age	Sample of Non-Yorcard Users	Population in Sheffield (2006 Census)	Age	Sample of Yorcard Users	Yorcard Users in Sheffield
16 and under	7.9%	8.2%	16 and under	Not surveyed	10.7% (school up to 18)
17-21	10.3%	9.3%	17-21	5.2%	44.4% (all commercial tickets and staff)
22-59	57.0%	58.0%	22-59	43.3%	
60 and over	24.8	24.5%	60 and over	47.6%	44.9% (ENCTS)
Non-specified	n/a	n/a	Non-specified	3.9%	n/a
<b>Total</b>	<b>757</b>	<b>513,234</b>	<b>Total</b>	<b>233</b>	<b>4514</b>

Table 3: Percentage distribution of age groups collected.

### Work Status

In order to determine the diversity of the sample, the occupation of each participant was also collected which is consistent on the sample of Phase 1. With the exception of a minority of consumers, participants were happy to provide this information and this sample is displayed in Table 4.

### Type of Transport Users and Profile

In the survey conducted with non-Yorcard users, participants were invited to give the postcode of their home address. Postcode information is considered quite contentious in terms of privacy infringement and as a result 108 participants were not willing to provide this information (14.3%), which is higher than that in Phase 1 (10.7%). It is known that the sample of non-Yorcard users were from a wide range of locations since only 20.2% of them were from the Sheffield pilot corridor. Of the other participants, 57.5% were from the surrounding areas of Sheffield (those with a non-pilot corridor Sheffield postcode), and 22.3% were from a variety of other towns and cities around the UK (non-Sheffield postcodes).

The sample of non-Yorcard users based on the type of transport used is shown in Table 5. This table shows that more bus users were from Sheffield and more train users and non-users interviewed were from elsewhere.

As mentioned earlier train operators did not participate in Phase 4, Yorcard users were only questioned whether or not they had travelled by bus in the past month. 91.4% of the participants from this sample are therefore categorised as bus users, 3.4% as non-bus users whilst 5.2% did not provide a valid response (see Table 6).

Work Status	Non-Yorcard User	Yorcard User
Employee in full time work (30+hours)	33.7%	25.8%
Employee in part time work (<30hours)	9.6%	8.1%
Self employed (full or part time)	1.6%	5.1%
Unemployed and available for work	5.5%	5.6%
Wholly retired from work	19.6%	34.8%
In full time education at school, college or university	26.4%	3.9%
Others (on government train programme, permanently sick or disabled, looking after the home or volunteer, etc.)	1.2%	5.1%
Did not provide work status	2.4%	11.6%
<b>Total</b>	<b>757</b>	<b>233</b>

Table 4: Percentage distribution of participants' occupation

Type of Transport Users	Live In Sheffield	Live Outside Sheffield	Postcode not provided
Bus user (%)	38.4% (167)	19.2% (41)	24.1% (26)
Train user (%)	23.9% (104)	38.3% (82)	38.9% (42)
Non-public transport user (%)	37.7% (164)	42.5% (91)	37.0% (40)
<b>Total</b>	<b>435</b>	<b>214</b>	<b>108</b>

Table 5: Non-Yorcard users - Percentage distribution of transport type used against origin (n=757)

Type of Transport Users	Percentage
Bus user (%)	91.4%
Non-bus user (%)	3.4%
Not specified	5.2%
<b>Total</b>	<b>233</b>

Table 6: Yorcard users' use of bus in the past month

Sections B and C of the on-street interview questionnaire (for non-Yorcard users) and Section A of the postal questionnaires (for Yorcard users) were used to ask participants how they had travelled by a specific mode of transport in the past month with an aim to build up a profile of the participants. Participants were asked to describe their main purpose for using this mode and how often they travelled for this purpose in a typical week.

The main purposes of bus journeys for non-Yorcard users were work (35.1%), education (20.7%) and shopping (15.9%) (see Figure 1). These findings are in common with the findings from Phase 1. Bear in mind that Yorcard users aged 16 and under did not participate in Phase 4, the main purposes of bus journeys for Yorcard users were work (34.7%), shopping (30.1%) and leisure (17.3%) (see Figure 2), which are different from non-Yorcard users and those Yorcard users surveyed in Phase 3.

The main purposes of train journeys for non-Yorcard users were work (31.4%), visiting family or friends (26.1%) and leisure (21.1%) (see Figure 3), which is about the same as the findings from Phase 1 with a slightly different order of the top 2 purposes.

**Journey purpose vs Journey frequency**

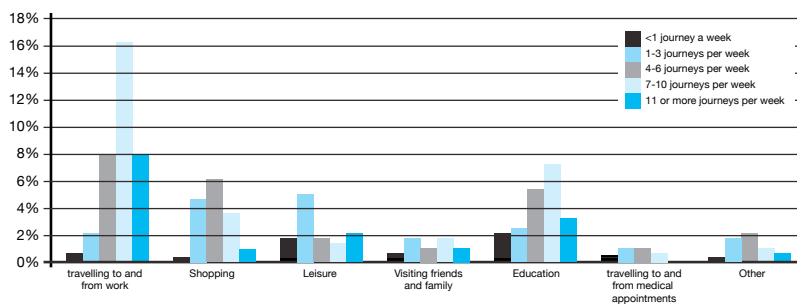


Figure 1: Non-Yorcard users who have travelled by bus in the past month – journey purpose vs. number of journeys per week (n=276)

**Journey purpose vs Journey frequency**

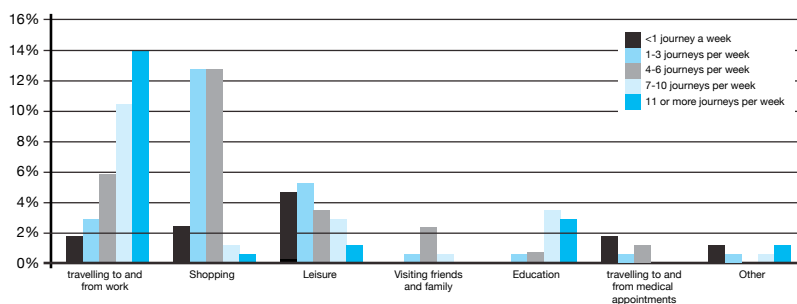


Figure 2: Yorcard users who have travelled by bus in the past month – journey purpose vs. number of journeys per week (n=278)

**Journey purpose vs Journey frequency**

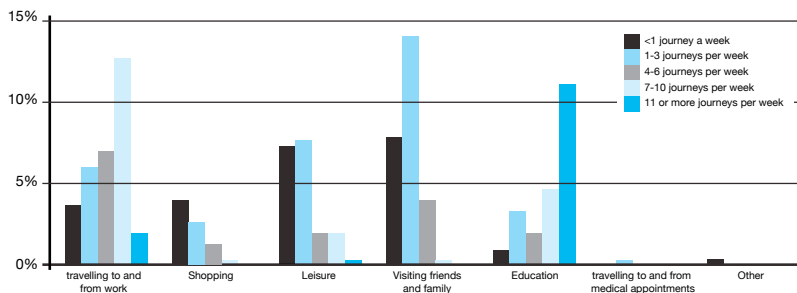


Figure 3: Non-Yorcard users who have travelled by train in the past month – journey purpose vs. number of journeys per week (n=299)

Main cause of the delay	16 and under	17-21		22-59		60+	
	non-Yorcard user	non-Yorcard user	Yorcard user	non-Yorcard user	Yorcard user	non-Yorcard user	Yorcard user
People paying with notes	8%	23%	0%	15%	20%	12%	5%
Lots of people boarding	20%	31%	45%	31%	40%	40%	44%
People not having their money ready	51%	20%	36%	29%	35%	30%	44%
Long conversations with the driver	22%	26%	18%	25%	5%	18%	7%
Total number of responses	51	35	11	153	84	67	91

Table 7: Main cause of delay when getting on the bus

Both non-Yorcard users and Yorcard users who had travelled by bus in the past month were asked to state what they consider to be the main causes of delay from a selection of possible causes. Table 7 shows a cross tabulation of the main cause of delay against age. Responses from participants aged 16 and under were significantly different from those aged 17 and above. The main cause of delay for this age group was 'people not having their money ready'. It is understood that participants aged 16 and under travelled by dedicated school buses much more often than public buses and either travel for free or pay a flat fare (40p). Hence they would less often encounter the situation of 'people paying with notes' compared to participants aged 17 and above. Responses from participants aged 17 and above are in line with those in Phase 1.

How many journeys do you usually make every week	Bus			Train	
	Non-Yorcard User		Yorcard User	Non-Yorcard User	
	Phase 1	Phase 4		Phase 1	Phase 4
<1 journey a week	8.9%	5.8%	10.2%	49.1%	24.1%
1-3 journeys per week	24.2%	18.2%	26.7%	30.5%	35.4%
4-6 journeys per week	20.6%	26.5%	27.6%	12.6%	17.4%
7-10 journeys per week	18.8%	33.2%	15.6%	6.0%	20.6%
11 or more journeys per week	27.6%	16.3%	20.0%	1.8%	2.6%
Total number of responses	384	313	225	167	311

Table 8: Frequency of journeys usually made per week

Table 8 shows that non-Yorcard users in Phase 4 have made more frequent journeys by both bus and train than those in Phase 1. It also shows that although more Yorcard users made less than 1 journey per week than non-Yorcard users in Phase 4, there are more Yorcard users making 11 or more journeys per week than non-Yorcard users.

Further examination reveals that:

- the average number of bus journeys made by each participant in a week was 6.2 in Phase 1 and 6.3 in Phase 4 by non-Yorcard users, and 5.5 in Phase 4 by Yorcard users;
- the average number of train journeys made by each participant in a week was 2.2 in Phase 1 and 3.7 in Phase 4 by non-Yorcard users.

The findings indicate that non-Yorcard users in both Phases 1 and 4 have made more journeys than Yorcard users. This is because that the majority of Yorcard users are senior and disabled concessionary pass holders who normally make fewer journeys than commuters. Examinations of the stated journey frequencies by non-Yorcard users proves that those with a concessionary pass do make fewer bus and train journeys per week than those without a concessionary pass (see Table 9). In addition a significant number of the Yorcard users were holders of the PayGo card whose target audience was the infrequent adult user of smart pilot bus routes.

Journey	With a concessionary pass	Without a concessionary pass
Bus journeys per week	6.1 (n=117)	6.6 (n=180)
Train journeys per week	3.3 (n=82)	3.8 (n=222)

Table 9. Comparisons of average bus/train journeys per week between concessionary pass holders and non-concessionary pass travellers

Null Hypothesis		Bus Travel
Aged 17-21	Difference between Yorcard users and non-Yorcard users	P=0.880
Aged 22-59	Difference between Yorcard users and non-Yorcard users	P=0.152
Aged 60+	Difference between Yorcard users and non-Yorcard users	P=0.007*

Table 10: Summary of null hypotheses and statistical tests (\* Difference is significant at the 5% level.)

A 2-tailed Mann-Whitney U test<sup>ii</sup> has been conducted to examine the null hypotheses that, for the 3 older age groups (17-21, 22-59 and 60+), Yorcard users and non-Yorcard users do not differ from each other in terms of travelling by bus. The results indicate that:

- For those aged 17-21, Yorcard users and non-Yorcard users do not differ from each other at the 5% level for travelling by buses (p=0.880, Table 10);
- For those aged 22-59, Yorcard users and non-Yorcard users do not differ from each other at the 5% level for travelling by buses (p=0.152, see Table 10); and
- For those aged 60+, Yorcard users and non-Yorcard users differ from each other significantly at the 5% level for travelling by buses (p=0.007, Table 10)

<sup>i</sup> 16 non-Yorcard users did not specify whether or not they had a concessionary pass.

<sup>ii</sup> A Mann-Whitney U test is used for testing differences between means when there are two groups and different subjects have been used in each group [Source: NORUSIS, M. J. (2004) SPSS 12.0 Guide to Data Analysis New Jersey, Prentice Hall. p388]

### 3.3 Ticket Types and Purchasing

In this section, participants were asked about how they bought tickets for their predominant mode of transport and are segmented into two groups according to their predominant mode: bus-users and train-users. A certain level of use and knowledge about tickets was required to answer the questions.

#### Ticket Types

Tables 11 and 12 present the types of tickets used by bus users and where the tickets were bought. The vast majority of bus tickets were bought on the bus with a very small amount of tickets bought in TICs, regardless of whether the user had a Yorcard or not. Just under 30% of non-Yorcard users and 40% of Yorcard users bought their weekly, monthly or longer period tickets either in the TIC or on the internet (as specified by the respondents). These findings are consistent with Phase 1 when it was recorded that almost all tickets were also bought on bus. This suggests that if the number of tickets sold on the bus is reduced due to the introduction of Yorcard, it could have a positive impact upon the dwell time at each bus stop, and thus the journey time, as fewer cash transactions are taking place.

To achieve this, as stated in Phase 3 Consumer Study report, Yorcard users should be able to store money onto the smartcard and pay by Yorcard rather than by cash. Although this function was available, there was no reduction in the number of people buying tickets with cash on the bus. Monitoring the number of ticket sales on the bus throughout will enable a record of effects on journey time to be kept which is in line with the Pilot Acceptance Criteria.

Type of Ticket	Where do you usually buy your ticket from?			
	On the Bus	TIC	Other	Total
Single	100.0%	N/A	N/A	58
40p concessionary pass	100.0%	N/A	N/A	4
Return or day ticket	97.8%	0.0%	2.2%	45
Weekly, monthly or longer period ticket	70.2%	21.1%	8.8%	57

Table 11: Non-Yorcard users whose predominant mode is bus (n=164)

Type of Ticket	Where do you usually buy your ticket from?			
	On the Bus	TIC	Other	Total
Single	100.0%	N/A	N/A	49
40p concessionary pass	100.0%	N/A	N/A	12
Return or day ticket	96.2%	3.8%	0.0%	26
Weekly, monthly or longer period ticket	60.5%	28.9%	10.5%	38

Table 12: Yorcard users whose predominant mode is bus (n=125)<sup>iii</sup>

Type of Ticket	Where do you usually buy your ticket from?				
	On the train	TIC	Railway station	Other	Total
Single	11.8%	0.0%	52.9%	35.3%	34
Return or day ticket	16.3%	0.8%	68.3%	14.6%	123
Weekly, monthly or longer period ticket	11.8% <sup>iv</sup>	2.9%	73.5%	11.8%	34

Table 13: Non-Yorcard users whose dominant mode is train (n=191)

Table 13 shows that the majority of non-Yorcard train-users bought their tickets on the train. The Internet was the second favourite means of buying single tickets and return or day tickets whilst TIC was the second favourite means of buying period tickets. In the case of the tickets purchased at the TIC's these are believed to be the TravelMaster products which are multi-modal as the TIC's do not sell rail only products.

<sup>iii</sup> It is not possible to buy Yorcard tickets on the bus therefore, it is assumed that the respondents are describing their previous ticket

<sup>iv</sup> Monthly and longer period tickets cannot be bought on the train, therefore these respondents must have bought weekly passes

Figure 4 demonstrates that the majority of non-Yorcard users bought return tickets and period tickets whilst the majority of Yorcard users who were required to purchase a ticket, bought single tickets and/or paid 40p concessionary fares. There is a slight variation in the tickets purchased and the origin of the participant.

#### Reason for Ticket Type Purchase

Non-Yorcard PT users and all Yorcard users were asked where they usually bought their PT tickets (Table 14) and the reasons for buying their chosen tickets. There were 41 non-Yorcard users and 4 Yorcard users who specified that they used 'other' ways to buy their tickets but did not provide any details.

In terms of the reasons for buying their chosen ticket, each participant could have more than one reason. Hence the total numbers in Tables 15A and 15B do not mean the amount of people but the frequency of that specific reason being chosen by participants. For the majority of participants, the tickets they choose are dependent upon value and convenience. Therefore, as with Phase 1, if Yorcard is to appeal to consumers it is vital that the tickets they purchase are convenient to buy and to use and offer them the best value.

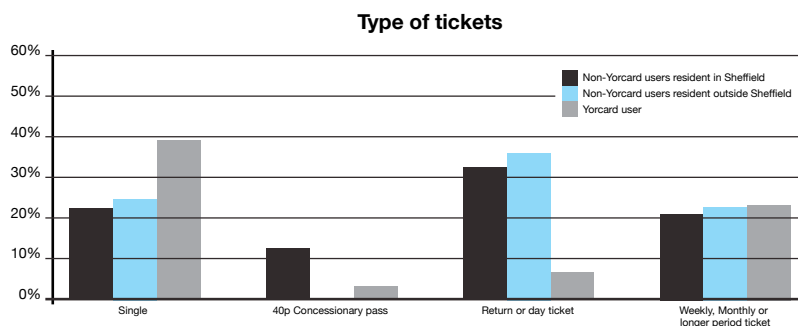


Figure 4: Type of ticket usually used by various participants (n=491)

Where do you usually buy your ticket from?	Non-Yorcard User	Where do you usually buy your ticket from?	Yorcard User
On the bus	182	On the bus	120
Railway station	129		
TIC	17	TIC	12
On train	38	Internet	1
Other	41	Other	4
<b>Total</b>	<b>407</b>	<b>Total</b>	<b>137</b>

Table14. Where do you usually buy your ticket from?

Three statements were used to understand why participants chose to buy their tickets in a certain way: 'I find it easy to buy tickets', 'I find it convenient to buy tickets' and 'the tickets available are easy to use'. Figures 5 and 6 demonstrate the respective responses of non-Yorcard users and Yorcard users for each of the questions.

For each statement, a higher percentage of non-Yorcard users have chosen the most positive response. Yorcard users' responses are also positive but not as much as non-Yorcard users. This is likely to be because there have been some bedding-in issues with the Yorcard system, which resulted in some of the equipment being unreliable prior to the time of this survey and this may have had an impact on their response on ease of use.

How do you decide which ticket to buy?	On the Bus	Railway station	TIC	On the Train	Other
Convenience	40.0%	37.3%	42.1%	57.1%	32.5%
unsure when returning	4.8%	8.5%	0.0%	2.4%	2.5%
It's the best value for the travelling I do	44.8%	52.9%	47.4%	31.0%	50.0%
I don't know what other tickets are available	4.3%	1.3%	0.0%	2.4%	0.0%
I use more than one operator	2.9%	0.0%	0.0%	0.0%	0.0%
I use a concessionary pass	3.3%	0.0%	10.5%	7.1%	15.0%
<b>TOTAL</b>	<b>210</b>	<b>153</b>	<b>19</b>	<b>42</b>	<b>40</b>

Table 15A: How did non-Yorcard users decide which ticket to buy and where to buy? (n=464)

How do you decide which ticket to buy?	On the Bus	TIC	Internet	Other
Convenience	27.5%	5.9%	100.0%	28.6%
unsure when returning	7.5%	0.0%	0.0%	0.0%
It's the best value for the travelling I do	41.3%	47.1%	0.0%	57.1%
I don't know what other tickets are available	4.4%	0.0%	0.0%	0.0%
I use more than one operator	13.1%	47.1%	0.0%	14.3%
I use a concessionary pass	6.3%	0.0%	0.0%	0.0%
Other	27.5%	5.9%	100.0%	28.6%
<b>TOTAL</b>	<b>160</b>	<b>17</b>	<b>1</b>	<b>7</b>

Table 15B: How did Yorcard users decide which ticket to buy and where to buy? (n=185)



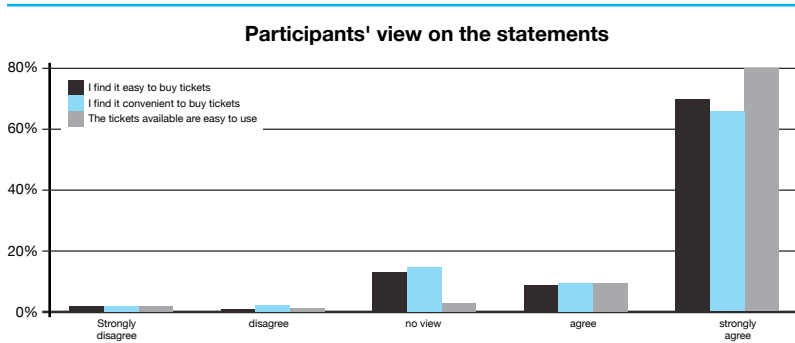


Figure 5: Non-Yorcard users' view on the statements

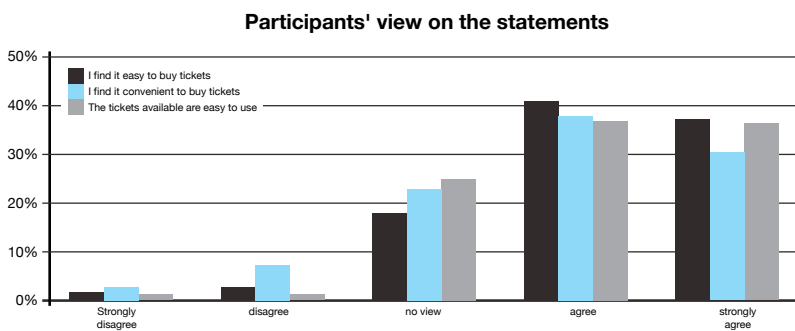


Figure 6: Yorcard users' view on the statements

### Ticket Information Source

The results of where participants would like to get more information about fares and tickets are shown by Figure 7. As each participant could have more than one option, the total number does not mean the amount of people but the frequency of that specific option being chosen by participants. Out of 757 Non-Yorcard users, 650 valid responses were received whilst out of 233 Yorcard users, 644 were received. Note Non -Yorcard users who said they did not travel by bus or train were not asked this question. Therefore the Non-Yorcard users in Figure 7 are also all bus and or train users.

The most popular information source chosen by non-Yorcard users was 'internet'. The most popular choices by Yorcard users are 'at the bus stops' and 'advert on buses'. Given that the vast majority of Yorcard users (88.4%) were bus users it is perhaps not surprising that bus stops and buses are seen as preferred places for this information to be displayed. About a quarter of non-Yorcard users stated that they did not need any more information whilst only 1.2% of Yorcard users made the same statement. This seems to indicate that more Yorcard users want more information about fares and tickets than non-Yorcard users. However, bear in mind that 88.4% of the Yorcard users were bus users whilst only 35% of the non-Yorcard users were bus users, which may suggest that bus users want more information about fares and tickets than other transport users.

Comparison of non-Yorcard users' responses indicates that more participants from Phase 4 preferred to get more information on fares and tickets 'at the bus stop' and 'the internet' than those from Phase 1. In general, more participants from Phase 4 stated that they had enough information than those from Phase 1 (see Figure 8). It is worth pointing out that only 5 options were given in Phase 1, which were 'at the bus stop', 'posters in public places', 'leaflets through the door', 'advert on buses' and 'other'. Out of 934 participants, 698 valid responses were provided.

Participants' preferred information sources

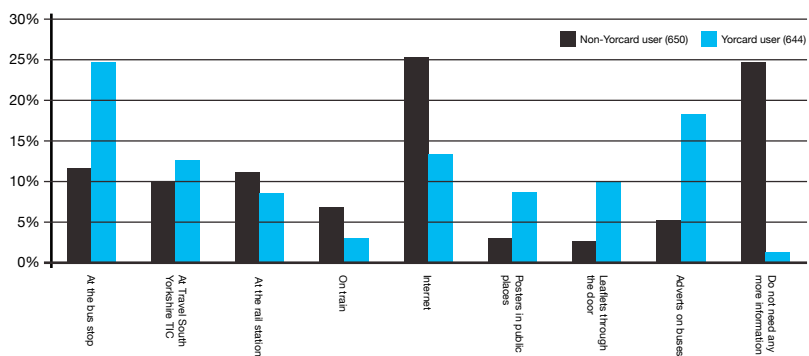


Figure 7. How would you like to get more information about fares and tickets?

Comparison of participants' preferred information sources

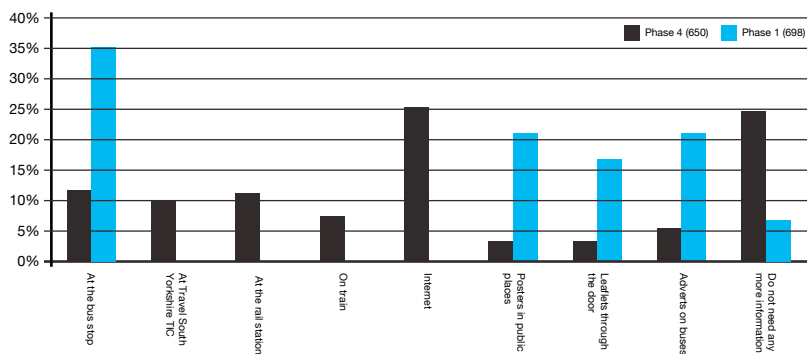


Figure 8. Comparison of non-Yorcard users' preferred information sources between Phase 1 and Phase 4

### 3.4 Public Transport Appeal

The impact of improvements in ticketing and payment on public transport was measured by asking participants to rate their agreement with three statements using a 5-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. Responses are shown in Tables 16 – 22.

The majority of non-Yorcard users did not think that public transport would be more appealing to them 'if it was easier to pay for tickets' (Table 16). Yorcard users were less negative than non-Yorcard users as lower percentages of them stated 'strongly disagree' and higher percentages of them stated 'neutral' (Table 17). In general, Yorcard users aged over 60 are more positive than those aged between 17 and 59.

Age	If it was easier to pay for tickets, I would be encouraged to use public transport more than I do now.					Total
	definitely not	probably not	no view	probably would	definitely would	
16 and under	5.5%	25.5%	34.5%	25.5%	9.1%	55
17-21	46.2%	14.1%	17.9%	16.7%	5.1%	78
22-59	62.6%	7.9%	6.0%	16.2%	7.2%	431
60 and above	68.3%	4.3%	21.5%	3.2%	2.7%	186

Table 16: non-Yorcard user (n=750)

Age	If it was easier to pay for tickets, I would be encouraged to use public transport more than I do now.					Total
	definitely not	probably not	no view	probably would	definitely would	
17-21	36.4%	27.3%	18.2%	18.2%	0.0%	11
22-59	23.7%	22.7%	35.1%	14.4%	4.1%	97
60 and above	6.1%	17.1%	51.2%	18.3%	7.3%	82

Table 17: Yorcard user (n=190)

Just about half of non-Yorcard users aged 16 and under believed that public transport would be more appealing 'if the tickets were more secure' (examples were given, including 'easy to replace' and 'could get money back if card is stolen') whilst the majority of those aged 17 and above did not think so (Table 18). Nonetheless, Yorcard users showed less negative views than non-Yorcard users as lower percentages of them stated 'strongly disagree' and higher percentages of those aged over 22 stated 'neutral' (Table 19). In general, Yorcard users aged between 22 and 59 are more positive than those aged between 17 and 21 as well as those aged 60 and over.

Age	If the tickets were more secure, I would be encouraged to use public transport more than I do now					Total
	definitely not	probably not	no view	probably would	definitely would	
16 and under	10.9%	10.9%	29.1%	32.7%	16.4%	55
17-21	39.0%	7.8%	14.3%	27.3%	11.7%	77
22-59	49.7%	9.5%	7.4%	19.7%	13.7%	431
60 and above	66.7%	5.9%	20.4%	4.3%	2.7%	186

Table 18: non-Yorcard user (n=749)

Age	If the tickets were more secure, I would be encouraged to use public transport more than I do now					Total
	definitely not	probably not	no view	probably would	definitely would	
17-21	25.0%	58.3%	8.3%	8.3%	0.0%	12
22-59	35.1%	24.7%	23.7%	13.4%	3.1%	97
60 and above	4.9%	21.0%	60.5%	6.2%	7.4%	81

Table 19: Yorcard user (n=190)

The majority of non-Yorcard users aged 16 and under thought that 'if boarding the bus could be made quicker' than they currently experience, public transport would appear to be more appealing to them, whilst the majority of those aged 17 and above did not (Table 20). Again Yorcard users were less negative than non-Yorcard users as much lower percentages of them stated 'strongly disagree' (Table 21). In general, Yorcard users aged over 60 are more positive than those aged between 17 and 59.

Age	If boarding the bus could be made quicker, I would be encouraged to use public transport more than I do now					Total
	definitely not	probably not	no view	probably would	definitely would	
16 and under	7.4%	11.1%	18.5%	33.3%	29.6%	54
17-21	42.3%	11.5%	12.8%	24.4%	9.0%	78
22-59	57.5%	7.0%	7.7%	15.8%	12.1%	431
60 and above	62.2%	10.8%	10.3%	12.4%	4.3%	185

Table 20: non-Yorcard user (n=748)

The majority of Yorcard users 'disagree' or 'strongly disagree' that 'if all the buses were equipped with a Touch-on Touch-off system which automatically calculates your fare' would make public transport more appealing. In general, the younger the Yorcard users are, the more positive they are. However, bear in mind that the number of participants aged between 17 and 21 is only 11, a larger sample from this age group is required for a more robust analysis.

Age	If boarding the bus could be made quicker, I would be encouraged to use public transport more than I do now					Total
	definitely not	probably not	no view	probably would	definitely would	
17-21	18.2%	36.4%	36.4%	9.1%	0.0%	11
22-59	26.3%	37.9%	27.4%	6.3%	2.1%	95
60 and above	24.2%	31.9%	29.7%	13.2%	1.1%	91

Table 21: Yorcard user (n=197)

Age	If all the buses were equipped with a Touch-on Touch-off system which automatically calculates your fare, I would be encouraged to use public transport more than I do now					Total
	definitely not	probably not	no view	probably would	definitely would	
17-21	18.2%	18.2%	45.5%	9.1%	9.1%	11
22-59	33.3%	26.0%	30.2%	5.2%	5.2%	96
60 and above	25.5%	30.9%	34.0%	7.4%	2.1%	94

Table 22: Yorcard user (n=201)

### 3.5 Yorcard

Compared to Phase 1, the awareness of Yorcard has increased dramatically from 5.5% to 20.2% among non-Yorcard users. The highest level of awareness of Yorcard was among bus users at 10%, with 5% of non-public transport users also aware of Yorcard (see Figure 9).

#### Experiences of Using Smartcards on Public Transport

There were 148 responses who said from where they got their first smartcard, which has formed the basis for this analysis. Invalid/missing responses have also been reported for consistency in reporting the overall figures across documents.

There were only a small number of responses (8) from those aged 17-21, the majority of whom had a Pay As You Go (PAYGo) smartcard for their first public transport smartcard. There were more responses to this question (64) from those aged 22-59, over half stating that their first public transport smartcard was also a PAYGo card although 20 (31.3%) stated that they had an 'other' smartcard. For the over 60s, there were also more responses (73) but the vast majority (83.6%) received an ENCTS smartcard as their first public transport smartcard, which is perhaps to be expected. Three responses were invalid.

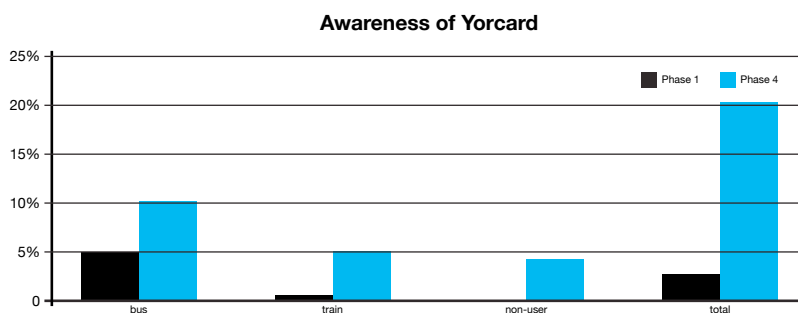


Figure 9: Non-Yorcard users' awareness of Yorcard– comparison between Phase 1 (n=547) and Phase 4 (n=757) Phase 1 and Phase 4

What was your first Public Transport Smartcard?	17-21	22-59	60 and over	All responses
Zero Fare/MegaTravel	12.5%	0.0%	N/A	0.7%
MegaTravel	25.0%	0.0%	N/A	1.4%
Student 16-18	0.0%	0.0%	N/A	0.0%
ENCTS	0.0%	3.1%	83.6%	42.6%
PAYGo	62.5%	65.6%	1.4%	32.4%
Other	0.0%	31.3%	15.1%	20.9%
Invalid/Missing				2.0%

Table 23: First Public Transport Smartcard

Table 24 shows the perception of using the smartcard. Nine of the original response could not be classified here. Overall, nearly half of all valid responses (48.0%) stated that the smartcard was 'very easy' to use, whilst only 2.0% found them 'very difficult' to use. There is a marked difference between the age groups, but it must be noted that the relatively high proportion of 17-21 year olds finding the smartcards 'very difficult' is due to the small number of responses from this age category. It is encouraging to note that at least three-quarters of responses in both the 22-59 and 60 and over age categories found their smartcards 'easy' or 'very easy' to use.

Table 25 shows user views on the ease of use of the Yorcard.com site. 17 respondents did not provide a valid answer to this question, but nearly 80% (104 out of 131) of the respondents who did, had not used the website. Of those who had used the website, just over 70% (19 out of 27) found it 'easy' or 'very easy' to use. (The web site provided customers with information about the Yorcard scheme. It did not provide any interactive services such as loading travel credit or ticket products onto an existing smartcard.)

As Table 26 indicates, nearly 5% of valid responses stated that they have had to exchange their smartcard due to a fault. As in Phase 3, the proportion of faulty and replaced cards decreases with the age groups, although the relatively low number of response from the 17-21 age group distorts this slightly. Nevertheless, 90% of smartcards did not require a replacement in both the 22-59 and 60 and over categories. The reason why a card was believed to be faulty was not requested.

Ease of use of your first Public Transport Smartcard	17-21	22-59	60 and over	All responses
Very Easy	37.5%	46.9%	56.7%	48.0%
Easy	37.5%	29.7%	34.3%	30.4%
Neither Easy nor Difficult	0.0%	9.4%	6.0%	6.8%
Difficult	0.0%	12.5%	3.0%	6.8%
Very Difficult	25.0%	1.6%	0.0%	2.0%
Invalid/Missing				6.1%

Table 24: User Views on Using their Smartcard

Ease of use of the Yorcard.com Website	17-21	22-59	60 and over	All responses
Not Used Website	75.0%	75.8%	83.6%	70.3%
Very Easy	0.0%	4.8%	8.2%	5.4%
Easy	25.0%	11.3%	3.3%	7.4%
Neither Easy nor Difficult	0.0%	4.8%	1.6%	2.7%
Difficult	0.0%	1.6%	3.3%	2.0%
Very Difficult	0.0%	1.6%	0.0%	0.7%
Invalid/Missing				11.5%

Table 25: User views about the Yorcard.com website which provided information

only. Exchanged Faulty Card?	17-21	22-59	60 and over	All responses
Yes	12.5%	6.2%	1.4%	4.1%
No	87.5%	93.8%	98.6%	90.5%
Invalid/Missing				5.4%

Table 26: Exchanging faulty cards

76.4% of valid responses (113 out of 140) said they had not needed to contact the Helpline or the TIC for help. Eight responses could not be used here as they did not provide their age for categorisation. Of those that had needed help, the main point of assistance was the TIC (20 responses) whilst only 5 responses said they had contacted the Helpline (Table 27). Overall, the service received from both services was deemed to be good, 4 out of 5 (80.0%) responses rating the Helpline as 'good' or 'very good', whilst 14 out of 20 (70.0%) responses rating the TIC as 'good' or 'very good' (Table 28).

It was important to understand whether having a smartcard had influenced the travel behaviour of respondents. Of the responses to this question, 8 were not usable, leaving 140 usable responses. Encouragingly, 57 of the valid respondents (40.7%) said they had made more journeys since receiving their smartcard, whilst only 5 (3.6%) said they had made fewer journeys. The proportion of respondents who said they made more journeys increased in line with the age categories. Over half of those in the 60 and over age category stating that they had made more journeys.

If respondents stated that they made more journeys, they were then asked to estimate how many more journeys per week they thought they had made, and the reasons why they had made more journeys. Table 30 shows the breakdown of the additional journeys made by the 57 respondents (who gave valid responses):

Required Help?	17-21	22-59	60 and over	All responses
Helpline	12.5%	3.1%	2.9%	3.4%
TIC	12.5%	17.2%	11.8%	13.5%
Both	0.0%	1.6%	1.5%	1.4%
None	75.0%	78.1%	83.8%	76.4%
Invalid/Missing				5.4%

Table 27: Use of the Helpline and TIC

Rating of Help Service Used	Very Good	Good	Neither Good nor Poor	Poor	Very Poor
Helpline	40.0%	40.0%	20.0%	0.0%	0.0%
TIC	35.0%	35.0%	15.0%	5.0%	10.0%

Table 28: Rating of Service from the Helpline and TIC

Change in Journeys Since Receiving Smartcard	17-21	22-59	60 and over	All responses
More	12.5%	26.2%	58.2%	38.5%
Fewer	0.0%	7.7%	0.0%	3.4%
About the Same	87.5%	66.2%	41.8%	53.4%
Invalid/Missing				4.7%

Table 29: User views on the changes in the number of public transport journeys they have made since having the smartcard

Additional Journeys Made Since Receiving Smartcard	17-21	22-59	60 and over	Total
1 to 2	1	8	17	26
3 to 4	0	9	11	20
5 to 6	0	2	5	7
7 or more	0	3	1	4

Table 30: Numbers of users who have made more public transport journeys per week have made since having the smartcard (n=57)



Across this subset of respondents who stated that they made more journeys since receiving their smartcard, the average number of additional weekly journeys was 3.2. However, in Phase 3 it was noted that some responses could not be directly attributed to having a smartcard and so certain respondents needed to be excluded for the analysis. Therefore, to calculate the direct impact of the smartcard in terms of additional journeys made, it was important to isolate those participants who said they had made more journeys and who gave reasons that could be directly attributed to having a smartcard.

For consistency between the Phases, it was necessary to follow the same procedure adopted in Phase 3. First, those participants who were in the 22-59 age category were isolated to eliminate any possibility of confusion with lower child fares or with ENCTS users. This left 17 participants, who said they made an average of 3.6 additional journeys per week. These participants were further filtered by removing anyone who stated they made more journeys due to options that could not be directly attributed to smartcards, namely:

- 'I use the bus or train where before I used a different mode of travel; or
- 'It is not related to having a smartcard'

This left 12 participants from the original 57 participants who said they had made more journeys since receiving their smartcard. Therefore, 21.0% of respondents who made more journeys did so because of having a smartcard. For these participants, the average number of additional weekly journeys was 4.0 per person.

Reason	17-21	22-59	60 and over	Total
Easy to Use	1	15	19	35
Like the Technology	0	4	3	7
Save Me Time	0	10	9	19
Seems Cheaper	1	8	16	25
Previously Used Other Mode	0	4	15	19
Not Smartcard Related	0	3	2	5
Other	0	2	3	5

Table 31: Participants who have made more journeys since having the smartcard (all responses)

To summarise, for the additional journeys that can be attributed to having a smartcard:

- From this survey, it was found that 57 participants said they had made more journeys since receiving their smartcard;
- Filtering the responses for ENCTS and non-smartcard reasons indicates that 21.0% of participants (12 out of 57) stated that they had made 4.0 additional journeys per week, and did so because of having a smartcard;
- This amounts to 0.2 additional journeys per week per participant surveyed, a figure consistent with the 0.1 additional journeys calculated in Phase 3.

As the absolute number of usable responses was low, it is suggested that any business case for the introduction of smartcards should not be based solely on these figures.

Reasons for making more journeys are shown in Table 31. Respondents were able to select more than one reason.

Reason	22-59 Year Olds
Easy to Use	10
Like the Technology	3
Save Me Time	7
Seems Cheaper	4

Table 32: Participants who have made more journeys since having the smartcard (22-59 years old, responses which can be attributed to smartcards.)

For the entire sample, 'It is really easy to use' was the main reason followed by 'it seems cheaper than before', the same finding as in Phase 3. 'It saves me time' was also a popular option, indicating that the time-saving aspect of smartcards could prove to be a key benefit in the greater uptake of smartcard.

'It is really easy to use' was also the most popular reason amongst the subset of 12 participants who had been identified as having made more journeys directly attributed to having a smartcard. 'It saves me time' was the second most popular option for these respondents.

For those respondents who had not made more journeys since receiving their smartcard, the main reason was that they didn't need to, or were unable to make more journeys. 'Other issues' which were not related to having a smartcard was the second most popular reason. (Table 33).

#### Opinions on Touch-on Touch-off Operations

Exit validators were fitted to buses and could potentially be used by customers to touch-off with their smartcards from late April 2009 on routes 52 and 120. With the exception of PAYGo customers, no marketing information was produced for other smartcard users to explain the purpose of the exit validators.

Respondents were asked if they used their smartcard on bus journeys, and if they had previously used it to touch-on whilst boarding. 135 out of the 233 (57.9%) respondents said they had used their smartcard on bus journeys; of these participants who had used their card on a bus journey 71 (52.6%) of these respondents said they had touched-on in the past, 64 (47.4%) said they had not touched on.

Respondents were then asked to rate how strongly they agreed or disagreed with a set of statements relating to both touch-on and touch-off operations. In previous Phases, a comparison was made between bus and rail travel, but in Phase 4 the focus was on the differences between the touch-on and touch-off procedures.

Reason	17-21	22-59	60 and over	Total
Too Complicated/Don't Understand How to Use	0	4	0	4
Equipment Never Works Properly	2	9	1	12
Takes Too Much Time	1	5	0	6
Seems Too Expensive	0	14	0	14
Don't Need To/Can't Make More Journeys	5	24	16	45
Would Rather Use Another Mode of Transport	0	0	1	1
Not Related to Having a Smartcard	3	14	11	28
Other Reason	0	5	1	6

Table 33: Users who have made the same or fewer journeys since having the smartcard.

As table 34 indicates, the majority of respondents agreed with each statement, with the exception of 'Smartcard Reader Always Works' where approximately the same proportion of respondents agreed and disagreed with this statement. This was the only statement to also receive a notable proportion of 'strongly disagree' responses.

For touch-off operations (which were only introduced for Phase 4), a similar picture to the touch-on operations emerges. Again, the majority of respondents agree with each statement, although the 'Smartcard Reader Well Placed' received an equal proportion of 'Strongly Agree' and 'Agree' responses, suggesting that this reader is well placed in the vehicles. However, the reliability of the touch-off readers was also an issue, as 11.3% of respondents 'Strongly Disagreed' with this statement (Table 35).

To identify whether there were any notable differences between opinions on Touch-on and Touch-off operations, the respective percentage values were compared (Touch-on minus Touch-off), as shown in Table 36. There were only two comparisons which yielded a difference of more than 10%, highlighted in bold, which suggested that overall, opinions on Touch-on and Touch-off operations were consistent.

Touch-on Operations	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	41.9%	48.1%	8.5%	1.6%	0.0%
Smartcard Reader at Right Height	38.4%	53.6%	5.6%	2.4%	0.0%
Smartcard Display Easy to Read	30.9%	45.5%	11.4%	11.4%	0.8%
Can See Lights on Reader	30.6%	43.5%	16.9%	8.1%	0.8%
Can Hear Beep from Reader	32.3%	44.9%	12.6%	9.4%	0.8%
Smartcard Reader Always Works	16.8%	28.8%	20.0%	27.2%	7.2%

Table 34: Use of smartcards for Touching-on during bus journeys

Touch-off Operations	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	36.0%	36.0%	17.3%	9.3%	1.3%
Smartcard Reader at Right Height	32.9%	53.4%	12.3%	1.4%	0.0%
Smartcard Display Easy to Read	24.7%	47.9%	17.8%	8.2%	1.4%
Can See Lights on Reader	23.3%	47.9%	17.8%	11.0%	0.0%
Can Hear Beep from Reader	27.8%	44.4%	13.9%	9.7%	4.2%
Smartcard Reader Always Works	18.3%	31.0%	26.8%	12.7%	11.3%

Table 35: Use of smartcards for Touching-off during bus journeys

Difference (On – Off)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	5.9%	12.1%	-8.8%	-7.8%	-1.3%
Smartcard Reader at Right Height	5.5%	0.2%	-6.7%	1.0%	0.0%
Smartcard Display Easy to Read	6.2%	-2.4%	-6.4%	3.2%	-0.6%
Can See Lights on Reader	7.4%	-4.4%	-0.9%	-2.9%	0.8%
Can Hear Beep from Reader	4.5%	0.4%	-1.3%	-0.3%	-3.4%
Smartcard Reader Always Works	-1.5%	-2.2%	-6.8%	14.5%	-4.1%

Table 36: Difference in Touch-on and Touch-off ratings during bus journeys

To test the consistency between Touch-on and Touch-off operations, a series of chi-square tests<sup>v</sup> were conducted on each of the statements, the results of which are shown in Table 37:

The results suggest that there is a significant difference (in the distribution of responses) for the 'Smartcard Reader is Well Placed' statement. 90.0% of responses 'agreed' or 'strongly agreed' that the Touch-on reader was well placed compared to 72.0% for the placement of the Touch-off reader.

Overall opinions on combining Touch-on and Touch-off were mixed, slightly more respondents stated that having both operations would make public transport travel more appealing to them (Table 38).

Respondents were then asked about their preference when using their smartcard on the bus, either Touch-on and Touch-off, Touch-on only or no preference. Table 39 presents the breakdown of responses, revealing that although slightly more respondents stated that Touch-on and Touch-off would make public transport more appealing to them, the majority (59.5%) would actually prefer to have Touch-on operations only. This was consistent among each of the age groups, and was particularly favoured by those in the 17-21 age category.

Statement	Chi-squared p-value
Smartcard Reader Well Placed	0.004*
Smartcard Reader at Right Height	0.360
Smartcard Display Easy to Read	0.506
Can See Lights on Reader	0.725
Can Hear Beep from Reader	0.827
Smartcard Reader Always Works	0.180

Table 37: Results of chi-squared analysis on each statement.  
\* - significant difference in the distributions at the 5% level.

Touch-on and Touch-off Make Public Transport More Appealing?	17-21	22-59	60 and over	All responses
Yes	40.0%	56.9%	54.9%	55.3%
No	60.0%	43.1%	45.1%	44.7%
<b>Total</b>	<b>5</b>	<b>58</b>	<b>51</b>	<b>114</b>

Table 38: Appeal of Touch-on and Touch-off Operations.

Preference	17-21	22-59	60 and over	All responses
Touch-on and Touch-off	0.0%	12.9%	8.8%	10.3%
Touch-on Only	85.7%	58.1%	57.9%	59.5%
No preference	14.3%	29.0%	33.3%	30.2%
<b>Total</b>	<b>7</b>	<b>62</b>	<b>57</b>	<b>126</b>

Table 39: Preference for Touch-on and/or Touch-off Operations.

<sup>v</sup> A chi-square test is used when dealing with tables of counts (or percentages) instead of means, to test for differences in the distribution of answers. [Source: NORUSIS, M. J. (2004) SPSS 12.0 Guide to Data Analysis New Jersey, Prentice Hall. P355.]

With a view to gain a better understanding of customers responses, an additional cross-tabulation between the appeal and preference for Touch-on and Touch-off operations was conducted (Table 40).

The result of this subsequent analysis confirms this finding, as only 21% (14 out of 66) of respondents who said Touch-on and Touch-off operations would make public transport more appealing actually said they would prefer such operations, whilst 50% (33 out of 66) said they would prefer Touch-on only. For those who did not find Touch-on and Touch-off operations appealing, 70% (40 out of 57) said they would prefer Touch-on only operations.

Finally, respondents were asked whether they would recommend smartcards for bus travel to their friends and family. As Table 41 indicates, at least two-thirds of respondents from each age group would recommend smartcards, and overall three-quarters of all respondents said they would recommend smartcards to their friends and family. 80% of those over 60 saying they would recommend smartcards, although this could be distorted by the travel options (i.e. free travel for the over 60s) provided by the ENCTS scheme.

Touch-on and Touch-off Make Public Transport More Appealing?	Preferred Method of Operation			Total responses
	Touch-on and Touch-off	Touch-on Only	No preference	
Yes	14	33	19	66
No	0	40	17	57

Table 40: Appeal of Touch-on and/or Touch-off Operations versus Preference.

Recommend Smartcards to Friends and Family	17-21	22-59	60 and over	All responses
Yes	66.7%	72.7%	80.0%	75.3%
No	33.3%	27.3%	20.0%	24.7%
<b>Total</b>	<b>6</b>	<b>44</b>	<b>35</b>	<b>85</b>

Table 41: Recommendation of Smartcards for Bus Travel to Friends and Family

From this section thus far, it can be said that smartcards do have an appeal, but Touch-on operations are most favoured amongst all respondents. However not all respondents may have had direct experience using the complete Touch-on and Touch-off system. Therefore, those users who said they had a Pay As You Go (PAYGo) card were isolated (n = 48), as these were the users who should have had full experience of both systems, and their responses to the above questions were recalculated.

As table 42 indicates, the majority of PAYGo respondents also agreed with each statement. This time 'Smartcard Reader Well Placed' received an equal proportion of 'agree' and 'strongly agree' responses whilst, as previously, 'Smartcard Reader Always Works' received a notable proportion of 'disagree' and 'strongly disagree' responses. PAYGo users were generally less negative about this aspect of the reader, only 23.9% 'disagreed' or 'strongly disagreed' with this statement compared to 34.4% of all respondents.

Touch-on Operations	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	43.5%	43.5%	10.9%	2.2%	0.0%
Smartcard Reader at Right Height	41.3%	54.3%	4.3%	0.0%	0.0%
Smartcard Display Easy to Read	28.9%	46.7%	15.6%	6.7%	2.2%
Can See Lights on Reader	28.3%	41.3%	19.6%	10.9%	0.0%
Can Hear Beep from Reader	37.0%	45.7%	8.7%	6.5%	2.2%
Smartcard Reader Always Works	26.1%	28.3%	21.7%	15.2%	8.7%

Table 42: Use of smartcards for Touching-on during bus journeys (PAYGo only)

Touch-off Operations	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	45.5%	31.8%	13.6%	9.1%	0.0%
Smartcard Reader at Right Height	38.6%	52.3%	9.1%	0.0%	0.0%
Smartcard Display Easy to Read	29.5%	43.2%	18.2%	6.8%	2.3%
Can See Lights on Reader	29.5%	45.5%	13.6%	11.4%	0.0%
Can Hear Beep from Reader	34.9%	48.8%	4.7%	9.3%	2.3%
Smartcard Reader Always Works	25.6%	27.9%	25.6%	11.6%	9.3%

Table 43: Use of smartcards for Touching-off during bus journeys (PAYGo only)

Difference (On – Off)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Smartcard Reader Well Placed	-2.0%	11.7%	-2.8%	-6.9%	0.0%
Smartcard Reader at Right Height	2.7%	2.1%	-4.7%	0.0%	0.0%
Smartcard Display Easy to Read	-0.7%	3.5%	-2.6%	-0.2%	-0.1%
Can See Lights on Reader	-1.3%	-4.2%	5.9%	-0.5%	0.0%
Can Hear Beep from Reader	2.1%	-3.2%	4.0%	-2.8%	-0.2%
Smartcard Reader Always Works	0.5%	0.4%	-3.8%	3.6%	-0.6%

Table 44: Difference in Touch-on and Touch-off ratings during bus journeys (PAYGo only)

For touch-off operations, a similar picture to the touch-on operations emerges. Again, the majority of PAYGo respondents agreed with each statement, although the 'Smartcard Reader Well Placed' received a higher proportion of 'Strongly Agree' responses, confirming the earlier notion that that this reader is well placed in the vehicles. However, the reliability of the touch-off readers was still an issue for PAYGo users, as 9.3% of respondents 'Strongly Disagreed' with this statement (Table 43).

As before, to identify whether there were any notable differences between opinions on Touch-on and Touch-off operations, the respective percentage values were compared (Touch-on minus Touch-off), as shown in Table 44. For PAYGo users there was only one comparison which yielded a difference of more than 10%, highlighted in bold, which suggested that overall, PAYGO users' opinions on Touch-on and Touch-off operations were consistent.

To test the consistency between Touch-on and Touch-off operations for PAYGo users, a series of chi-square tests were conducted on each of the statements, the results of which are shown in Table 45:

The results suggest that there are no significant differences (in the distribution of responses) for any of the statements (no p-value less than 0.05), supporting the notion that PAYGo users have equal opinions on the Touch-on and the Touch-off scanner.

The appeal of the Touch-on and Touch-off operations were approximately equally divided between PAYGo users: 22 respondents (48.9%) of respondents stating that having both operations would make public transport travel more appealing to them compared to 23 (51.1%) who said it would not (Table 46).

An analysis of PAYGo users preferred method of operation was undertaken. Table 47 presents the breakdown of responses, revealing that although almost half of the PAYGo respondents said Touch-on and Touch-off would make public transport more appealing to them, the majority (58.7%) would actually prefer to have Touch-on operations only. This is consistent with the earlier finding amongst all users.

Statement	Chi-squared p-value
Smartcard Reader Well Placed	0.406
Smartcard Reader at Right Height	0.665
Smartcard Display Easy to Read	0.984
Can See Lights on Reader	0.901
Can Hear Beep from Reader	0.849
Smartcard Reader Always Works	0.985

Table 45: Results of chi-squared analysis on each statement (PAYGo only).

Touch-on and Touch-off Make Public Transport More Appealing?	17-21	22-59	60 and over	All responses
Yes	20.0%	53.8%	0.0%	48.9%
No	80.0%	46.2%	100.0%	51.1%
<b>Total</b>	<b>5</b>	<b>39</b>	<b>1</b>	<b>45</b>

Table 46: Appeal of Touch-on and Touch-off Operations (PAYGo only).

Preference	17-21	22-59	60 and over	All responses
Touch-on and Touch-off	0.0%	20.0%	0.0%	17.4%
Touch-on Only	80.0%	55.0%	100.0%	58.7%
No preference	20.0%	25.0%	0.0%	23.9%
<b>Total</b>	<b>5</b>	<b>40</b>	<b>1</b>	<b>46</b>

Table 47: Preference for Touch-on and/or Touch-off Operations (PAYGo only).

With a view to gain a better understanding of PAYGo customer responses, further additional cross-tabulation between the appeal and preference for Touch-on Touch-off operations was conducted. (Table 48).

The result of this subsequent analysis shows an even divide between PAYGo respondents who said Touch-on and Touch-off operations would make public transport more appealing - only one more respondent said they would prefer Touch-on only compared to Touch-on and Touch-off operations. For those who did not find Touch-on and Touch-off operations appealing, nearly all (83%, 19 out of 23) said they would prefer Touch-on only operations.

Finally, the PAYGo respondents were asked whether they would recommend smartcards for bus travel to their friends and family. As Table 49 indicates, the majority said they would recommend smartcards to their friends and family.

Touch-on and Touch-off Make Public Transport More Appealing?	Preferred Method of Operation			Total responses
	Touch-on and Touch-off	Touch-on Only	No preference	
Yes	7	8	6	21
No	0	19	4	23

Table 48: Appeal of Touch-on and/or Touch-off Operations versus Preference (PAYGo only).

Recommend Smartcards to Friends and Family	17-21	22-59	60 and over	All responses
Yes	60.0%	63.2%	100.0%	63.6%
No	40.0%	36.8%	0.0%	36.4%
<b>Total</b>	<b>5</b>	<b>38</b>	<b>1</b>	<b>44</b>

Table 49: Recommendation of Smartcards for Bus Travel to Friends and Family



# Summary and Conclusions

## 4.1 Results

The data collection has been completed in line with the Phase 1 recommendations and the methodology for this Phase 4 Consumer Study. In order to capture the opinions of the Yorcard users a new methodology was introduced at this stage which utilised targeted mailing of a postal questionnaire, to compliment the on-street questionnaire, which was used to capture opinions of non-Yorcard users. Initial analysis has established that the sample size was achieved; however there was some deviation away from the sub-targets, particularly Yorcard train users and under 16 non-users. This has little effect on the overall robustness of the data collected as in both cases they have very low population sizes. This initial analysis has highlighted where some areas could be improved in identifying target samples sizes and enabling the collection of a more complete data set in future phases.

Prior to carrying out the on-street and postal questionnaires, focus groups were used to inform the questionnaire and to glean some more in-depth understanding of the interests of public transport customers and non-customers. The potential benefits highlighted by Yorcard users, i.e. convenience, improvements to boarding speed, security and easy ticketing are of particular interest. It was also highlighted by many of the participants, both Yorcard and non-Yorcard users, that a discount or loyalty card would encourage the use of Yorcard in the future.

Most Yorcard participants are from within the pilot corridor (S1–S10 postcodes) and, as with Phase 1, slightly more non-users and bus users interviewed on street were from within the pilot corridor than outside the corridor, whereas the majority of train users were from outside this corridor. The different modal profiles were very similar to those in Phase 1 in terms of frequency of travel and purpose.

Analysis has been carried out to establish the Yorcard and non-Yorcard user opinion of public transport and ticketing. A summary of these results, in comparison with key results from Phase 1, and user experience of using smartcards on public transport are presented below.

### Sample

This section presents the details of the sample collected and the ways they travel. The summary of the results from this section are presented here:

- There are slight differences in the behaviour of the Phase 4 sample compared to the phase 1 and 3 samples, however, overall the samples are similar, in both Phase 1 and 4, the non-Yorcard users made more journeys than the Yorcard users as more Yorcard users are concessionaires and PAYGo card holders who travel less frequently than commuters.
- The main reason for bus journeys made by non-Yorcard users were work, education and shopping and by Yorcard users were work, shopping and leisure, respectively.
- The main cause of delay over all is seen to be lots of people boarding. However, under 16s stated that people not having their money ready was the main cause.
- The majority of Yorcard users who carried out the postal survey were ENCTS or PAYGo cardholders.

### Ticket Types and Purchasing

This section presents the results of the types of tickets purchased and the ways in which passengers obtain ticket information. The summary of the results from this section are presented here:

- More tickets are bought on the bus by both Yorcard and non-Yorcard users than off the bus at other retail outlets. This suggests that the Yorcard users are not necessarily describing using their Yorcard as it is not possible to buy a Yorcard onboard a bus or they are describing their previous ticket. Equally, if more tickets were available off bus, this could reduce the boarding time at each stop as cash-handling would be reduced.
- The majority of non-Yorcard users bought return tickets and period tickets whilst the majority of Yorcard users who were required to purchase a ticket, bought single tickets and/or paid 40p concessionary fares.
- For the majority of participants, the tickets they choose are dependent upon value and convenience. Therefore, as with Phase 1, if Yorcard is to appeal to consumers it is vital that the tickets they purchase are convenient to buy and to use and offer them the best value.
- For each statement about ticketing, a higher percentage of non-Yorcard users have chosen the most positive response. Yorcard users' responses are also positive but not as much as non-Yorcard users. This is likely to be because there have been some bedding-in issues with the Yorcard system, which resulted in some of the equipment being unreliable, including at the time of survey.

- Yorcard users stated their preferred location for information about fares and tickets was at bus stops. Non-Yorcard users stated they would like this information online. This difference is likely to be due to the fact that the majority of Yorcard users (88.4%) are bus users and therefore this location is the most accessible. There were fewer bus users among non-Yorcard users. About a quarter of them claimed that they did not need more information about fares and tickets.

### Public Transport Appeal

The results from the Public Transport Appeal section relate directly to a number of the Yorcard objectives including: reducing barriers to travel; reducing delays and improving reliability; enhancing the image of public transport; improving sales channels; and informing the Business Case. They also relate to the DfT objective of analysing the customer reaction and the customer experience throughout the pilot.

The highlight results from this section are:

- The majority of non-Yorcard users did not think that public transport would be more appealing to them 'if it was easier to pay for tickets'
- Just about half of non-Yorcard users aged 16 and under believed that public transport would be more appealing 'if the tickets were more secure' whilst the majority of those aged 17 and above did not think so
- The majority of non-Yorcard users aged 16 and under thought that 'if boarding the bus could be made quicker' than they currently experience, public transport would appear to be more appealing to them, whilst the majority of those aged 17 and above thought in the opposite way

- The majority of Yorcard users 'disagree' or 'strongly disagree' that 'If all the buses were equipped with a Touch-on Touch-off system which automatically calculates your fare' would make public transport more appealing. In general, the younger the Yorcard users are, the more positive they are.

### Yorcard

This section was used to understand the awareness of Yorcard in Sheffield in the non-Yorcard user community. It also examines the user experience of smartcards by Yorcard users:

- Compared to Phase 1, the awareness of Yorcard has increased dramatically from 5.5% to 20.2% among non-Yorcard users. The highest level of awareness of Yorcard was among bus users at 10%, with 5% of non public transport users also aware of Yorcard
- Over three-quarters of responses in both the 22-59 and 60 and over age categories found their smartcards 'easy' or 'very easy' to use.
- Of those who had used the website which provided information only, the majority found it 'easy' or 'very easy' to use.
- Nearly 5% of responses stated that they have had to exchange their smartcard due to a fault and the majority (75%) of users have not used the help service. Of those who have used the help service, the majority (80% for Helpline and 70% for TIC) rated it as 'good' or 'very good', which is more positive than in Phase 3.

- 5% (12 respondents) of Yorcard users had increased the number of journeys as a result of having a smartcard. This equates to an extra 0.2 journeys per week per person surveyed, which is in line with Phase 3. The main reason was 'it is really easy to use'. However, it is suggested that any business case for the introduction of smartcards should not be based solely on these figures as the absolute numbers are low.
- There were mixed responses to the statement 'the Smartcard reader Always works' and this was the only statement to also receive a notable proportion of 'strongly disagree' responses.
- For touch-off operations, the 'Smartcard Reader Well Placed' received an equal proportion of 'Strongly Agree' and 'Agree' responses, suggesting that this reader is well placed in the vehicles.
- Overall opinions on combining Touch-on and Touch-off were mixed, slightly more respondents stated that having both operations would make public transport travel more appealing to them. However, the majority of respondents when offered a choice of operations from a limited list would prefer to have touch-on only.
- As with Phase 3, the majority of respondents said they would recommend smartcards to friends and family.

## 4.2 Limitations

Limitations have been identified as:

- School Children were not sent the postal questionnaire for Phase 4. Therefore the results and opinions collated specifically about smartcards from the postal questionnaire in Phase 3 could not be compared with this phase.
- Due to timing of the Phase 4 element of the pilot, the focus groups had to take place during the summer holidays. This meant that the focus group with school children took place after the on-street interviews. Despite this, there was little impact upon the questionnaire as it was important at this stage to keep the content consistent.
- There were some issues prior to the phase regarding the reliability of the equipment. As a result this may have affected some of the responses and opinions of the participants and the results captured about smartcard technology.

## 4.3 Objectives

The objectives which were relevant to this study and first highlighted and discussed in Phase 1 are as follows.

### **Relevant DfT Objectives:**

- Analysing the passenger reaction (b(3))
- An assessment of the Customer Experience

### **Relevant Yorcard Objectives:**

- Reducing the barriers to the use of public transport
- Enhancing the image of public transport
- Improving sales channels; and
- Informing the Business Case

These have been realised through questionnaires and focus groups that look at:

- The perception of boarding and journey times
- Ease of product purchase
- Customer support
- Public transport appeal; and

Each of these objectives will be addressed below in light of the consumer research carried out between Phase 1 and 4.

### **Analysing the Passenger Reaction (DfT b.(3))**

The methodology employed for this aspect of the research has demonstrated that it has been possible to gain and analyse the passenger reaction to smartcards. The reaction seen throughout Phases 1, 3 and 4 have been a mixture ranging from the positive 'idea of smartcards', with many people, particularly public transport users, tending to like the idea in principal, to the negative 'idea of smartcards', with people citing issues such as 'Big Brother' as a major concern. The reaction in practise was more average as much of the questioning was on a practical level and as the technology did not work all the time, which will have had a negative impact on some of the responses. The Phase 7 reporting looks at the impact that the trial may have had on the research.

### **An Assessment of the Customer Experience (DfT c.)**

The collation of all the results and conclusions made in the reports and documented in Phase 7 will draw together the overall impact that Yorcard has had on customers and feed into an assessment of the customer experience. As with the above, this is a mixture of reactions which will conclude with experiences based upon what has been learnt from the boarding time and equipment user studies, as well as this study.

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**Reducing the barriers to public transport**

It was first highlighted in Phase 1 that there could be a number of ways that the new technology could have an impact upon the barriers to using public transport. Ideally, improving the sales channels and making it easier to buy and use tickets would have a positive impact. In addition, increasing the security and versatility of ticketing could help to improve the appeal of using this ticket over another. Perceptions, particularly those analysed through the focus groups, have been collected through the series of reports, which has helped to understand whether smartcards would reduce the barriers to public transport.

**Enhance the Image of Public Transport**

This objective is closely related to the objective above as it depends entirely upon perceptions. In terms of smartcards children in particular, have been observed to really like the idea of smartcards because they seem modern and you can, in theory, do lots of different things with them. There were other cases, however, where smartcards were very much seen as a negative. Much of these opinions were collected via the focus groups carried out throughout the research. By collating these responses, it will be understood whether the image of public transport can be improved and to whom it would be improved for.

**Improving Sales Channels**

As with the equipment users research, there has been a positive trend in terms of the sales channels. Unfortunately, this has been due to the fact that many customers, particularly children, would prefer not to have to speak to the driver. It has also been seen that any help required during or after sales has resulted in a positive experience.

**Business Case**

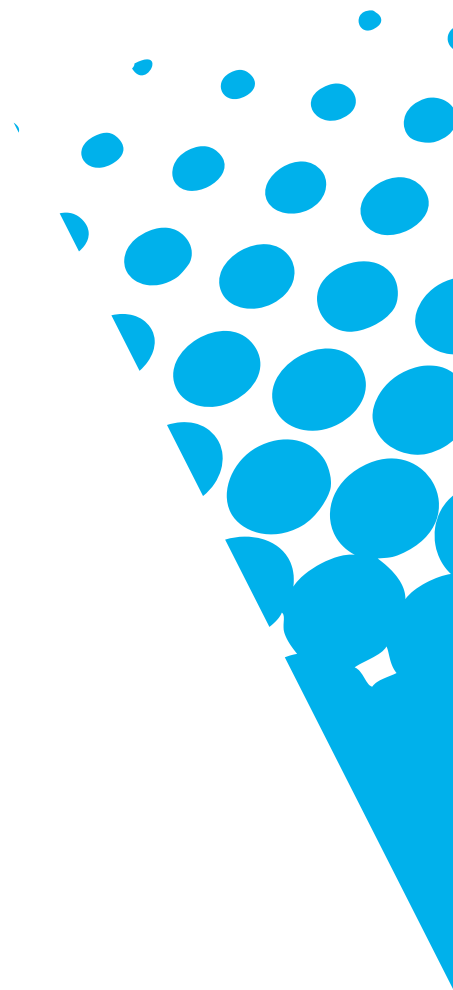
Traditionally the business case should be considered in terms of hard figures and statistics. However, with smartcards, a lot of the benefits are not as tangible. There are referred to as 'soft benefits'. In terms of understanding the soft benefits to customers, this research can demonstrate insight into the perceptions of smartcards and what people think of them in theory. However, as the trial is not in its current form to be rolled out across the region, it has been difficult to truly analyse the benefits in practise. Using a smartcard has been shown to be a little cumbersome, and concerns over, for example, forgetting to touch off, etc, have impacted negatively on the results.

The final report which will look at the business case in Phase 7 will pull together all the aspects of the research and provide a conclusion, as the research should not be looked at in isolation.

# Recommendations

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Recommendations for future work, including methodology and ways of working will be discussed in great detail in the Phase 7 final reports





Yorkstar

# Contents

## 1.0 Introduction

## 2.0 Methodology and Planning Review

## 3.0 Analysis of Phase 4 Data

1.1 Background .....	107	2.1 Review .....	111	3.1 Summary of Analysis .....	112
1.2 Summary of Deliverables .....	107	2.2 Risk and Issues .....	111	3.2 Bus Stop Dwell Time.....	112
1.3 Review of Progress..... of Deliverables	108	2.3 Lessons Learned.....	111	3.3 Perceptions of Delay .....	114
1.4 Review Against Budget.....	108			3.4 Touch On vs..... Touch On/Touch Off	114
1.5 Meeting DfT Objectives .....	109				
1.6 Meeting Yorcard Objectives.....	109				

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**4.0 Limitations and Review of Objectives**

4.1 Limitations ..... 115  
4.2 Objectives..... 115

**5.0 Advice for the Business Case**

Advice for the Business Case ..... 116

**6.0 Recommendations**

Recommendations ..... 117

**7.0 Appendices**

Appendix 1 ..... 118  
Appendix 2 ..... 120

# Executive Summary

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The Yorcard Project is intended to deliver a multi-modal, multi-operator public transport smartcard scheme to be trialled on selected buses in Sheffield and on the local train service between Sheffield and Doncaster and intermediate stations.

This report presents:

- A summary of the deliverables forming the contract between DfT and SYPTE
- How each deliverable was completed, and how progress was made throughout Phase 4
- A review of DfT and Yorcard objectives and how objectives have been met
- A review of the methodologies used including the limitations, risks and issues that arose during the Phase 4 work
- The findings from Phase 4 that are common across different studies
- Recommendations for the future delivery of the Yorcard research programme

# Introduction

## 1.1 Background

---

This Yorcard Phase 4 End of Phase Report sets down the outputs forming part of a research contract between the South Yorkshire Passenger Transport Executive (SYLTE) and the Department for Transport (DfT), Transport Technology and Standards Division. An overview of the tender and a full description of the Yorcard pilot can be found in the General Reference Document.

The purpose of this report is therefore to provide an evaluation of the results from the Phase 4 reports and determine any cross-over between the findings. It is also the purpose to review the delivery of the Phase and identify any lessons learned from a practical perspective regarding the management of the Phase and how this could be improved for any future projects.

## 1.2 Summary of Deliverables

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The intention of Phase 4 was to baseline measurements that would be tracked throughout the life of the Yorcard Pilot to enable monitoring of change and evaluation of the scheme. Phase 4 was the last of four Phases which included the following primary deliverables :

- A boarding time study
- An equipment user study
  - With Travel South Yorkshire Information Centres (TICs)
  - With bus drivers
- A Bus and Rail user study
- And this end of stage report

### 1.3 Review of Progress of Deliverables

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Passenger data collected for Phase 4 was sought when the Yorcard pilot operated in a closed system (ToTo). Some customers were actively using the touch on touch off (ToTo) means of travelling on bus during this phase. The closed system became operational on bus from July 2009 until the end of the operational pilot on Friday 2 October 2009. Up to 1,200 touch off transactions were recorded in a week of which one third were customers using the new Pay as you Go card (PAYGo)

At the time the data was collected for Phase 4, there was only one other ToTo operation in the United Kingdom

The reliability of on-bus equipment (which had been identified in Phase 3 as an issue) had improved significantly from Easter 2009 and through-out Phase 4. For Touch On operations a reliability of around 95% was recorded from Easter 2009. For Touch On/Touch Off operations a reliability of 90% and over (with the exception of one week) was achieved from late July 2009. (Note neither level of reliability was deemed acceptable by Yorcard and the bus operators.)

During Phase 4 three new commercial smart bus products were launched. In addition, a new Pay as you Go (PayGo) card was launched. This card required the customer to touch on as they boarded the bus and touch off as they alighted the bus at newly installed exit validators. The system calculated the adult single fare. The card was valid on First service 52 and Stagecoach services 52 and 120. The system could also calculate and deliver for the customer the best value day product for each service and operator by capping fares at a published level.

### 1.4 Review Against Budget

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The overall costs were within the agreed limits for the Phase. To ensure that sufficient data quality and quantity was obtained, it was necessary to add financial incentives to encourage a reasonable participation rate from customers and bus drivers.

The operational part of the rail pilot was completed by 31st December 2008. Therefore only multi-modal smartcards could be used in flash mode on rail during Phase 4.

Phase 4 equipment survey aimed to create a profile of equipment users who have been affected by the introduction of Yorcard to determine their opinion of the new equipment and compare it to the responses given in Phase 1, which was the period prior to the installation of smartcard technology, and Phase 2, when only Touch-on smartcard ticketing operations were active.

## 1.5 Meeting DfT Objectives

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The DfT have stipulated the following objectives as part of the tender specification:

- a. All elements of the pilot scheme shall be fully compliant to the prevailing ITSO documentation.
- b. Conduct a robust analysis of (1) bus boarding times, (2) Systems performance and (3) passenger reaction to address the concerns of all key stakeholders involved in the rollout of smartcard technologies within a deregulated transport industry. This should provide a comparison of existing performance measures prior to the introduction of smartcards to the pilot area.
- c. The research will assess the Customer Experience and the Operator and PTE expectations and provide recommendations for rollout. Included within this analyses shall be a study of the business case for deployment of similar regional schemes.
- d. To understand the value of new innovative ticketing products to the key stakeholders.
- e. To understand the value of using Citizen cards as an alternative to transport only smartcards.
- f. To ensure that all deliverables are clear, concise, accurate, thorough, of a high technical quality and well written.
- g. The research will complement the Yorcard pilot timetable.

This report must therefore evaluate how the relevant objectives will be met.

## 1.6 Meeting Yorcard Objectives

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It is also important to consider the objectives of Yorcard and its stakeholders. This report considers how the most relevant objectives are likely to be influenced by Yorcard. The remaining objectives are predominantly technical and will be evaluated in other phases of this research work. Please refer to the General Reference Document for the full list:

- Reduce barriers to the use of public transport;
- Reduce delays and improving reliability;
- Reduce fraud of all types;
- Enhance the image of public transport;
- Improve sales channels;
- Inform business cases.

# Methodology and Planning Review

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This section provides a review of the methodology used and explores how the processes for delivery of future phases of this research project can be improved.

## 2.1 Review

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- The studies were conducted in accordance with the agreed methodologies. Recommendations from Phases 1 to 3 were taken into account and applied in Phase 4.

## 2.2 Risk and Issues

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The following risks and their outcomes were identified as being relevant to Phase 4

- That there is insufficient volume of smartcard activity to enable data from all studies to be robust and meaningful.

There were an insufficient number of passengers observed to use their smartcards in touch off mode to account for the differences in alighting times by passenger types.

- That questionnaires within First South Yorkshire are presented only to those drivers trained to use the new technology.

First South Yorkshire managers ensured that the questionnaires were passed to drivers who met the aforementioned condition : CLOSED

- That a reasonable bedding in period (estimate 6-8 weeks) is in place prior to any data being collected in Phase 4.

The closed system was tested thoroughly for an extended period on pilot bus services prior to the launch of the PayGo card in July 2009. Questionnaires were sent to customers in September 2009.

No issues of significance were identified as being relevant to Phase 4:

## 2.3 Lessons Learned

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Project based lessons learned relating to the delivery of the Yorcard project in general will be presented in the Best Practice Final Report. Workshops were held with all the stakeholders in the summer and autumn of 2009 and the outcomes from these have been fed into the appropriate reports and the draft business plan.

There were no research based lessons learned relating to planning and delivery of the reports.

# Analysis of Phase 4 Data

## 3.1 Summary of Analysis

The results presented in this section relate to the findings in Phase 4 reports. Reference and comparisons with work undertaken in earlier Phases 1 to 3 is made where appropriate. A summary table of the key findings relative to the Yorcard and DfT objectives is shown at Appendix 1.

## 3.2 Bus Stop Dwell Time

Bus Stop Dwell Time is the total time that the bus is at a particular stop and, in terms of the analysis, the effect of Yorcard on this time could have the greatest impact for the operator. An overview of the headline times is shown in table 1 below:

Measurement Description		PHASE 1 Baseline	PHASE 2 Open System	PHASE 3 Open System	PHASE 4 Closed System
		Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)	Mean Time – sec (Standard Deviation)
Bus Stop Dwell Time:	per bus	28.66	40.77	47.00	32.30
		(68.06)	(60.69)	(50.20)	(44.33)
	per boarding and alighting passenger	7.08	12.35	7.20	9.12
		(9.98)	(26.69)	(11.66)	(19.92)
Bus Stop Boarding/ Alighting Time:	per bus	23.78	33.14	42.90	29.13
		(34.95)	(51.95)	(48.10)	(42.73)
	per boarding and alighting passenger	5.76	9.08	5.85	7.98
		(9.22)	(13.33)	(10.30)	(19.17)

Table 1: headline statistics from the boarding time studies.

The results obtained indicate that the Dwell Time per passenger in Phase 4 differs significantly from that in Phase 1 and the time has increased. The average number of passengers per bus has not changed : therefore, the time each passenger takes to board and alight has increased.

A regression analysis was performed to understand the relationship between Dwell Time and different ticket types for paper based tickets. This is represented below:

$$\text{Dwell Time (sec)} = 8.32 + (7.36 \text{ Adult Cash}) + (4.47 \text{ Adult Smart Cash}) + (5.91 \text{ Child Cash}) + (4.77 \text{ Child Smart Cash}) + (3.38 \text{ Flash Pass}) + (5.20 \text{ Smart Flash Pass}) + (1.34 \text{ Total Alighters}) + (1.68 \text{ Vehicle Type 'D'})$$



Table 2 presents a comparison of the individual ticket type co-efficients calculated by each regression analysis from the different Phases, which also indicates a reduction in the time for cash-based transactions:

Ticket Type	Boarding Time Per Passenger (sec)		
	Phase 2	Phase 3	Phase 4 (ToTo)
Adult Cash	8.51	7.15	7.36
Adult Smart Cash	5.55*	N/A	4.47
Child Cash	6.99	2.79	5.91
Child Smart Cash	5.55*	N/A	4.77
Flash Pass	2.93	4.19	3.38
Smart Flash Pass	N/A	N/A	5.20

\* - 'Adult Smart Cash' and 'Child Smart Cash' were combined to give an equivalent ticket type of 'Smartcard' in Phase 2

Table 2 : Comparison of Ticket Type Co-efficients across the Phases

With respect to smart-tickets versus standard tickets the regression analysis has shown that for Touch on cash-based transactions, smartcards do appear to reduce the Dwell Time. For 'Adult Cash' tickets, this reduction in time is around 3 sec whilst for 'Child Cash' tickets, the reduction is around 1 second. For 'Flash Pass' tickets, the regression analysis indicates that smartcards increase the Dwell Time compared to standard ticketing. This could be due to the fact that standard flash passes needed to be shown to the driver, whilst smart flash passes need to be touched on the scanner and then shown to the driver.

Bus drivers identified in the Phase 4 equipment survey report, their perception of the top three causes of delay. These were :

- Passengers boarding bus and not ready to pay their fare
- Passengers paying with notes
- Issuing paper period products which come with a bespoke wallet

The first two bullet points were also identified in the equipment survey reports Phase 1 and 2 as number one and two causes of delay. In Phase 4, 16% of drivers stated that smartcards are amongst the top three contributors to delays in Phase 4, 1% less than in Phase 2. However, the results from Phases 2 and 4 suggest smartcard technologies can offer a solution to the above problems by removing the need for passengers to pay with cash or require large amounts of change when paying with notes.

### 3.3 Perceptions of Delay

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The results from the consumer survey reported that one of the main perceptions of delay from the customer perspective remains that of people not having their money ready or people boarding the bus and offering to pay the driver with notes.

The boarding survey showed that certain smartcard tickets and passes are slower than the paper equivalent. Despite this, feedback from the customer surveys showed that many customers viewed smartcards favourably. The majority citing that the smartcards were either easy or very easy to use. An analysis of the customer returns received, predicted 0.2 additional journeys per week per participant surveyed for those customers who said that they made additional journeys which could be attributable to having a smartcard. This figure is consistent with the 0.1 additional journeys calculated in Phase 3. As the absolute number of usable responses (12 respondents in Phase 4 stated they made more journeys) was low, it is suggested that any business case for the introduction of smartcards should not be based solely on these figures.

The majority of drivers who responded to the questionnaire, said that they perceived that smartcards were easier for the customer to use and that the equipment had been well placed within the vehicle.

### 3.4 Touch On versus Touch On/Touch Off

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Slightly more than half of respondents stated that Touch-on and Touch-off would make Public Transport more appealing to them. When presented with a choice of only one method of operations, the majority (59.5%) expressed a preference for Touch-on operations only. This was consistent among each of the age groups, and was particularly favoured by those in the 17-21 age category. The information obtained from this survey must be seen in the context that the touch on touch off operations took place over a period of 12 weeks with limited numbers of participants.

Customers were on the whole quite positive about the smartcard equipment installed on the buses and how they operated. Some customers made adverse comments about the reliability of the equipment and this may largely be as a result of their experiences earlier in the year when as reported above and in previous reports, reliability of on bus equipment was identified as an issue.

When asked to select only one method of operation from a short list of possible options, the Touch-on only operation attracted, by a small margin, the highest support from drivers. Of those drivers who selected Touch On only operations, the main reasons given in support of their choice was they thought the boarding and alighting process was faster and would be easier for the passenger.

# Limitations and Review of Objectives

## 4.1 Limitations

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The analysis carried out for this report has enabled the identification of the important calculations to compare throughout this research project. Each of the measurements identified in this report will be taken in turn to highlight and summarise the important findings in relation to the objectives.

## 4.2 Objectives

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Limitations have been identified in this report and these need to be understood when interpreting the data obtained from the research. The limitations are as follows:

- There remained some issues with the reliability of the on bus equipment. In previous reports, the reliability was reported at 70-80%. For Touch on operations a reliability of around 95% was recorded from Easter 2009. For Touch On/Touch Off operations a reliability of 90 and over percent (with the exception of one week) was achieved from late July 2009. Customers' experiences of using smartcard earlier in the year probably had a bearing on their perception on the reliability of the equipment at the time they were interviewed or completed the questionnaire.
- 151 passenger events were recorded alighting on one day of operations using the Touch off technique during the Boarding Time Study. This limited the analysis both for the Dwell Time components and the Regression.
- Because there were limited Yorcards in circulation, the off bus methodology is limited as it was difficult to capture smartcards in use during ToTo.
- The focus group for children was not held for operational reasons until after the pilot had been completed. Despite this, there was little impact on the questionnaire as it was important at this stage to keep the content consistent.

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It is also important that this report is not taken in isolation and that the data from other research tasks are used to help support these findings wherever possible. This report identifies any cross over and links back to Phases 1, to 3.

This study has set out to meet the objectives of the stakeholders involved in the Yorcard project. A full assessment of the impact on project objectives is shown at appendices 1 & 2.

# Advice for the Business Case

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The business case to the DfT is currently being drafted and draws upon the data collected and analysed from all the research Phases. The research information will be drawn upon to make the case for full roll out and shape the form it should take.

The studies undertaken during Phase 4 have enabled measurements to be compared to the measurements taken in Phases 1 to 3 where appropriate.

# Recommendations

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The data collection and evaluation for Phases 1 to 4 has now been completed. The analysis presented in the Phase 4 reports has provided robust results suggesting that the data collected are reliable.

Recommendations appropriate to each deliverable have been made in each respective report.

- The methodology outlined in this report was shown to be valid

And hence the data obtained should feed into the final Phase 7 reports and help inform and support the business case.

# Appendix 1

## Appendix 1: Summary of the analysis of Yorcard Objectives.

	Objective	Study Deliverable		
		Boarding Time	Equipment User	Consumer
1	Reduce barriers to the use of public transport	The introduction of the Pay as you Go card was attractive to some customers. The system calculated the adult single fare for the customer and could also deliver a daily capped product. The customer did not have to have the correct fare or speak to the driver.	Drivers said that they thought the equipment was easy to use for customers.	The results of the consumer survey indicate that a small number of bus journeys have been generated attributable to the introduction of smartcards. The reasons that attracted the highest number of responses from adult customers (22 to 59 year olds) were easier to use and saves the customer time. It is estimated that 0.2 additional journeys per week per participant surveyed were undertaken. This figure is consistent with the 0.1 additional journeys calculated in Phase 3. As the absolute number of usable responses (12 respondents in Phase 4 stated they made more journeys) was low, it is suggested that any business case for the introduction of smartcards should not be based solely on these figures.
2	Reduce delays and improving reliability	Regression analysis from Phase 4 (ToTo) has shown that for customers transferring from cash-based transactions to smartcard transactions, there is a reduction in Dwell Time. For 'Adult Cash' tickets, this reduction in time is around 3 sec whilst for 'Child Cash' tickets, the reduction is around 1 second. For 'Flash Pass' tickets, the regression analysis indicates that smartcards increase the Dwell Time compared to standard ticketing. This could be due to the fact that standard flash passes needed to be shown to the driver, whilst smart flash passes need to be touched on the scanner and then shown to the driver.	Over half of the drivers felt that the equipment had not made the boarding process quicker.	Customers said that delays on the bus are caused by people not having their money ready, people paying with notes and lots of people boarding.  A Pay as you Go smartcard takes away the need for cash and change and one consequence of adopting a ToTo system is to speed up boarding times for those customers moving from paying a cash fare to using a Pay as you Go smartcard.

3	Reduce fraud of all types	N/A	Compared to Phase 1, the number of drivers stating that they experienced fraudulent paper ticket use has increased slightly. When questioned, drivers reported a small decrease in the level of fraudulent use of smartcards. There is also some evidence from the driver's survey that the smartcard readers have a positive impact on detection of fraud.	Just about half (49%) of non-Yorcard users aged 16 and under believed that Public Transport would be more appealing 'if the tickets were more secure' whilst the majority (61%) of those aged 17 and above did not think so.
4	Enhance the image of public transport	N/A	N/A	Children in particular, have been observed to like the idea of smartcards because they seem modern and you can, in theory, do lots of different things with them. See also objective 3 above.
5	Reduce administrative costs	N/A	N/A	N/A
6	Improve sales channels	N/A	It was suggested by some TIC staff that one retail unit per TIC limited the service they could offer.	As with the equipment users research, there has been a positive trend in terms of sales from the retail channels offered in the pilot. Unfortunately, this has been due to the fact that many customers, particularly children, would prefer not to have to speak to the driver. It has also been seen that any help required during or after sales has resulted in a positive experience.
7	Improve MTC revenue distribution by providing more accurate information on journey lengths	N/A	N/A	N/A
8	Prove ITSO compliant equipment and operational protocols in a major scheme	N/A	N/A	N/A
9	Integrate with Real Time Information	N/A	N/A	N/A
10	Inform Business Cases	The data, analysis and output reports have all been drawn upon when drafting the business case to the DfT.		

*Note: N/A in this context (and for the next table) means not applicable in terms of this Phase and study output. The full research programme will deliver against each objective for the Best Practice Final Report in Phase 7. The full research programme will deliver against each objective for the Best Practice Final Report in Phase 7.*

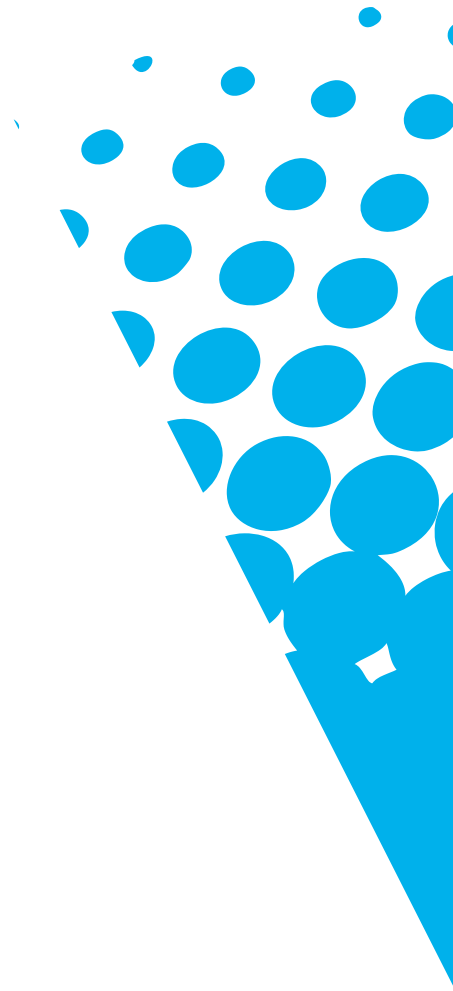
# Appendix 2

## Appendix 2: Summary of the analysis of DfT Objectives.

	Objective	Study Deliverable		
		Boarding Time	Equipment User	Consumer
a	All elements of the pilot scheme shall be fully compliant to the prevailing ITSO documentation.	N/A	N/A	N/A
b	Conduct a robust analysis of (1) bus boarding times, (2) Systems performance and (3) passenger reaction to address the concerns of all key stakeholders involved in the rollout of smartcard technologies within a deregulated transport industry. This should provide a comparison of existing performance measures prior to the introduction of smartcards to the pilot area.	By collecting data about boarding passengers, such as, numbers, the time the first passenger steps on the bus to the last, and the ticket types used, it has been possible to estimate the additional time each passenger adds to overall Dwell Time, depending upon the ticket type used and this was observed across each of the phases.  A comparison of the data collected across the Phases has also proved possible	The surveys undertaken have identified driver perceptions, concerns and their views as to what tasks take the longest to resolve and the causes of any delays to bus journeys.  This has been tracked through the different phases of the research from pre-smartcard through, to Touch on only to Touch on Touch off (ToTo). (Note in the case of ToTo the volume of data is limited.)	Passenger reaction has been captured in the consumer survey report. The reaction of the passenger has been reported as being positive.  Although certain smartcard tickets may be slower than paper equivalents, this was not reflected in the customer survey feedback.
c	The research shall assess the Customer Experience and the Operator and PTE expectations and provide recommendations for rollout. Included within this analyses shall be a study of the business case for deployment of similar regional schemes.	As (b) above. Tracking has enabled the evaluation of the impact of the use of smartcard technology on boarding and alighting times. This information has been used to inform the business case	As (b) above. Tracking has enabled the evaluation of the impact of the use of smartcard technology. This information has been used to inform the business case	As (b) above. Tracking has enabled the evaluation of the impact of the use of smartcard technology. This information has been used to inform the business case



	Objective	Boarding Time	Equipment User	Consumer
d	To understand the value of new innovative ticketing products to the key stakeholders.	The transaction times of the smart Adult cash pass (Pay as you Go) were recorded to be quicker than adult cash transactions.	N/A	For the majority of participants, the tickets they choose are dependent upon value and convenience. Therefore, as with Phase 1, if Yorcard is to appeal to consumers it is vital that the tickets they purchase are convenient to buy and to use and offer them the best value.
e	To understand the value of using Citizen cards as an alternative to transport only smartcards.	To be discussed as part of Phases 6 and 7.		
f	To ensure that all deliverables are clear, concise, accurate, thorough, of a high technical quality and well written.	Clear reports have been written based on a template agreed by research stakeholders.		
g	The research shall complement the Yorcard pilot timetable.	Data was collected during the period when smartcard exit reading technology was installed and operational on bus.		





Yorcard

# Contents

## 1.0 Executive Summary

## 2.0 Background & Introduction

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1.1	Additions to this version..... 126 of the Data Book	2.1	Scope of the Data Book..... 128
1.2	Summary of..... 126 Data Interpretation		
1.3	Effects of the Calendar..... 127 of Events		

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## 3.0 Calendar of Events

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3.1	Data Collection ..... Methodologies	129
3.2	Calendar of Events .....	130
3.3	Summary of Monthly ..... Weather Reports	130

## 4.0 Results

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4.1	Bus Patronage.....	131
4.2	Rail Patronage .....	131
4.3	Service Performance Outputs....	132

# Executive Summary

## 1.1 Additions to this version of the Data Book

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This is the fourth and final Data Book for the Yorcard project, and includes a summary of the data collected during the Phase 4 surveys, - boarding time, equipment user and consumer surveys - from August 17th 2009 to October 2nd 2009 (last operational day of the Pilot). The Data Book also includes an incident report and calendar of events, information on patronage figures for the pilot routes used in this Yorcard project on local trains between Sheffield-Doncaster, and monthly weather reports for August 2009 and September 2009.

## 1.2 Summary of Data Interpretation

---

The data collected during Phase 1 was used to establish a baseline scenario against which the results of future phases are compared, in order to measure and monitor the impact of the introduction of the Yorcard smartcards. Smartcards were introduced to a limited number (69) of school children on 19th February 2008 (approximately halfway through the duration of Phase 1) before going live in Phase 2 on Stagecoach pilot services on 28th April 2008 and on First pilot services through September 2008. Rail services went live shortly after, on November 3rd 2008.

Comparison of the survey results between Phase 1 and Phase 2 suggested that the new ETMs had a slightly negative impact on operations in this Phase. Key statistics from the Boarding Time studies showed an increase in the average Dwell Time and Boarding/Alighting times from Phase 1 to Phase 2. Results from the Drivers Survey indicated that in Phase 2, all the ETM tasks were perceived to be slightly more difficult, and a lot more time consuming compared to Phase 1.

The Driver Survey commenced towards the end of Phase 2, shortly after all pilot services went live, and it was suggested that the bedding-in period of the new ETMs and drivers learning how to operate them could have had an effect on the results. As Phase 3 went live so soon after the Phase 2 data collection, it was decided that it was unnecessary to undertake a Driver or TIC Survey in this Phase as the results would be similar.

Comparing the key statistics from the respective Boarding Time studies between Phases 2 and 3 indicated an increase in the average dwell and boarding/alighting times, but the standard deviation for both measurements had decreased, suggesting the boarding/alighting process was slightly more consistent in Phase 3 than in Phase 2. Looking at the average boarding/alighting time per boarding/alighting passenger reveals that this measurement had also decreased, from 9.08 seconds per passenger in Phase 2 to 5.85 seconds in Phase 3 respectively, a similar time to the baseline figure established in Phase 1, 5.76 seconds.

## 1.3 Effects of the Calendar of Events

Comparing the survey results of Phase 4 with the previous phase indicates a fall in the average dwell and boarding/alighting times, and also a decrease in the standard deviations of both measures. This suggests that the boarding/alighting process in Phase 4 is not only quicker than in Phase 3, but also more consistent. Comparing these Phase 4 results with the baseline established in Phase 1 suggest that Touch-on Touch-off operations are slightly slower than before smartcard operations were introduced (average dwell time of 32.30 seconds in Phase 4 versus 28.66 seconds in Phase 1), but the standard deviation for the dwell time is significantly smaller (44.33 seconds in Phase 4 compared to 68.06 seconds in Phase 1). However, it must be noted that the period of ToTo operations was relatively short compared to the other Phases. Therefore some of the relatively few customers touching off may not have become familiar with the required processes. The specific exercise undertaken to measure the alighting time for Touch-off operations was inconclusive as there were only 151 recorded ToTo observations.

Looking at the results of the various Driver surveys indicates that there has been no significant shift in opinions regarding the difficulty of the various ETM tasks and, in general, each task is still perceived to be as time consuming in Phase 4 as it was previously. 'They [the validators] make my job easier' and reliability ('Validators work all the time') have seen a slight increase in Driver opinions, although both still have a rating around '2 – Disagree'. Cash-handling is still perceived to be the greatest security risk to Drivers, and any measures to minimise the amount of cash handling are also viewed as the optimum way to make the job safer.

With respect to the different methods of smartcard operations, Drivers generally perceived Touch-on only operations to be the most suitable and feasible method out of all the options, although it was notable that pre-smartcard operations were also highly favoured. As previously stated, the period of actual ToTo operation was relatively short and, as found for smartcard users, drivers had little time to adapt to the new methods of working, which may have had a negative influence on their opinions of ToTo.

For employees of the Travel Information Centres, the only comparison available in Phase 4 was with Phase 1. In general, little had changed between the baseline and the responses in Phase 4, although one notable difference was that 'Making Concessionary Passes' was ranked as the most time consuming task in Phase 4 compared to the respective values in Phase 1.

It was encouraging to note that there was virtually no change in Consumer opinion about the convenience and ease of use of the ticketing regimes between Phase 1 and Phase 3, and this has continued into Phase 4, as Touch-on Touch-off operations became active. In fact, perceptions about the ease and convenience of buying tickets, and using tickets, have increased in Phase 4 compared to previous phases. Opinions about the various features of the smartcard validators have not changed compared to Phase 3.

The introduction of smartcards across all the pilot routes was spread across Phase 2, the Touch-on operations commenced throughout Phase 3, whilst Phase 4 saw the introduction of Touch-on and Touch-off ticketing operations.

The majority of Phase 4 was conducted throughout the school summer holidays and the summer vacation period of the Sheffield universities. Having no 'school run' could have had an impact, given the lighter loadings and reduction in peak-time traffic, and students only returned to study in Sheffield towards the end of Phase 4.

There were no atypical weather events, and as the monthly summaries for August and September 2009 indicate, these months had better weather conditions than the respective monthly long term averages.

# Background & Introduction

## 2.1 Scope of the Data Book

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The Yorcard Project was intended to deliver a multi-modal, multi operator public transport smartcard scheme to be trialled in part of the South Yorkshire area during 2008. The scheme offers certain commercial and concessionary ticket products in 'Smart' format and is built to the ITSO specification. Yorcard Limited has procured all the hardware, software and services required to enable the successful implementation of a Pilot scheme. The Pilot is being mounted on the services of three bus operators in the S10 area of Sheffield and on Doncaster to Sheffield rail services. Details of the Yorcard project and the research programme can be found in the research General Reference document.

This Yorcard Data Book is the document that sets out detail results of the outputs of the Pilot for use by Yorcard Project Stakeholders and other public and private sector participants. It is also available for use by any organisation that is considering implementing either a new ITSO compliant public transport smartcard scheme, or those considering the extension or upgrade of an existing smartcard scheme, in accordance with the conditions for circulation set down from time to time.

The Yorcard Data Book sets down the consolidated outputs of a research contract between the South Yorkshire Passenger Transport Executive (SYPTE) and the Department for Transport (DfT) Transport Technology and Standards Division.

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The scope of the Data Book is to facilitate:

- Evaluation of the success of Yorcard Pilot by individual stakeholders on both technical and commercial grounds and thus to:
  - Inform both public and private sector business cases for the expansion of the system to full roll out in South and West Yorkshire across all modes of transport.
- Informed discussions with potential funding organisations.
- Negotiations with Scheidt and Bachmann (primary supplier) under the terms of the Supply and Service Agreement entered into in 2007.

The Data Book is prepared in such a manner that:

- It complies with the terms set out in the Yorcard 'Participation Agreements';
- It enables commercially confidential data to be protected; and
- It complies with all current competition legislation at the time of initial preparation and that it can be adapted during the currency of the Pilot period should there be any change to or judicial interpretation of such legislation howsoever arising.



# Calendar of Events

## 3.1 Data Collection Methodologies

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The Calendar of Events sets out background reasons for any deviation from the baseline data collected within the live Yorcard Pilot and reference periods.

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The Calendar of Events started in June 2007 and shows occurrences of any and all of the following so far as information is available. For Phase 4, the Calendar of Events commences with the subsequent event following on from the end of Phase 3 (end of July 2009) and finishes at the end of the pilot timeframe, October 2009.

Primary events listed in the Calendar include the following:

- Major road incidents (roadworks, accidents, exceptional traffic levels and congestion);
- Delays to the Public Transport networks (engineering works, route diversions);
- Alterations to Public Transport services (timetable changes, route revisions, ticketing, ENCTS introduction, marketing, information and associated promotions);
- Special calendar dates (public holidays, school and university holidays, religious days, industrial action);
- Yorcard data collection dates;
- Yorcard project milestones; and
- Exceptional meteorological events (heavy rain, snow)

## 3.2 Calendar of Events

The following table show key events and any significant meteorological conditions which could have had an impact on services during the data collection for this Phase.

Date(s) and time(s)	Event
<b>9 July 2009</b>	<b><i>Pay as you Go cards introduced for customers</i></b>
<b>w/c 17 August 2009</b>	<b><i>Data collection for Phase 4 Consumer Focus Groups</i></b>
31 August 2009	Sale of Stagecoach 28 day Megarider smart products and monthly smart TravelMasters discontinued
3 September 2009	School Autumn term starts
6 September 2009	Great Yorkshire Run : some diversions
<b>w/c 7 September 2009</b>	<b><i>Data collection for Phase 4 Boarding Time Study</i></b>
21 September 2009	Sheffield Hallam University term 1 commences Part of City centre closed due to a Police Incident
25 September 2009	Cease the sale of First Week Red (52), all smart TravelMaster's and Pay as you Go cards.
28 September 2009	Sheffield University term 1 commences
<b>2 October 2009</b>	<b><i>Last operational pilot day</i></b>

Table 1 – Calendar of Events occurring during Phase 4

Notes to accompany Calendar of Events:

- Data collection dates have w/c and the first Monday to avoid any issues regarding reporting of sensitive data and if data collection was multiple days in a week.*
- Yorcard project milestone dates in bold italics.*

## 3.3 Summary of Monthly Weather Reports

A daily weather report was obtained from Weston Park weather station, the official climatological station in Sheffield. The following tables present a monthly summary of the weather conditions throughout the data collection for this Phase, with more detailed data and discussion occurring in other reports.

August 2009 Summary	Temperature (Max.)	Temperature (Min.)	Temperature (Max. & Min.)	Rain (mm)	Sunshine (Hours)
<b>Monthly Total</b>	-	-	-	54.2	194.5
<b>Monthly Average</b>	20.7	13.3	17.0	1.7	6.3
<b>Long Term Trend</b>	20.5	12.1	16.3	63	183

September 2009 Summary	Temperature (Max.)	Temperature (Min.)	Temperature (Max. & Min.)	Rain (mm)	Sunshine (Hours)
<b>Monthly Total</b>	-	-	-	31.6	151.1
<b>Monthly Average</b>	17.8	11.0	14.4	1.1	5.0
<b>Long Term Trend</b>	17.3	10.1	13.7	64	131

# Results

## 4.1 Bus Patronage

This data has been supplied by SYPTE and covers the larger operators in the area, accounting for approximately 97% of bus operations in South Yorkshire.

Data includes school operations provided by the operators supplying the data. Values are not adjusted to take account of the other 3% as these services are primarily school services.

Year	Quarter	Months Covered	Patronage (Millions)
2009	Q3 2009	July to September	27.60

## 4.2 Rail Patronage

Figures represent the scaled number of tickets sold per month for travel between stations on the pilot route which are fitted with Yorcard equipment (Sheffield, Meadowhall, Rotherham Central, Swinton, Mexborough, Conisborough and Doncaster) only. Figures are based upon a sample of less than 1% of journeys which are then scaled up to estimate the total numbers.

Passengers travelling on this line as part of a through journey (e.g. Leicester to Grimsby via Sheffield) are not included.

Source: SYPTE monitoring origin and destination surveys.

## 2009

Ticket Type	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Adult Return								37291	43829			
Adult Single								19696	20454			
Child Concessions								12019	6682			
Child Non Concessions								43552	37474			
Other								422	0			
Pre-Paid (Other)								15905	13745			
Pre-Paid (PTE)								61737	54681			
Unknown								1242	2423			

<sup>1</sup> Data is supplied for information only. From 31st December 2008 the Rail Smartcard operations were concluded

## 4.3 Service Performance Outputs

This section will report on the research outputs.

### Boarding Time - Phase 4

	Boarding Time Measurement (see below)	Average (Mean) (Sec.)	Standard Deviation (Sec.)	Buses Observed (no.)	Minimum (Sec.)	Q1 (Sec.)	Median (Sec.)	Q3 (Sec.)	Maximum (Sec.)
Data without Other Factors	A	32.30	44.33	1185	3.30	10.51	18.17	34.49	387.21
	B	29.13	42.73	1185	1.18	8.40	15.32	31.26	382.75
	C	7.98	19.17	1185	1.10	2.72	4.30	7.15	334.06
	D	14.81	32.53	306	1.03	5.26	7.74	12.56	368.21
	E	9.08	6.06	136	1.03	4.82	7.40	11.47	32.98
	F	21.37	31.53	427	0.61	3.25	10.50	24.64	298.91
	G	3.81	3.46	144	0.31	1.12	2.94	5.13	19.63
	H	14.26	22.49	228	0.63	2.39	4.3	17.78	195.81
	I	9.59	11.53	123	0.91	2.25	3.58	12.34	45.94
	J	7.44	6.40	650	0.38	2.77	5.32	9.97	40.80
	K	1.24	0.62	318	0.22	0.89	1.14	1.42	5.18

### Boarding Time - Phase 3

	Boarding Time Measurement (see below)	Average (Mean) (Sec.)	Standard Deviation (Sec.)	Buses Observed (no.)	Minimum (Sec.)	Q1 (Sec.)	Median (Sec.)	Q3 (Sec.)	Maximum (Sec.)
Data without Other Factors	A	47.00	50.20	936	3.29	16.28	31.89	57.81	399.96
	B	42.90	48.10	936	1.68	13.86	27.83	54.02	397.01
	C	5.85	10.30	936	0.65	3.13	4.47	7.00	125.95
	D	15.30	36.60	163	0.32	5.31	8.38	17.60	285.34
	E	11.60	13.30	54	1.51	4.23	7.63	12.97	125.67
	F	36.10	36.06	335	1.01	7.07	15.76	34.81	379.00
	G	3.85	3.34	33	0.58	0.95	1.53	5.32	30.57
	H	28.60	37.28	177	0.30	5.76	15.67	34.07	230.69
	I	7.75	11.32	53	0.30	2.41	3.40	5.38	74.51
	J	19.97	10.36	558	0.45	3.09	6.33	13.59	82.60
	K	2.70	1.39	119	0.08	0.84	1.23	1.66	12.92

## Boarding Time - Phase 2

	Boarding Time Measurement (see below)	Average (Mean) (Sec.)	Standard Deviation (Sec.)	Buses Observed (no.)	Minimum (Sec.)	Q1 (Sec.)	Median (Sec.)	Q3 (Sec.)	Maximum (Sec.)
Data without Other Factors	A	40.77	60.69	1212	2.38	12.58	23.47	42.03	542.69
	B	33.14	51.95	1212	1.97	9.73	18.90	34.46	560.21
	C	9.08	13.33	1212	0.75	3.10	5.55	9.45	124.70
	D	19.81	36.71	303	1.39	7.26	12.14	23.77	242.01
	E	17.71	32.07	158	1.97	7.02	10.23	19.53	123.59
	F	25.88	50.96	474	0.83	4.05	10.22	26.83	590.21
	G	4.90	6.82	274	0.42	1.67	3.22	5.73	75.29
	H	14.04	15.65	191	0.38	2.68	7.00	17.00	221.32
	I	4.62	1.44	92	0.38	2.03	2.67	3.50	9.31
	J	9.00	12.24	504	0.13	3.00	6.24	12.28	154.13
	K	1.38	0.71	268	0.01	0.98	1.25	1.54	6.50

## Boarding Time - Phase 1

	Boarding Time Measurement (see below)	Average (Mean) (Sec.)	Standard Deviation (Sec.)	Buses Observed (no.)	Minimum (Sec.)	Q1 (Sec.)	Median (Sec.)	Q3 (Sec.)	Maximum (Sec.)
With Other Factors	A	34.25	72.52	1049	2.66	10.90	18.71	34.07	1884.03
Data without Other Factors	A	28.66	68.06	965	2.66	10.19	17.95	29.34	1884.03
	B	23.78	34.95	965	0.40	8.00	14.67	26.01	596.66
	C	5.76	9.22	965	0.40	2.47	4.16	6.60	241.98
	D	10.47	23.82	254	0.60	3.83	6.07	9.92	268.35
	E	9.51	19.21	128	0.60	3.52	6.00	10.69	212.48
	F	19.79	37.63	448	0.47	3.35	8.01	22.32	568.6
	G	2.91	2.37	254	0.24	1.21	2.25	3.80	15.30
	H	9.34	6.32	34	3.31	4.75	6.55	11.57	24.40
	I	7.57	1.83	16	5.00	6.12	7.01	9.40	10.94
	J	18.95	10.76	161	3.79	11.66	17.56	23.90	62.43
	K	2.44	0.76	94	1.42	1.89	2.27	2.94	5.56

## Boarding Time Measurements

A	Dwell Time	G	Boarding Time (2) per boarding passenger (no alighters)
B	Average Bus Stop B/A time	H	Average Alighting Time (1)
C	Bus Stop B/A time per B/A passenger	I	Alighting Time (1) (no boarders)
D	Average Boarding Time (1)	J	Average Alighting Time (2)
E	Boarding Time (1) (no alighters)	K	Alighting Time (2) per alighting passenger (no boarders)
F	Average Boarding Time (2)		

Please refer to the General Reference Document for a detailed definition of each measurement.

# Consumer Survey

## Section 1 – About You

(Base = All Respondents. Phase 1 = 946, Phase 3 = 1143, Phase 4 = 990)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4			
			n	%	n	%	n	%	n	%		
1a	Age	16 and under	75	8%	No Consumer Survey in Phase 2		112	10%	72	7%		
		17-59	617	65%			676	59%	610	62%		
		60 and over	252	27%			349	31%	299	30%		
		Missing/No Answer	2	0%			6	1%	9	1%		
1b	Gender	Male	473	50%			562	49%	488	49%		
		Female	471	50%			573	50%	494	50%		
		Missing/No Answer	2	0%			8	1%	8	1%		
1c	Home Postcode	Not to be reported (Personal Data Confidentiality)										
1d	Which of the statements best describes you at the moment?	Employed in full time work	264	28%			No Consumer Survey in Phase 2		354	31%	315	32%
		Employed in part time work	67	7%					97	8%	92	9%
		Self employed	16	2%	20	2%			24	2%		
		Gov't training programme	4	0%	1	0%			6	1%		
		Unemployed and available for work	24	3%	34	3%			55	6%		
		Permanently sick or disabled	8	1%	18	2%			4	0%		
		Wholly retired from work	228	24%	278	24%			229	23%		
		Looking after the home	13	1%	6	1%			9	1%		
		In full time education	298	32%	306	27%			210	21%		
		Refused to tell			2	0%			3	0%		
1e	Which of the following types of transport have you used in the past month?	Bus	514	54%			650	57%	525	46%		
		Train	305	32%			426	37%	310	27%		
		Tram	385	41%			N/A	N/A	N/A	N/A		
		None of the above	209	22%			N/A	N/A	N/A	N/A		
		Missing/No Answer	19	2%			27	2%	43	4%		

## Section 2 – Non-Bus Users

(Base = Respondents who didn't use Bus or Train in Q1. Ph1 = 383, Ph3 = 316, Ph4 = 229)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
2a	What type of transport do you use most frequently?	Tram	161	42%	No Consumer Survey in Phase 2		54	17%	13	6%
		Car	143	37%			31	10%	154	67%
		Taxi	2	1%			3	1%	2	1%
		Motorcycle	2	1%			N/A	N/A	N/A	N/A
		Pedal cycle	2	1%			4	1%	7	3%
		Walking	60	16%			42	13%	47	21%
		Park and tram	1	0%			N/A	N/A	N/A	N/A
		Other	2	1%			119	38%	4	2%
		Missing/No Answer	10	3%			63	20%	2	1%
2b	Why do you prefer to use this mode of transport rather than bus or train?	It is convenient	212	55%			162	51%	142	62%
		It costs less than using other modes	52	14%			41	13%	56	24%
		I can travel alone - it's peaceful/ quieter	16	4%			34	11%	21	9%
		It's quicker than other modes	74	19%			71	22%	40	17%
		I can exercise at the same time	25	7%			14	4%	22	10%
		I don't know how to use public transport	1	0%			2	1%	1	0%
		Other	107	28%			59	19%	84	37%

## Section 3 – Public Transport Appeal

(Base = Various. Phase 1 = 946, Phase 3 = Various, Phase 4 = Various)

Q'n No	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	Mean
			Median	Median	Median	Median
			Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
3a	Please tell me how strongly you agree or disagree with the following statements	I find it easy to buy tickets	4	No Consumer Survey in Phase 2	4.1	4.7
			4		4.5	4.5
			0.92		0.97	0.91
		I find it convenient to buy tickets	3.8		4.0	4.1
			4		4.5	4.5
			0.97		1.00	1.02
		The tickets available are easy to use	4.2		4.1	4.4
			4		4.5	4.5
			0.86		0.98	0.87
		I have a ticket or pass to suit my travel needs	3.9		N/A	N/A
			4		N/A	N/A
			1.25		N/A	N/A
3b	Which of the following would encourage you to use public transport more?	If it were easier to pay for tickets	2.6	No Consumer Survey in Phase 2	2.6	2.4
			3		2	2
			1.34		1.15	1.22
		The tickets were more secure	2.9		2.8	2.4
			3		2.5	2.5
			1.41		1.24	1.29
		If boarding the bus could be made quicker	N/A		3.0	2.3
			N/A		3	1.5
			N/A		1.26	1.25
3c	Please rank the following statements regarding thoughts to causing delays to public transport journeys	People paying with notes	2.5	No Consumer Survey in Phase 2	2.5	2.7
			2		3	3
			0.5		0.97	0.93
		Lots of people boarding	2.2		2.2	2.1
			2		2	2
			1.06		1.10	1.10
		Not having money ready	2		2.0	2.1
			2		2	2
			0.98		0.90	1.02
		Long conversations with the driver	3.2		3.3	3.1
			4		4	4
			1.03		1.02	1.17

## Section 4 – Purchasing Tickets

(Base = Respondents who used Bus or Train in Q1. Ph1 = 563, Ph3 = 643, Ph4 = 644)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4				
			n	%	n	%	n	%	n	%			
4a	Which type of public transport do you use most often?	Bus	383	68%	No Consumer Survey in Phase 2	354	55%	234	36%				
		Train	171	30%						241	37%	228	35%
		Missing/No Answer	9	2%						24	4%	0	0%
4b	What type of ticket do you usually use?	Single ticket	122	22%		24	4%	182	28%				
		Free concess'ry pass	159	28%						80	12%	153	24%
		40p concess'ry pass	41	7%						67	10%	41	6%
		Return or day ticket	142	25%						156	24%	207	32%
		Period ticket (of any length)	90	16%						51	8%	137	21%
		Missing/No Answer	9	2%						289	45%	106	16%
4c	What type of period ticket do you usually use?	Not to be reported (Commercial Sensitivity)											
4d	Where do you usually buy your ticket from?	On the bus	244	43%	No Consumer Survey in Phase 2	136	21%	294	55%				
		Railway station	76	13%		147	23%	129	24%				
		Online	35	6%		N/A	N/A	1	0%				
		TIC	146	26%		20	3%	28	5%				
		On train	8	1%		8	1%	38	7%				
		Local shop or Paypoint store	2	0%		N/A	N/A	N/A	N/A				
		Other	25	4%		40	6%	42	8%				
		Missing/No Answer	27	5%		292	45%	0	0%				
4e	How do you decide which ticket to buy?	Convenience	131	23%	No Consumer Survey in Phase 2	175	27%	227	35%				
		Unsure when returning	39	7%		41	6%	37	6%				
		Best value for the travelling I do	229	41%		319	50%	305	47%				
		I don't know what other tickets are available	6	1%		28	4%	20	3%				
		I use more than one operator	7	1%		23	4%	36	6%				
		I use a concessionary pass	198	35%		N/A	N/A	N/A	N/A				
		Other	8	1%		40	6%	27	4%				
		Missing/No Answer	27	5%		292	45%	0	0%				
4f	Where do you usually find information about public transport fares and tickets?	Traveline	22	4%	No Consumer Survey in Phase 2	N/A	N/A	N/A	N/A				
		On the bus	99	18%		N/A	N/A	N/A	N/A				
		Online	187	33%		N/A	N/A	N/A	N/A				
		Railway station	51	9%		N/A	N/A	N/A	N/A				
		TIC	94	17%		N/A	N/A	N/A	N/A				
		On the train	1	0%		N/A	N/A	N/A	N/A				
		At the bus stop	32	6%		N/A	N/A	N/A	N/A				
		Word of mouth	21	4%		N/A	N/A	N/A	N/A				
		Other	11	2%		N/A	N/A	N/A	N/A				
		Missing/No Answer	45	8%		N/A	N/A	N/A	N/A				
4g	Do you usually find the information accurate?	Yes	485	86%	No Consumer Survey in Phase 2	N/A	N/A	N/A	N/A				
		No	44	8%		N/A	N/A	N/A	N/A				
		Missing/No Answer	34	6%		N/A	N/A	N/A	N/A				
4h	How would you like to get more information about fares and tickets?	At the bus stop	245	44%	No Consumer Survey in Phase 2	241	22%	233	18%				
		TIC	N/A	N/A		77	7%	147	11%				
		Railway Station	N/A	N/A		95	9%	127	10%				
		On train	N/A	N/A		42	4%	63	5%				
		Internet	N/A	N/A		237	22%	252	19%				
		Posters in public places	143	25%		59	5%	76	6%				
		Leaflets through door	117	21%		80	7%	81	6%				
		Adverts on bus	146	26%		94	9%	151	12%				
		Other	46	8%		176	16%	168	13%				



## Section 5 – Journeys by Bus

(Base = Various. Phase 1 = 383, Phase 3 = 650, Phase 4 = 525)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
5a	How many bus journeys do you usually make every week?	<1	31	8%	No Consumer Survey in Phase 2		57	9%	36	7%
		1-3	92	24%			121	19%	112	21%
		4-6	81	21%			151	23%	143	27%
		7-10	72	19%			129	20%	136	26%
		11+	101	26%			149	23%	94	18%
		Missing/No Answer	6	2%			43	7%	4	1%
5b	Which is your most frequent purpose for travelling by bus?	To/from Work	95	25%			197	30%	155	30%
		Shopping	90	23%			117	18%	92	18%
		Leisure	46	12%			59	9%	61	12%
		Visiting friends and family	29	8%			23	4%	23	4%
		Education	109	28%			137	21%	69	13%
		To/from Medical appointments	3	1%			15	2%	15	3%
		Other	1	0%			13	2%	23	4%
		Missing/No Answer	10	3%			89	14%	87	17%
5c	Is your most frequent journey a single or return?	Single	141	37%			N/A	N/A	N/A	N/A
		Return	229	60%			N/A	N/A	N/A	N/A
		Missing/No Answer	13	3%			N/A	N/A	N/A	N/A
5d	For your most frequent journey which day/s do you travel in a typical week?	All weekdays	283	74%			N/A	N/A	N/A	N/A
		Monday	36	9%	N/A	N/A	N/A	N/A		
		Tuesday	31	8%	N/A	N/A	N/A	N/A		
		Wednesday	39	10%	N/A	N/A	N/A	N/A		
		Thursday	30	8%	N/A	N/A	N/A	N/A		
		Friday	42	11%	N/A	N/A	N/A	N/A		
		Saturday	117	31%	N/A	N/A	N/A	N/A		
		Sunday	86	22%	N/A	N/A	N/A	N/A		
5e	For your most frequent journey, what time do you normally travel?	Single Journey		No Consumer Survey in Phase 2		N/A	N/A	N/A	N/A	
		M-F bef. 0900	121			32%	N/A	N/A	N/A	N/A
		M-F 0900-1530	90			23%	N/A	N/A	N/A	N/A
		M-F 1530-1830	11			3%	N/A	N/A	N/A	N/A
		M-F after 1830	5			1%	N/A	N/A	N/A	N/A
		Sat bef. 1830	7			2%	N/A	N/A	N/A	N/A
		Sat after 1830	5			1%	N/A	N/A	N/A	N/A
		Sun bef. 1830	1			0%	N/A	N/A	N/A	N/A
		Sun after 1830	1			0%	N/A	N/A	N/A	N/A
		No fixed time	120			31%	N/A	N/A	N/A	N/A
		Missing/No Answer	22	6%	N/A	N/A	N/A	N/A		
		Return Journey		No Consumer Survey in Phase 2		N/A	N/A	N/A	N/A	
		M-F bef. 0900	2			1%	N/A	N/A	N/A	N/A
		M-F 0900-1530	44			11%	N/A	N/A	N/A	N/A
		M-F 1530-1830	113			30%	N/A	N/A	N/A	N/A
		M-F after 1830	19			5%	N/A	N/A	N/A	N/A
		Sat bef. 1830	6			2%	N/A	N/A	N/A	N/A
		Sat after 1830	1			0%	N/A	N/A	N/A	N/A
Sun bef. 1830	5	1%	N/A			N/A	N/A	N/A		
Sun after 1830	0	0%	N/A			N/A	N/A	N/A		
No fixed time	83	22%	N/A	N/A	N/A	N/A				
Missing/No Answer	110	29%	N/A	N/A	N/A	N/A				
5f	For your most frequent journey what routes do you normally use?	Not to be reported (Commercial Sensitivity)								

Q'n No.	Question	Answer Categories	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	Mean
			Median	Median	Median	Median
			Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
5g (i)	Thinking about how you use your smartcard on bus, how strongly do you agree or disagree with the following statements? (1 = Strongly Disagree, through to 5 = Strongly Agree)	Smartcard reader is well placed on bus	N/A	No Consumer Survey in Phase 2	4.2	4.3
			N/A		4	4
			N/A		0.74	0.69
		Smartcard reader is at the right height	N/A		4.2	4.3
			N/A		4	4
			N/A		0.7	0.67
		Smartcard reader display is easy to read	N/A		3.9	3.9
			N/A		4	4
			N/A		0.95	0.99
		I can see smartcard reader lights	N/A		3.7	3.9
			N/A		4	4
			N/A		1.01	0.94
		I can hear smartcard reader beeps	N/A		3.8	4.0
			N/A		4	4
			N/A		1.02	0.98
Smartcard reader always works	N/A	2.8	3.2			
	N/A	3	3			
	N/A	1.27	1.23			
5g (ii)	Thinking about how you use your smartcard when touching-off, how strongly do you agree or disagree with the following statements? (1 = Strongly Disagree, through to 5 = Strongly Agree)	Smartcard reader is well placed on bus	N/A	No Consumer Survey in Phase 2	N/A	4.0
			N/A		N/A	4
			N/A		N/A	1.02
		Smartcard reader is at the right height	N/A		N/A	4.2
			N/A		N/A	4
			N/A		N/A	0.7
		Smartcard reader display is easy to read	N/A		N/A	3.9
			N/A		N/A	4
			N/A		N/A	0.93
		I can see smartcard reader lights	N/A		N/A	3.8
			N/A		N/A	4
			N/A		N/A	0.91
		I can hear smartcard reader beeps	N/A		N/A	3.8
			N/A		N/A	4
			N/A		N/A	1.08
Smartcard reader always works	N/A	N/A	3.3			
	N/A	N/A	3			
	N/A	N/A	1.24			

## Section 6 – Journeys by Train

(Base = Various. Phase 1 = 171, Phase 3 = 426, Phase 4 = 310)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
6a	How many train journeys do you usually make every week?	<1	80	47%	No Consumer Survey in Phase 2		191	45%	74	24%
		1-3	51	30%			125	29%	110	35%
		4-6	21	12%			39	9%	51	16%
		7-10	10	6%			30	7%	64	21%
		11+	3	2%			18	4%	8	3%
		Missing/No Answer	6	4%			23	5%	3	1%
		6b	Which is your most frequent purpose for travelling by train?	To/from Work			30	18%	116	27%
Shopping	18	11%		37			9%	25	8%	
Leisure	38	22%		85			20%	56	18%	
Visiting friends and family	61	36%		103			24%	78	25%	
Education	11	6%		30			7%	33	11%	
To/from Medical appointments	5	3%		4			1%	1	0%	
Other	2	1%		21			5%	1	0%	
6c	Is your most frequent journey a single or return?	Missing/No Answer	6	4%			30	7%	23	7%
6d		For your most frequent journey which day/s do you travel in a typical week?	Single	18	11%	N/A	N/A	N/A	N/A	
Return			144	84%	N/A	N/A	N/A	N/A		
Missing/No Answer	9		5%	N/A	N/A	N/A	N/A			
All weekdays	50		29%	N/A	N/A	N/A	N/A			
Monday	27		16%	N/A	N/A	N/A	N/A			
Tuesday	39		23%	N/A	N/A	N/A	N/A			
Wednesday	36		21%	N/A	N/A	N/A	N/A			
Thursday	29		17%	N/A	N/A	N/A	N/A			
Friday	68		40%	N/A	N/A	N/A	N/A			
6e	For your most frequent journey, what time do you normally travel?	Saturday	46	27%	N/A	N/A	N/A	N/A		
Sunday		44	26%	N/A	N/A	N/A	N/A			
Single Journey					No Consumer Survey in Phase 2		N/A	N/A	N/A	N/A
M-F bef. 0900		22	13%	N/A			N/A	N/A	N/A	
M-F 0900-1530		27	16%	N/A			N/A	N/A	N/A	
M-F 1530-1830		15	9%	N/A			N/A	N/A	N/A	
M-F after 1830		6	4%	N/A			N/A	N/A	N/A	
Sat bef. 1830		10	6%	N/A			N/A	N/A	N/A	
Sat after 1830		0	0%	N/A			N/A	N/A	N/A	
Sun bef. 1830		0	0%	N/A			N/A	N/A	N/A	
Sun after 1830		0	0%	N/A			N/A	N/A	N/A	
No fixed time		74	43%	N/A			N/A	N/A	N/A	
Missing/No Answer		17	10%	N/A	N/A	N/A	N/A			
Return Journey					No Consumer Survey in Phase 2		N/A	N/A	N/A	N/A
M-F bef. 0900		1	1%	N/A			N/A	N/A	N/A	
M-F 0900-1530		5	3%	N/A			N/A	N/A	N/A	
M-F 1530-1830		26	15%	N/A			N/A	N/A	N/A	
M-F after 1830		13	8%	N/A			N/A	N/A	N/A	
Sat bef. 1830		2	1%	N/A			N/A	N/A	N/A	
Sat after 1830		3	2%	N/A			N/A	N/A	N/A	
Sun bef. 1830		13	8%	N/A			N/A	N/A	N/A	
Sun after 1830		9	5%	N/A			N/A	N/A	N/A	
No fixed time		69	40%	N/A			N/A	N/A	N/A	
Missing/No Answer	30	18%	N/A	N/A	N/A	N/A				
6f	Do you travel on local train service between Doncaster and Sheffield? If so which stations do you use?	Sheffield	66	39%	361	85%	235	76%		
Meadowhall		39	23%	81	19%	34	11%			
Rotherham Cen		22	13%	32	8%	2	1%			
Swinton		22	13%	4	1%	2	1%			
Mexborough		21	12%	4	1%	1	0%			
Conisbrough		20	12%	3	1%	0	0%			
Doncaster		52	30%	79	19%	17	5%			
Don't travel on this line		96	56%	27	6%	56	18%			

Q'n No.	Question	Answer Categories	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	Mean
			Median	Median	Median	Median
			Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
6g	Thinking about how you use your smartcard on train, how strongly do you agree or disagree with the following statements? (1 = Strongly Disagree, through to 5 = Strongly Agree)	Station s/card readers are easy to find	N/A	No Consumer Survey in Phase 2	3.1	N/A
			N/A		3	N/A
			N/A		1.13	N/A
		Smartcard reader is at the right height	N/A		3.7	N/A
			N/A		4	N/A
			N/A		0.86	N/A
		Smartcard reader display is easy to read	N/A		3.3	N/A
			N/A		3	N/A
			N/A		0.99	N/A
		I can see smartcard reader lights	N/A		3.3	N/A
			N/A		3	N/A
			N/A		1.02	N/A
		I can hear smartcard reader beeps	N/A		3.2	N/A
			N/A		3	N/A
			N/A		1.07	N/A
		Smartcard reader always works	N/A		2.2	N/A
			N/A		2	N/A
			N/A		1.29	N/A
		Enough readers around stations	N/A		2.9	N/A
			N/A		3	N/A
N/A	1.04		N/A			
I would recommend smartcards	N/A	3.1	N/A			
	N/A	3	N/A			
	N/A	1.08	N/A			

## Section 7 – Experiences of Using Smartcards on Public Transport

(Base = All who said they have got a smartcard in Q7a. Phase 3 = 273, Phase 4 = 148)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
7a	Where did you get your first smartcard from?	In school	N/A	N/A	No Consumer Survey in Phase 2		43	16%	17	11%
		Given ENCTS	N/A	N/A			59	22%	64	43%
		From TIC	N/A	N/A			51	19%	48	32%
		Other	N/A	N/A			120	44%	19	13%
7b	How easy do you think it was when you got your first smartcard?	Very Easy	N/A	N/A			130	48%	72	49%
		Easy	N/A	N/A			73	27%	46	31%
		Neutral	N/A	N/A			53	19%	13	9%
		Difficult	N/A	N/A			4	1%	10	7%
		Very Difficult	N/A	N/A			6	2%	3	2%
		Missing/No Answer	N/A	N/A			7	3%	4	3%
7c	How easy do you find using the yorcard.com website?	Not Used Website	N/A	N/A			210	77%	109	74%
		Very Easy	N/A	N/A			16	6%	8	5%
		Easy	N/A	N/A			13	5%	11	7%
		Neutral	N/A	N/A			19	7%	4	3%
		Difficult	N/A	N/A			3	1%	3	2%
		Very Difficult	N/A	N/A			4	1%	1	1%
7d	Have you had to exchange your smartcard because it was faulty?	Yes	N/A	N/A	16	6%	6	4%		
		Easy	N/A	N/A	256	94%	139	94%		
		Missing/No Answer	N/A	N/A	1	0%	3	2%		
7e	Have you contacted the helpline or a TIC for help with your smartcard?	Helpline	N/A	N/A	4	1%	5	3%		
		TIC	N/A	N/A	24	9%	20	14%		
		Both	N/A	N/A	0	0%	2	1%		
		None	N/A	N/A	245	90%	117	79%		
		Missing/No Answer	N/A	N/A	0	0%	4	3%		

(Base = Those who had required help in Q7e. Phase 3 = 28, Phase 4 = 27)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
7f	How would you rate the service you received?	Very Good	N/A	N/A	No Consumer Survey in Phase 2		6	21%	9	33%
		Good	N/A	N/A			16	57%	10	37%
		Neutral	N/A	N/A			3	11%	4	15%
		Poor	N/A	N/A			1	4%	1	4%
		Very Poor	N/A	N/A			1	4%	3	11%
		Missing/No Answer	N/A	N/A			1	4%	0	0%

(Base = All who said they have got a smartcard in Q7a, split by non-ENCTS and ENCTS cardholders.

Phase 3 = 214+59, Phase 4 = 84+64)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n1	n1%	n1	n1%
7g	Do you think you have changed the frequency of Public Transport journeys?	More journeys	N/A	N/A	No Consumer Survey in Phase 2		N2	n2%	n2	n2%
		Less journeys	N/A	N/A			50	23%	23	27%
		About the same	N/A	N/A			25	42%	34	53%
		Missing/No Answer	N/A	N/A			5	2%	5	6%
								1	2%	0
				153	71%	54	64%			
				28	47%	25	39%			
				6	3%	2	2%			
						8%		5	8%	

n1 – non-ENCTS cardholders; n2 – ENCTS cardholders

(Base = Those who said they made more journeys in Q7g, split by non-ENCTS and ENCTS cardholders.  
Phase 3 = 50+25, Phase 4 = 23+34)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n1	n1%	n2	n2%
7h	How many more Public Transport journeys per week have you made since receiving your smartcard?	1 to 2	N/A	N/A	No Consumer Survey in Phase 2	N2	n2%	n1	n1%	
		3 to 4	N/A	N/A		23	46%	9	39%	
		5 to 6	N/A	N/A		8	32%	17	50%	
		7 or more	N/A	N/A		7	14%	9	39%	
		Missing/No Answer	N/A	N/A		10	40%	11	32%	
						7	14%	2	9%	
			2	8%	5	15%				
			11	22%	3	13%				
			4	16%	1	3%				
			2	4%	0	0%				
			1	4%	0	0%				

n1 – non-ENCTS cardholders; n2 – ENCTS cardholders

(Base = Those who said they made more journeys in Q7g, split by non-ENCTS and ENCTS cardholders.  
Phase 3 = 50+25, Phase 4 = 23+34)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n1	n1%	n2	n2%
7i	Why have you made more Public Transport journeys made since receiving your smartcard?	Easy to use	N/A	N/A	No Consumer Survey in Phase 2	N2	n2%	n1	n1%	
		Like technology	N/A	N/A		20	40%	16	70%	
		Saves time	N/A	N/A		15	60%	19	56%	
		Seems cheaper	N/A	N/A		8	16%	4	17%	
		Used different mode of travel previously	N/A	N/A		3	12%	3	9%	
		Not related to having a smartcard	N/A	N/A		15	30%	10	43%	
		Other	N/A	N/A		4	16%	9	26%	
						16	32%	9	39%	
						12	48%	16	47%	
						7	14%	4	17%	
			7	28%	15	44%				
			10	20%	3	13%				
			3	12%	2	6%				
			9	18%	2	9%				
			4	16%	3	9%				

n1 – non-ENCTS cardholders; n2 – ENCTS cardholders

(Base = Those who said they made the same or fewer journeys in Q7g, split by non-ENCTS and ENCTS cardholders.  
Phase 3 = 158+29, Phase 4 = 59+25)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n1	n1%	n2	n2%
7j	Why have you made the same or fewer Public Transport journeys made since receiving your smartcard?	Complicated/ don't understand it	N/A	N/A	No Consumer Survey in Phase 2	N2	n2%	n1	n1%	
		Equipment doesn't work properly	N/A	N/A		5	3%	4	7%	
		Takes extra time than before	N/A	N/A		0	0%	0	0%	
		Seems more expensive than before	N/A	N/A		10	6%	11	19%	
		Don't need to or can't make more journeys	N/A	N/A		3	10%	1	4%	
		Would rather use other modes	N/A	N/A		4	3%	6	10%	
		Not related to having a smartcard	N/A	N/A		0	0%	0	0%	
		Other	N/A	N/A		2	1%	14	24%	
						0	0%	0	0%	
						63	40%	29	49%	
						19	66%	15	60%	
						13	8%	1	2%	
			0	0%	0	0%				
			60	38%	18	31%				
			11	38%	11	44%				
			16	10%	5	8%				
			0	0%	1	4%				

n1 – non-ENCTS cardholders; n2 – ENCTS cardholders

YORCARD Awareness (Phase 1 = 937, Phase 3 = 765, Phase 4 = 757)

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
-	Yorcard is a public transport smartcard for storing tickets and passes. Have you heard of it?	Yes	52	6%	No Consumer Survey in Phase 2	230	30%	153	20%	
		No	854	91%		518	68%	599	79%	
		Missing/No Answer	31	3%		17	2%	5	1%	

# Driver Survey

## Section 1 – Employment

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
1a	How many years experience do you have?	0<2	18	17%	24	19%	No Driver Survey in Phase 3		46	24%
		2<4	19	18%	20	16%			32	16%
		4<6	10	10%	11	9%			17	9%
		6<8	12	11%	14	11%			24	12%
		8 or more	46	44%	57	45%			75	39%
1b	Do you work full or part time?	Not to be reported (Commercial Sensitivity)								

## Section 2 – Shift Patterns and Routes

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
2a	Do you usually work a fixed shift?	Not to be reported (Commercial Sensitivity)								
-	What hours do you usually work?	Not to be reported (Commercial Sensitivity)								
-	What shift pattern do you usually work?	Not to be reported (Commercial Sensitivity)								
2b	Which bus routes do you usually work on?	Not to be reported (Commercial Sensitivity)								
2c	How often do you work on these routes?	Not to be reported (Commercial Sensitivity)								

## Section 3 – Your New Electronic Machine and Validator

Q'n No	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	Mean
			Median	Median	Median	Median
			Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
3a	Thinking about the new ticket machine and validators you use on the bus, how strongly would you agree or disagree with the following statements? (1 – 'Strongly Disagree', 5 – 'Strongly Agree')	They have has made my job easier	N/A	2.82	No Driver Survey in Phase 3	2.95
				3		3
				1.15		1.22
		Ticket machine is well placed in the driver's cab		3.88		3.84
				4		4
				0.76		0.88
		Entry validator is well placed for me to help		3.67*		3.87
				4*		4
				0.98*		0.77
		Exit Validator is well placed for me to help		3.67*		3.61
				4*		4
				0.98*		0.87
		They help people board more quickly		2.57		2.44
				2		2
		They are reliable and always work		1.19		1.22
	2.31	2.58				
	2	2				
	1.21	1.16				
	3.17	3.20				
	4	3				
	1.08	1.04				



## Section 3 – Continued

Q'n No	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	percentage (%) saying task was most difficult
			Median	Median	Median	
			Std. Dev.	Std. Dev.	Std. Dev.	
3b	Thinking of the ETM you use, how difficult or easy do you find each of the following tasks? (1 = 'Very Difficult', through to 10 = 'Very Easy')	Logging on	9.08	8.68	No Driver Survey in Phase 3	0%
			10	10		
			2.03	2.24		
		Updating the fare stage	9.22	9.06		0%
			10	10		
			2.11	2.06		
		Reading the ETM display	8.33	8.24		2%
			10	10		
			2.50	2.62		
		Pressing the buttons	8.61	8.05		1%
			10	9		
			2.17	2.63		
		Memorising what the buttons do	7.84	6.80		12%
			8	8		
			2.46	2.68		
		Issuing paper tickets	8.83	8.01		1%
			10	9		
			2.31	2.57		
		Issuing paper tickets with wallet	8.19	6.18		15%
			9	6		
			2.66	2.96		
		Changing ticket rolls	8.09	8.01		6%
			10	9		
			2.57	2.50		
		Unjamming the ticket roll	7.03	6.86		6%
			8	8		
			3.22	2.83		
		Scrolling menus or selecting tickets	7.86	6.31		49%
8	7					
2.53	3.21					
Validating Smartcards	N/A	7.16	5%			
	N/A	8				
	N/A	2.85				
Processing Smartcard tickets	N/A	6.69	3%			
	N/A	7				
	N/A	2.85				
3c	Are there any other ETM tasks you find difficult or easy to do?	Open question	No answers given	No answers given	No Driver Survey in Phase 3	84 drivers said there were (see report)

## Section 3 – Continued

Q'n No	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4
			Mean	Mean	Mean	Is Task Time consuming? Yes (%)
			Median	Median	Median	
			Std. Dev.	Std. Dev.	Std. Dev.	
3d	Are there any ETM tasks you find time consuming? (1 = 'Very', through to 10 = 'Not at all')	Logging on	7.54	1.76	No Driver Survey in Phase 3	30%
			9	2		
			3.17	0.43		
		Updating the fare stage	9.20	1.94		4%
			10	2		
			1.91	0.23		
		Reading the ETM display	8.72	1.81		11%
			10	2		
			2.28	0.39		
		Pressing the buttons	8.67	1.73		21%
			10	2		
			2.20	0.44		
		Memorising what the buttons do	7.66	1.57		37%
			8	2		
			2.49	0.50		
		Issuing paper tickets	8.23	1.74		25%
			10	2		
			2.60	0.44		
		Issuing paper tickets with wallet	7.00	1.46		57%
			8	1		
			3.20	0.50		
		Changing ticket rolls	6.78	1.73		26%
			8	2		
			3.02	0.45		
		Unjamming the ticket roll	6.14	1.61		34%
			6	2		
			3.20	0.49		
		Scrolling menus or selecting tickets	7.97	1.39		77%
			8	1		
			2.53	0.49		
		Validating Smartcards	N/A	1.69		35%
			N/A	2		
N/A	0.46					
Processing Smartcard tickets	N/A	1.74	32%			
	N/A	2				
	N/A	0.44				

## Section 4 – Keeping to Time

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
4a	Putting aside traffic delays, do you find it easy to keep to the bus timetable?	Yes	133	80%	73	55%	No Driver Survey in Phase 3		N/A	
		No	34	20%	54	41%				
		No Answer	0	0%	6	5%				
Q'n No.	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4				
			Mean	Mean	Mean	Mean				
			Median	Median	Median	Median				
			Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.				
4b	Which of the following do you think delays the bus?	Customers not having fare ready	2.31	2.34	No Driver Survey in Phase 3	2.25				
			1	2		2				
		Customers paying with notes	2.5	1.49		2.02				
			3.05	2.67		2.68				
		Lots of people boarding	2	2		2				
			2.48	1.45		1.72				
		Issuing paper tickets	4.54	2.99		3.51				
			4	3		4				
		Issuing paper tickets with wallet	2.56	1.39		1.75				
			7.13	3.35		3.64				
		Being unable to read passes or tickets	8	3		4				
			2.61	1.51		2.07				
		Finding the correct ticket on ETM	4.79	3.17		2.64				
			4	3		3				
		Passengers disputing fares or documents	2.97	1.46		1.39				
			3.74	3.37		3.25				
		Discussions with people about fares etc.	3	4		3				
			2.74	1.33		1.47				
		Passengers using Smartcards	6.88	3.05		2.82				
			8	3		3				
Passengers using Smartcards	2.65	1.58	1.93							
	4.9	3.46	3.61							
Passengers using Smartcards	5	3	4							
	2.83	1.65	1.50							
Passengers using Smartcards	5.1	3.21	3.88							
	5	3	4							
Passengers using Smartcards	2.90	1.68	1.42							
	N/A	3.43	3.02							
Passengers using Smartcards	N/A	4	3							
	N/A	1.89	2.33							

## Section 5 – Safety and Security

Q'n No	Question	Answer	Phase 1		Phase 2		Phase 3		Phase 4	
			Mean		Mean		Mean		Mean	
			Median		Median		Median		Median	
			Std. Dev.		Std. Dev.		Std. Dev.		Std. Dev.	
5a	Please rank the following from 1 to 4, where 1 in your opinion is the greatest security risk	Carrying cash on the bus	1.58		1.71		No Driver Survey in Phase 3		1.97	
			1		1			2		
			0.91		0.97			1.00		
		Carrying cash to the depot	2.21		2.61			2.42		
			2		3			2		
			1.09		1.09			1.07		
		Carrying cash on a Monday or Tuesday	2.4		2.41			2.30		
			2		2			2		
			1.17		1.08			0.90		
		Passenger confrontation	2.91		3.28			3.33		
			3		4			4		
			1.05		1.05			1.33		
5b	Please rank the importance of the following improvements to safety and security, from 1 to 3	Less cash handling	1.31		1.38		1.43			
			1		1		1			
		Reliable way to validate a ticket or pass	0.63		0.70		0.46			
			2.11		2.38		2.49			
		Not accepting payment from large notes	2		3		3			
			0.84		0.84		0.49			
			1.97		2.01		2.12			
			2		2		2			
			0.80		0.74		0.46			

## Section 6 – Fraud

Q'n No	Question	Answer	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
			6a	How often do you encounter expired or fake tickets and passes?	0-2 3-4 5-6 7+	57 25 12 5	58% 25% 12% 5%	80 38 8 6	61% 29% 6% 5%	No Driver Survey in Phase 3
6b	How many times each day does the ticketing equipment show an invalid ticket or pass when a Smartcard is used?	0-2 3-4 5-6 7+	N/A N/A N/A N/A	79 31 6 12	62% 24% 5% 9%	130 38 8 13	69% 20% 4% 7%			
6c	Excluding Smartcards, what do you think is the most common method of passenger fraud?	Out of date tickets Copied or fake tickets Passing tickets back to others Tickets from other operators Over-riding Rushing past the driver or hiding behind other boarders	46 3 1 0 14 10	62% 4% 1% 0% 19% 14%	75 15 10 3 40 11	49% 10% 6% 2% 26% 7%	102 9 5 2 44 4	61% 5% 3% 1% 26% 2%		
6d	Considering Smartcards only, what do you think is the most common method of passenger fraud?	Printed dates on smartcards have expired Paper counterpart doesn't match Smartcards passed back for others to use Equipment shows invalid Smartcard	N/A N/A N/A N/A	37 19 12 53	31% 16% 10% 44%	N/A 45 17 73	N/A 25% 10% 41%			

## Section 7 – About You

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
7a	Age	18-24	4	4%	6	5%	No Driver Survey in Phase 3		11	23%
		25-34	18	18%	20	16%			31	34%
		35-44	31	32%	45	36%			62	76%
		45-59	33	34%	44	35%			69	55%
		60+	12	12%	11	9%			22	12%
7b	Gender	Male	95	97%	123	98%			184	94%
		Female	3	3%	3	2%			11	6%

## Section 8 – Comparing Smartcard Equipment

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
8a	How many smartcard users do you think bother to scan their card when getting off the bus?	All or Nearly All	N/A		N/A		No Driver Survey in Phase 3		102	61%
		About 3 out of 4							9	5%
		About Half							5	3%
		About 1 in 4 or less							2	1%

Q'n No	Question	Answer	Phase 1	Phase 2	Phase 3	Phase 4
			Touch-on	Touch-on	Touch-on	Touch-on
			Touch-off	Touch-off	Touch-off	Touch-off
			Pre-S/card	Pre-S/card	Pre-S/card	Before S/card
			Neither	Neither	Neither	Neither
8b	Thinking about when passengers only touched-on compared to now, where they also touch-off, please indicate whether things have got better with the new smartcard equipment	Quicker getting people on and off the bus	N/A	N/A	No Driver Survey in Phase 3	39%
						12%
		Equipment is easier to use	N/A	N/A	No Driver Survey in Phase 3	38%
						11%
		Equipment is more reliable	N/A	N/A	No Driver Survey in Phase 3	30%
						14%
		Easier for the passengers	N/A	N/A	No Driver Survey in Phase 3	41%
						15%
		Feel safer as a bus driver	N/A	N/A	No Driver Survey in Phase 3	20%
						10%
		Generally easier for me as a bus driver	N/A	N/A	No Driver Survey in Phase 3	42%
						28%
						40%
						14%
						35%
						11%
				19%		
				14%		
				19%		
				48%		
				27%		
				16%		
				34%		
				23%		

# Travel Information Centre Survey

## Section 1 – Employment

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
1a	How many years experience do you have?	0 - <2	2	33%	No TIC Survey in Phase 2		No TIC Survey in Phase 3		1	11%
		2 - <4	0	0%					0	0%
		4 - <6	0	0%					1	11%
		6 - <8	0	0%					1	11%
		8 or more	4	67%					6	67%
1b	Do you work full or part time?	Full Time	4	67%					4	44%
		Part Time	2	33%					5	56%
1c	Is your role Clerical or Supervisory?	Clerical	4	67%					7	78%
		Supervisory	2	33%					2	22%

## Section 2 – About You

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
2a	Age	18-24	0	0%	No TIC Survey in Phase 2		No TIC Survey in Phase 3		1	11%
		25-34	2	33%					1	11%
		35-44	1	17%					0	0%
		45-59	2	33%					7	78%
		60+	1	17%					0	0%
2b	Gender	Male	0	0%					1	11%
		Female	6	100					8	89%

## Section 3 – Selling Tickets

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
3a	Do you understand the ticket range used in Yorcard area?	Yes	4	67%	No TIC Survey in Phase 2		No TIC Survey in Phase 3		N/A	
		Nearly all	0	0%						
		Some	1	17%						
		No	1	17%						
Q'n No.	Question	Answer	Phase 1		Phase 2		Phase 3		Phase 4	
			Mean		Mean		Mean		Mean	
			Median		Median		Median		Median	
			Std. Dev.		Std. Dev.		Std. Dev.		Std. Dev.	
3b	How much do you agree with the following statements?	I sell the customer the ticket they ask for	1.00		No TIC Survey in Phase 2		No TIC Survey in Phase 3		2.33	
			1						1.50	
			0.00						1.75	
		I discuss the tickets available and then recommend a ticket	2.00						3.17	
			2						3.00	
			0.58						1.17	
		I discuss the tickets available and the customer decides	2.00						3.00	
	2		2.50							
		0.82		1.27						
Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
3c	How often do you spend time discussing tickets with customers?	Every day	5	83%	No TIC Survey in Phase 2		No TIC Survey in Phase 3		8	89%
		Once a week	1	17%					1	11%
		Less than once a week	0	0%					0	0%
		Never	0	0%					0	0%
3d	Do you find that customers are confused about tickets?	Yes	1	17%					6	67%
		No	4	67%					3	33%
3e			N/A							
3f	How often do you feel under pressure to serve customers quickly?	Often	0	0%	No TIC Survey in Phase 2		No TIC Survey in Phase 3		3	33%
		Only when there are long queues	6	100%					3	33%
		Rarely	0	0%					3	33%

## Section 4 – Using the Ticket & Pass Issuing Equipment

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
4a	How time consuming do you find logging into the systems?	1	0	0%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	0	0%		
		2	3	50%			1	11%		
		3	1	17%			5	56%		
		4	2	33%			2	22%		
		5	0	0%			1	11%		
4b	Do you think that this process could be simplified?	Yes	0	0%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	2	22%		
		No	6	100%			7	78%		
4c	N/A									
4d	On a scale of 1 to 5, how time consuming do you find it to enter data?	1	1	17%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	0	0%		
		2	2	33%			1	11%		
		3	0	0%			6	67%		
		4	3	50%			2	22%		
		5	0	0%			0	0%		
Q'n No.	Question	Answer	Phase 1		Phase 2		Phase 3		Phase 4	
4e	Thinking about issuing concession passes, please rank the following tasks in order of which you think are the most time consuming to the least	Verifying entitlement	Mean	2.00	No TIC Survey in Phase 2	No TIC Survey in Phase 3	Mean	2.25		
			Median	2			2.00			
			Std. Dev.	0.45			0.71			
		Identifying the customer in eCRM	Mean	1.75			2.50			
			Median	2			2.50			
			Std. Dev.	0.82			0.53			
		Making the pass	Mean	2.25			1.22			
			Median	2			1.00			
			Std. Dev.	0.72			0.67			
Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
4f	Do you think any of the above (4e) processes could be simplified?	Yes	0	0%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	4	50%		
		No	4	100%			4	50%		
4g	N/A									
4h	Do you experience any of the following problems when collecting information for issuing concession passes?	Postcode or address not in system	1	17%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	5	56%		
		Wrong types of photos	3	50%			4	44%		
		Applicants not having the right documents	6	100%			8	89%		
		Applicants are not eligible	3	50%			7	78%		
4i	Thinking of the problems you encounter in 4(h), do you think that the process for collecting information for a concessionary pass could be simplified?	Yes	0	0%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	1	12%		
		No	4	100%			7	88%		

## Section 5 – Payments

Q'n No.	Question	Answer Categories	Phase 1		Phase 2		Phase 3		Phase 4	
			n	%	n	%	n	%	n	%
5a	On a scale of 1 to 5, how time consuming do you find it to take payments for tickets and passes?	1	1	17%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	0	0%		
		2	1	17%			1	11%		
		3	0	0%			5	56%		
		4	2	33%			2	22%		
		5	2	33%			1	11%		
Q'n No	Question	Answer	Phase 1		Phase 2		Phase 3		Phase 4	
			Mean		Mean		Mean		Mean	
			Median		Median		Median		Median	
			Std. Dev.		Std. Dev.		Std. Dev.		Std. Dev.	
5b	Please rank the following in order of the most time consuming to the least.	People paying by chip and pin	1.80	No TIC Survey in Phase 2	No TIC Survey in Phase 3	1.33				
			2			1				
		0.84	0.71							
		Giving change for notes	2.60			2.11				
			3			2.00				
		Not having enough change	0.55			0.60				
			1.60			2.56				
1	3.00									
0.89	0.73									
5c	Do you think any of the above (5b) processes could be simplified?	Yes	1	20%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	2	29%		
		No	4	80%			5	71%		
5d	N/A									
5e	On a scale of 1 to 5, how time consuming do you find it to offer refunds or exchanges for tickets?	1	1	17%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	0	0%		
		2	1	17%			1	11%		
		3	1	17%			6	67%		
		4	2	33%			2	22%		
		5	1	17%			0	0%		
5f	Do you think any of the above (5e) processes could be simplified?	Yes	1	25%	No TIC Survey in Phase 2	No TIC Survey in Phase 3	0	0%		
		No	3	75%			7	100%		









