A   Introduction

Norfolk County Council (NCC) has developed a Public Transport Major Scheme to improve public transport interchange and bus priority in Norwich City Centre. As part of delivering the aims of this scheme, NCC installed 15 on-street ticket vending machines (TVMs) at selected locations in Norwich, which included Norwich City Centre, the bus station, railway station, the University of East Anglia (UEA) campus and the Norfolk and Norwich University Hospital.

The project provided NCC with a system that enabled a step change in the level of off-bus ticket sales and had the aims of delivering:

- Journey time and wait time savings for public transport users
- Improved efficiency and reliability of bus services, contributing to increased bus patronage and Local Transport Plan targets
- Potential for additional revenue and operating cost savings for bus operators
- Increased capacity of on-street stops to accommodate additional departures
- System capable of future upgrade to support smart card ticketing

This project was innovative in that it delivered the first comprehensive solution for roadside bus ticket sales suitable for the deregulated environment applicable in the UK outside London.

A1   Objectives

The measure objectives are:

- **Objective 1 -** To reduce bus boarding times at city centre bus stops and other key bus stops by providing facilities for passengers to purchase a ticket at the bus stop prior to boarding by installing 16 roadside ticket vending machines
- **Objective 2** - To develop a ticket vending machine and revenue management system suitable for a competitive, multi-operator environment
- **Objective 3** - To deliver systems that are capable of being upgraded to support future initiatives e.g. smart cards
- **Objective 4** - By reducing dwell times at bus stops, to improve the efficiency and reliability of bus services in Norwich
- **Objective 5** - Improved efficiency and reliability of bus services, contributing to increased bus patronage and Local Transport Plan targets
- **Objective 6** - Potential for additional revenue and operating cost savings for bus operators
- **Objective 7 -** Increased capacity of on-street stops to accommodate additional departures

A2 Description

The roadside TVMs have networked communications links and enable remote monitoring of machine performance and ticket sales. The TVMs offer a full range of single, return and day tickets for travel within the five fare zones covering the greater Norwich area. Tickets can be purchased for five different bus operators and the machines accept cash (notes and coins) and give change. Fifteen (15) TVMs are installed at locations within Norwich, including the bus and rail stations, Castle Meadow, St Stephens Street, Red Lion Street, University of East Anglia, Norfolk and Norwich University Hospital. Please note that the TVM locations map for the city centre below indicates two TVMs are installed at the rail station. However, there is only one TVM at the rail station and the 'spare' TVM has been used for testing and development purposes prior to it being installed in an alternative location (to be completed). Servers for remote monitoring and revenue management systems are located at County Hall, Norwich.

TVM Locations City Centre.pdf   TVM Locations UEA and Hospital.pdf

Task 1
- Establishment of user needs and confirmation of the functional design specification. This will include discussions with bus operators, feedback from general public and technical capabilities of the machines.

Task 2
- Hardware build and software development
- Factory acceptance testing to ensure that the machines have the required functionality and operate without fault
- Installation and testing of Central Management System and TVMs
- Training of maintenance contractors and officers from Passenger Transport Unit at Norfolk County Council. This is to be provided by the machine manufacturers and the Training Officer at Norfolk County Council
- Evaluation of performance statistics

B Measure implementation

B1 Innovative aspects

Innovative Aspects:
- New physical infrastructure solutions

The innovative aspects of the measure are:

- **New physical infrastructure solution, regionally** – Traditionally the majority of passengers using bus services in Norwich and many other UK

cities have purchased their ticket from the driver on boarding. Season and multi-journey tickets are often sold off-bus through outlets such as newsagents and convenience stores, but the full potential of off-bus ticketing is not realised unless customers can easily purchase tickets for an individual journey after the decision to make that journey but before boarding the bus. There is increasing interest amongst UK local authorities in the potential for the efficiency of urban bus services to be improved by moving ticket sales off-bus using roadside ticket vending machines, but the only major application of this concept to date in the UK is in central London where this is facilitated by the regulation of services and tariffs by a single body (Transport for London). This project is innovative in delivering the **first comprehensive solution for roadside bus ticket sales** suitable for the deregulated environment applicable in the UK outside London.

B2   Situation before CIVITAS

The use of driver only operation together with the introduction of an increasingly comprehensive range of ticket types has led to lengthy dwell times at bus stops, particularly in the city centre. This in turn causes delays to scheduled journeys and to traffic congestion in the vicinity of bus stops which reduces air quality at those locations.

B3   Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Functional Design Specification *(April 05 - ongoing)* – This stage involved an assessment of how the machines were to perform and what functionality they would provide to the customer. This included ideas for how the ticket purchasing process would work, which operators would be included and what ticket types would be offered. This is an on-going process as the design of the graphical user interface and the information provided to customers is updated regularly based on customer feedback and changing circumstances in public transport provision.

Stage 2: Hardware Build *(March 05 – November 05)* – This related to the physical build of the machines in Dortmund, Germany. Build was done in two phases to represent two different installation phases.

Stage 3: Software Development for CMS *(March 05 – November 05)* – This is related to the development of the back-office central management system (CMS). It was important to ensure that the system was able to accurately identify faults and report ticket sales and revenue for individual bus operators.

Stage 4: Development of Graphical User Interface *(April 05 – ongoing)* – This is related to the development of the graphical interface and is heavily based on the functional design specification (Stage 1). This has been changed on several occasions during the project based on feedback from customers. A key change has been the provision of more information on bus service provision and the changing of screen colours to make the screen more visible to those with impaired vision. This is an on-going process as the design of the graphical user interface and the information provided to

customers is updated regularly based on customer feedback and changing circumstances in public transport provision.

Stage 5: Installation *(July 05 – February 06)* – This is related to the physical installation of the machines. This was carried out in two phases (Phase 1 was July 2005 and Phase 2 was February 2006).

Stage 6: Staff training *(August 05 – March 2006)* – Training was provided in cash collection and machine maintenance. In addition, training was provided in use of the central management system.

B4   Deviations from the original plan

The deviations from the original plan comprised:

- **Slight delay initial machine installation** – There was a relatively minor delay in the installation of machines, which was mainly caused by required electrical and communications works not being completed on time. The overall impact on the programme was minor.

- **Delay in delivery of payment using credit / debit cards** – The original plan included the delivery of functionality enabling payment by credit / debit cards. No specific date for this was set but it was hoped that this would be completed by March 2008. Delays were initially caused by problems in obtaining reliable communications links to the machines. Whilst these communications problems were resolved by end-2007, provision of electronic payment remains undelivered due to concerns over on-going revenue costs associated with this. Transaction charges occur for credit / debit cards and a business case is currently being prepared based on existing and future machine usage to identify what on-going funding is needed to support this and where funding can come from. We hope to conclude this analysis during Autumn-2008 and make a decision as to whether or not to proceed.

- **Provision of multi-operator ticketing across all machines** – The original plan was for tickets to be available for a wide range of bus operators across all machines. Delays in achieving reliable communications links to all machines meant that some machines presented tickets for more than one operator whilst others only had tickets for one operator. All communications problems have now been resolved and all machines are selling tickets for more than one bus operator.

- **Separation of service & maintenance and cash collection activities** – The original plan included service & maintenance and cash collection activities being undertaken by the same organisation to provide economies of scale and minimise on-going costs. Unfortunately, it was found that the technical skill levels of cash collection staff was not sufficient to resolve the various faults found with the machines. Some machines were therefore out of service for a while and additional cost had to be spent on engineers from the machine suppliers coming to Norwich from Dortmund. A new service & maintenance contract has been awarded so this is now separate to the cash collection. This has been a big success and has led to a significant increase in the machine reliability.

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure 8.4.** – Rail station interchange. There is a TVM installed at the rail station interchange. This was incorporated early in the design of the facility to ensure that this was located in a prominent position so that maximum benefit could be achieved. We also considered at a very early stage of the CIVITAS project that it would be a good idea to create a specific bus boarding area where all tickets had to be purchased off bus. The rail station was considered an ideal location for this and supported the aim of having a ticket machine installed as part of Measure 8.4. The delivery of this initiative is still being discussed with bus operators.

B5 Inter-relationships with other measures

C Evaluation – methodology and results

C1 Measurement methodology

C1.1 Impacts and Indicators

Table of Indicators

NO.	INDICATOR	DESCRIPTION	DATA /UNITS
1	Operating revenues	Revenues per PT pkm	Euros/pkm, quantitative, derived or measurement
2	Operating costs	Costs per PT pkm	Euros/pkm, quantitative, derived or measurement
13	Awareness level	Degree to which the awareness of the policies/measures has changed	Index, qualitative, collected, survey
14	Acceptance level	Attitude survey of current acceptance with the measure	Index, qualitative, collected, survey
15	Perception of PT accessibility	Attitude survey of perception of physical accessibility of PT network (distance to nearest PT stops)	Index, qualitative, collected, survey
18	Accuracy of PT timekeeping	Percentage of services arriving/departing on time compared to timetables (each city should fix the interval of time considered as a delay compared with timetable)	%, quantitative, collected, measurement
19	Quality of PT service	Perception of quality of PT services	Index, qualitative, collected, survey
23	Average vehicle speed – peak (local indicator)	Average vehicle speed over total network	Km/hr, quantitative, derived
24	Average vehicle speed - off peak (local indicator)	Average vehicle speed over total network	Km/hr, quantitative, derived
26	Average modal split-PAX	Percentage of pkm for each mode	%, quantitative, derived
28	Average occupancy	Mean no. persons per vehicle/day	Persons/vehicle, quantitative, derived, measurement
Local Indicator 1	Average bus boarding time – Peak	Average bus boarding time per passenger	Seconds per pax
Local Indicator 2	Average bus boarding time – Off Peak	Average bus boarding time per passenger	Seconds per pax

Detailed description of the indicator methodologies:

- **Indicator 1** (*Operation Revenues*) –All monies from ticket sales are recorded in a back-office data handling system. A wide range of information is available on how the machines are performing, what tickets are sold and when tickets are sold. A breakdown of ticket sales for each different operator and individual bus service is available and is used for statistical analysis and for payment to operators.

- **Indicator 2** (*Operation Costs*) – The operating costs of the machines are broken down into separate elements, which comprise of:

  (a) Cash collection

  (b) Machine maintenance

  (c) Software development and updates

  (d) Paper supplies

  (e) Insurance

  (f) Power and communications

  (g) Publicity and marketing

  These costs are being met by Norfolk County Council.

- **Indicator 13** (*Awareness Level*) – A telephone survey was conducted by Mott MacDonald in April 2007. Surveys were conducted by NCC at the N&N Hospital in Norwich during March 2008 and part of this asked customers about awareness and use of the ticket machine at the hospital. An indicator of awareness is also shown in the revenues generated.

- **Indicator 14** (*Acceptance level*) – Acceptance level is indicated by use of the machines in terms of ticket sales and revenue generated. Surveys outlined in the methodology for Indicator 13 will indicate how many people have used the machines compared to those who are aware of the machines – this will indicate an acceptance level.

- **Indicator 15** (*Accuracy of PT timekeeping*) – On time bus punctuality data is available from our bus tracking system, BusNet.

- **Indicator 18** (*Quality of PT service*) – Regular surveys provide an overall value of passenger satisfaction, although questions are not specifically asked to determine satisfaction with ticket machines.

- **Indicator 23** (*Average vehicle speed - peak*) – On reflection, information presented in Local Indicators 1 and 2 is more meaningful than the average speed. This information has not been collected in preference to using Local Indicator output.

- **Indicator 24** (*Average vehicle speed – off peak*) – See comments for Indicator 23 above.

- **Indicator 26** (*Average modal split*) –It is understood that modal split surveys are no longer conducted by Norfolk CC. An alternative source of comparable information is being sought.

- **Indicator 28** (*Average occupancy*) – It is understood that average occupancy surveys are no longer conducted by Norfolk CC. An alternative source of comparable information is being sought.

- **Local Indicator 1** (Average bus boarding time – Peak) – Surveys were conducted to identify the average time it takes each passenger to board a bus and complete the ticket purchase / transaction with the driver. Surveys were conducted during the afternoon / evening peak (1630 – 1800) in Norwich city centre.

- **Local Indicator 2** (Average bus boarding time – Off Peak) – See comments for Local Indicator 1 above. Surveys were conducted during the time period 1030 – 1630.

C1.2 Establishing a baseline

Before installation of the TVMs, passengers could only purchase bus tickets on-board the bus from the driver or from a travel shop in the centre of Norwich (mainly season tickets). We have identified that current average boarding times per passenger are high (approx. 8 seconds per passenger) and this is having a negative impact on bus service reliability and punctuality. This is based on surveys in 2003.

At present, there are 14 million bus journeys per year by bus in Norwich and the baseline is that none of these journeys would have been made using tickets purchased from on-street ticket vending machines.

## C1.3 Building the business-as-usual scenario

During the implementation of this Measure, there are a number of schemes being delivered in Norwich that aim to reduce congestion, increase bus service reliability and punctuality and encourage modal shift from car to public transport. In addition, the competitive nature of the bus industry in Norfolk (and in particular in Norwich) has resulted in several wide-ranging changes in bus service frequencies, routes and fares. All of these factors need to be considered when quantifying the impact of this Measure.

C2 Measure results

The results are presented under the same headings as those in Section C1.1.

Indicator 1 (*Operation Revenues*)

Total revenue from ticket sales over the period August 2005 – August 2008 is £280k.

TVM Ticket Sales (Aug 05 - Aug 08)
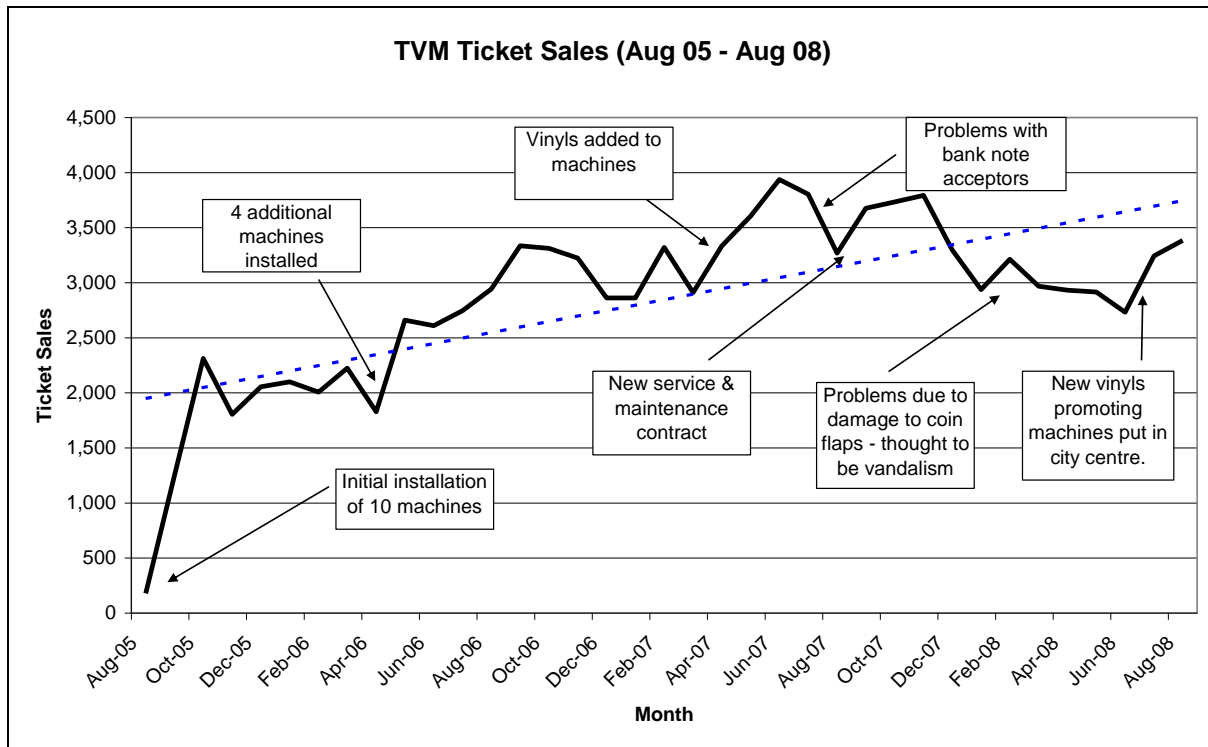
A picture of steadily increasing revenues is shown since installation. This graph is annotated to indicate key events over this period. Key events affecting revenues can be summarised as:

- Additional four machines being installed

- New vinyls added to machines and in the city centre to raise awareness of the machines – this occurred in May 2007 and July 2008

- Problems experienced with acceptance of £20 notes – a change in the format of the note meant new software was needed to rectify this

- New service & maintenance contract awarded to improve machine reliability

- Problems with approx 1/3 of machines affected by suspected vandalism, which resulted in coin flaps being damaged and machines out of order while sufficient replacement parts were ordered.

% Tickets Sold (Jan 07 - Aug 08)
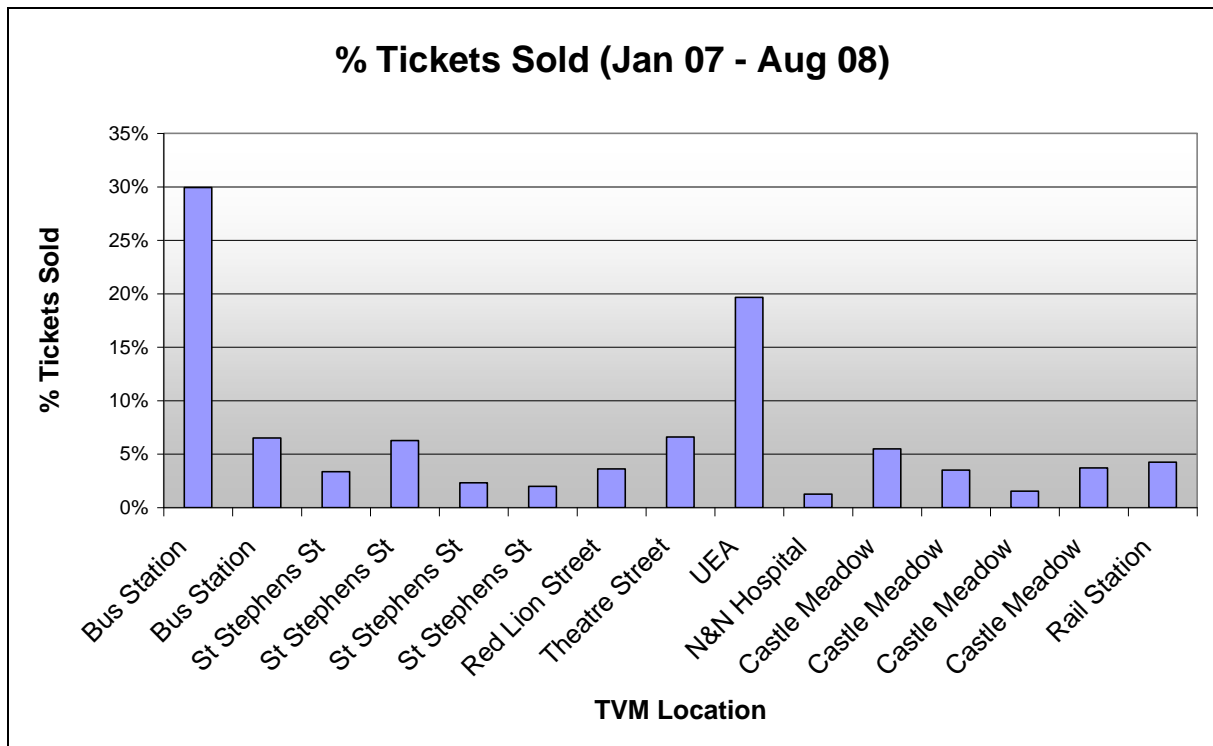
The graph above shows the proportion of overall ticket sales coming from each machine. It is clear that machines at the bus station and university (UEA) sell considerably more tickets than machines located elsewhere. This is consistent with these areas having high bus loadings and being key transport interchanges.

No commission is currently charged to operators and all monies from ticket sales are provided to the bus operators. A proposal for charging commission on ticket sales has been proposed to the operators and comments are awaited.

Indicator 2 (*Operation Costs*)

The total annual operation cost for the ticket vending machines is around £40k per annum. These costs are currently met by NCC. Efforts are continually being made to reduce these costs and the following is being undertaken:

- A new service & maintenance agreement has been awarded, which offers modest cost savings of around 5-15%

- Replacement paper supplies have been competitively tendered, which has lowered costs slightly by 5-10%

- A feasibility study is currently being undertaken to see if there are any cost savings for software updates and development to be undertaken by consultant partner Mott MacDonald rather than machine suppliers ICA GmbH.
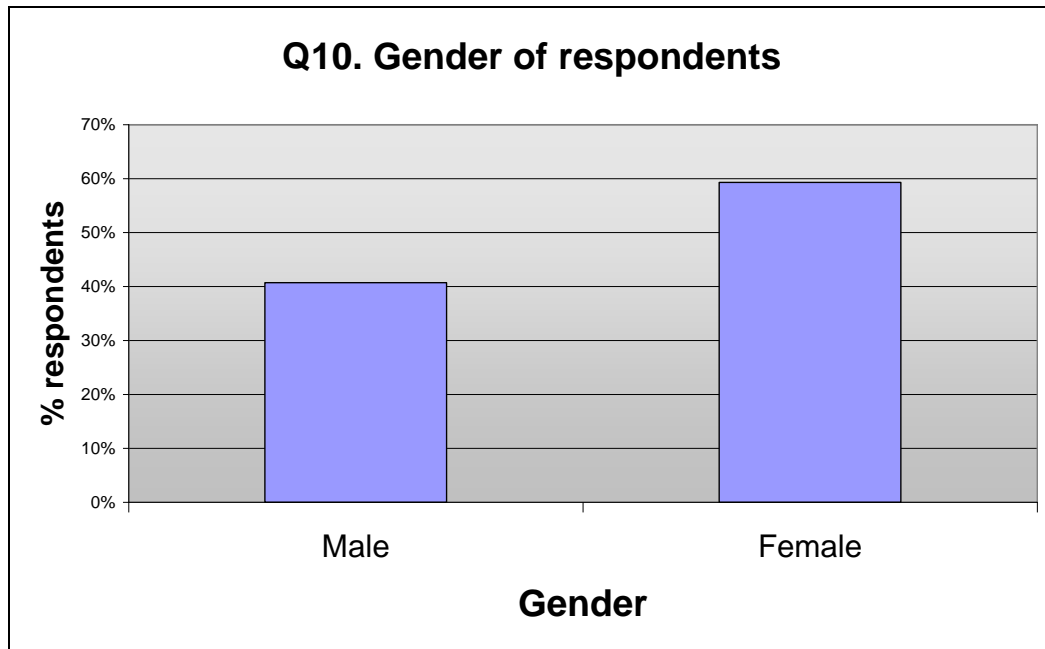
Participating bus operators have agreed to work with NCC in identifying cost savings that may be accruing as a result of the ticket machines.
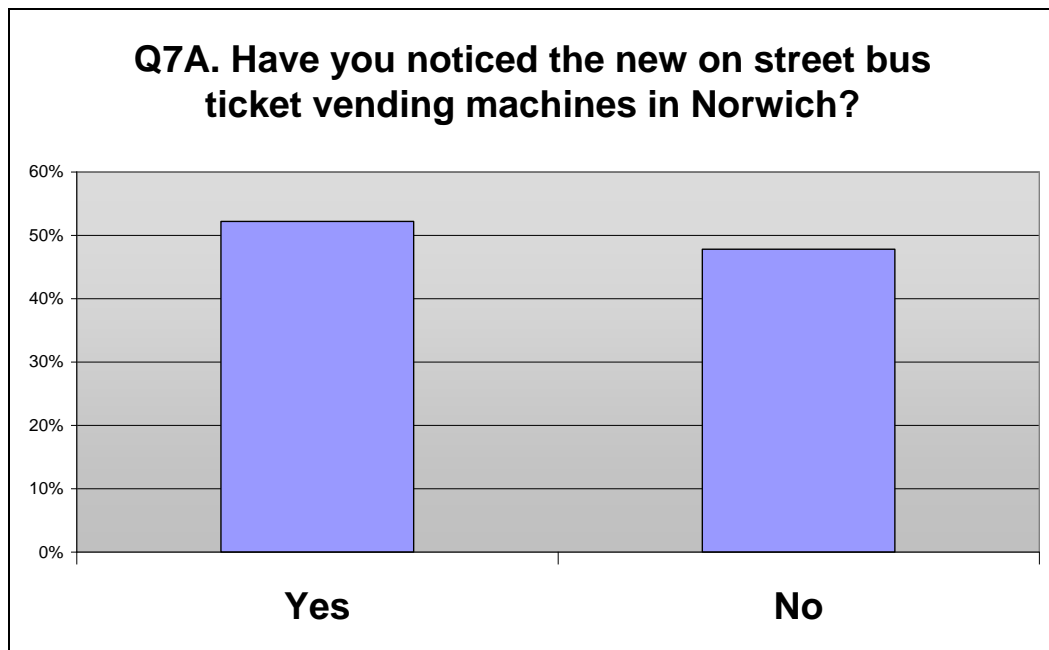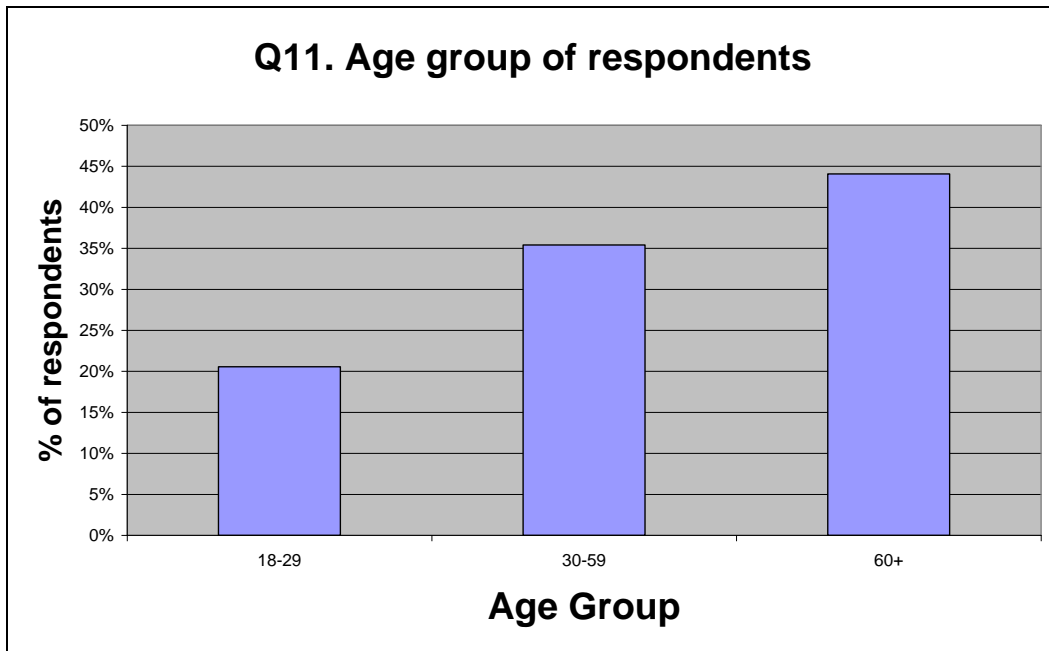
During 2007/8, it is estimated that approximately 65 paper rolls of paper have been saved by the bus operators through ticket sales from the machines (each roll produces around 650 tickets). This would amount to a saving of around £50 per annum.
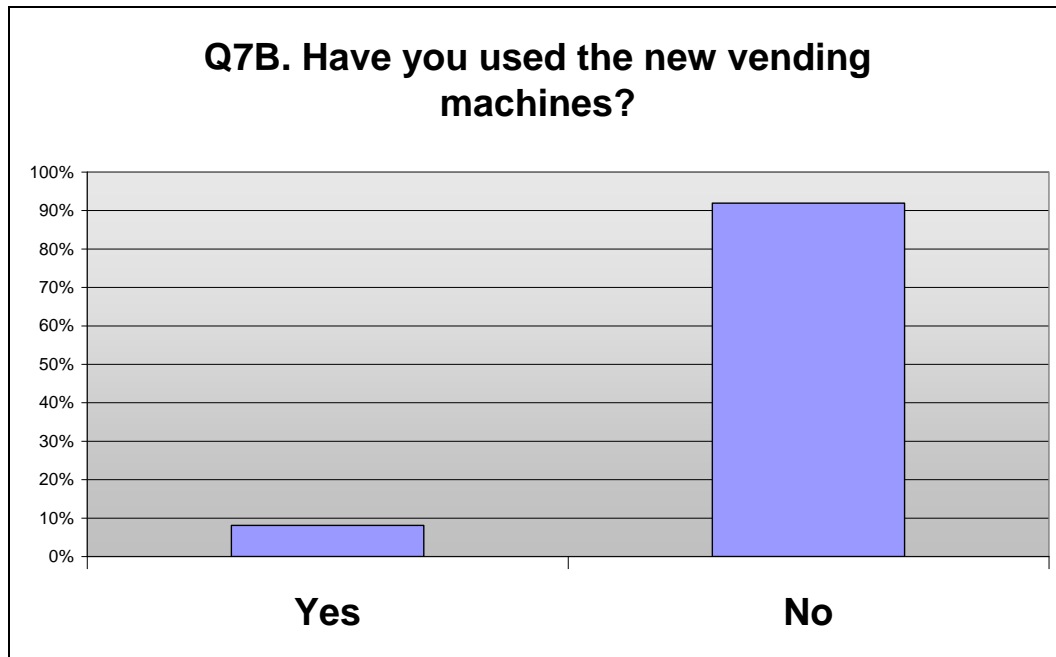
The tickets sold through the vending machines are smaller in size than those printed on the bus and this has led to a saving in paper overall of around 70 sqm.

Indicator 13 (*Awareness Level*)

A telephone attitudinal survey conducted by Mott MacDonald in April 2007 indicated that 52.2% of those questioned were aware of the ticket machines but only 8% of people had actually used them. This was based on a cross-section of the general public and not specifically bus users. It is not known how this cross-section compares with bus users.

Q11. Age group of respondents

Q7A. Have you noticed the new on street bus ticket vending machines in Norwich?

Q7B. Have you used the new vending machines?

Findings from surveys conducted by NCC at the N&N Hospital in Norwich during March 2008 are outlined below.

Question 1: Gender
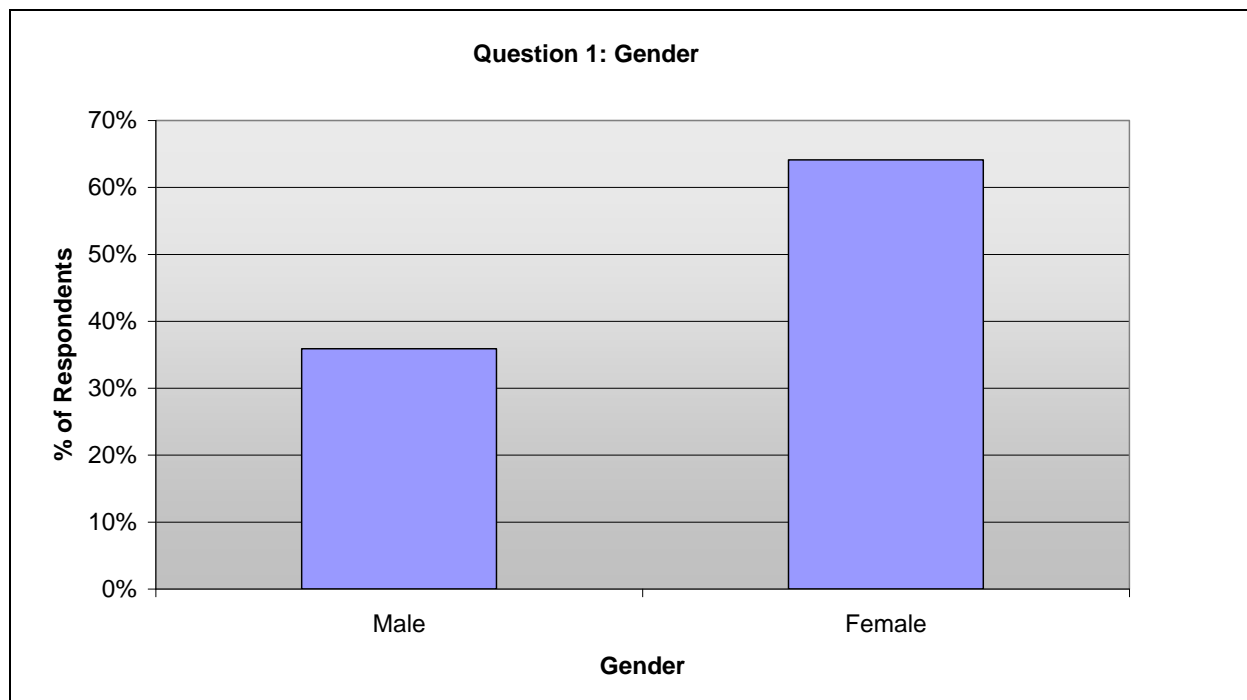
The proportions of males and females is similar to that found in the telephone survey conducted in 2007.

Question 12: Were you aware there is a bus ticket vending machine at the hospital?

Question 13: Have you used the bus ticket machine?
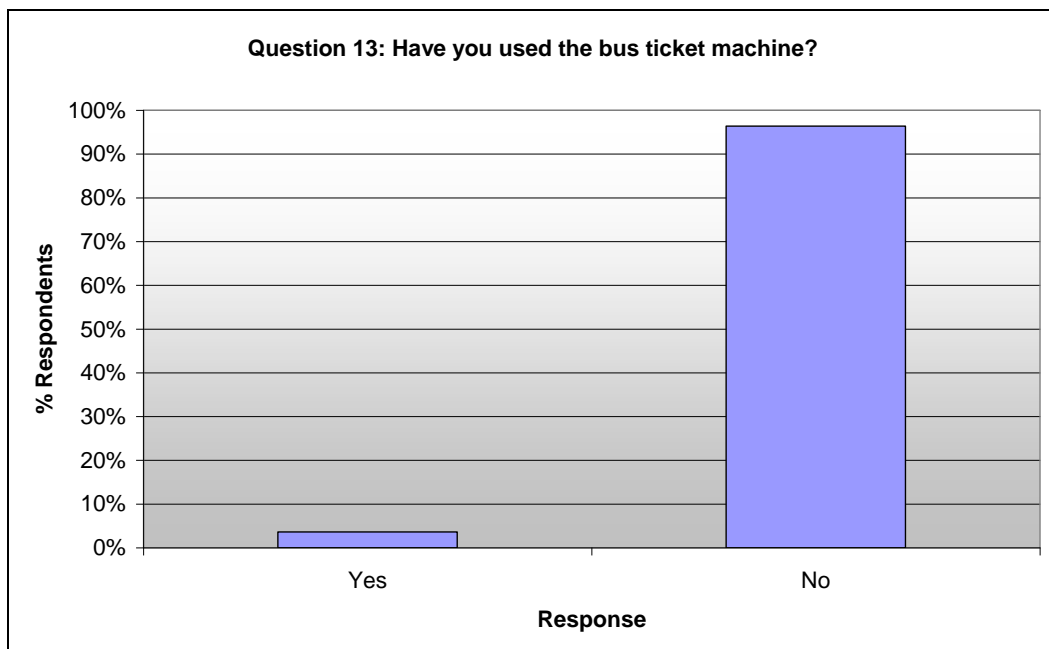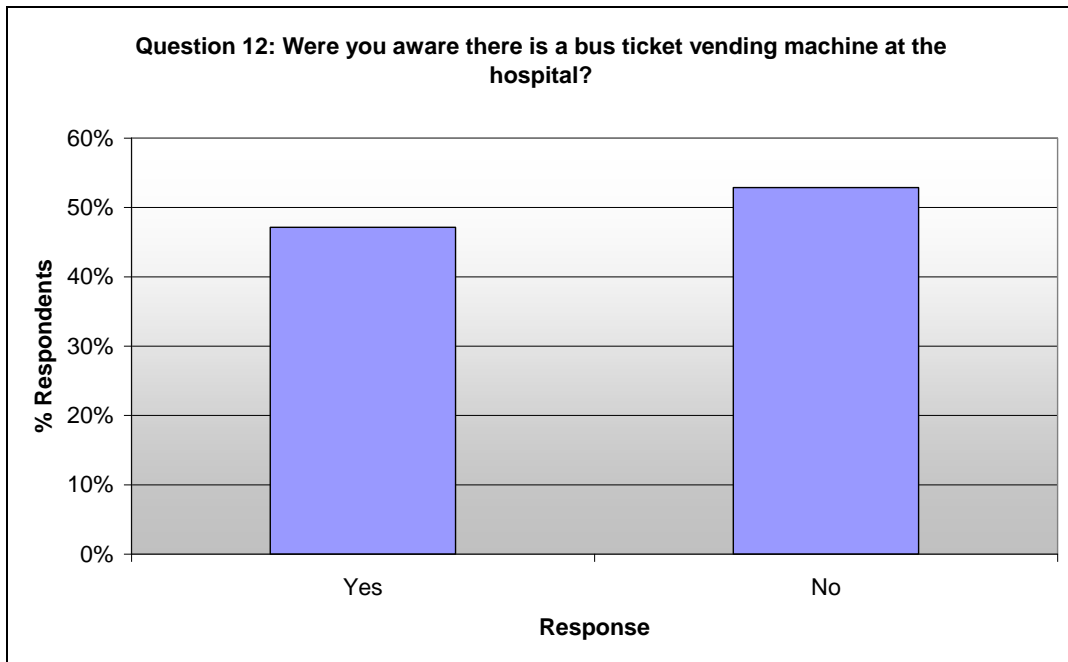
These findings are consistent with the machine at the hospital selling few tickets. Although a significant proportion (47%) of the respondents stated that they were aware there was a ticket machine at the hospital, only 4% had

actually used the machine. Reasons stated for not using the machine are summarised below:

- Already have a weekly / annual season ticket: 15%

- Not aware of machine: 4%

- Already have a travel pass (incl. concessionary pass): 56%

- Not convenient to use machine: 1%

- Cannot be bothered to use machine: 1%

- Bought ticket elsewhere: 6%

- Prefer to pay the driver: 13%

- Registered disabled: 3%

- Machine not always give change: 1%

The most common response is that the customer already has a travel pass – the majority of these will be concessionary pass holders. The second most common response was that people already had a valid ticket (15%), with the third being that people preferred to pay the driver. The response that the machine does not give change suggests that there has been a fault with the machine as this functionality should be available all of the time that the machine is in service.

Revenues generated would suggest there is an increasing level of awareness as there is a steadily increasing trend.

Indicator 14 (*Acceptance level*)

The total number of tickets sold through the machines has increased steadily in a trend that matches the revenue generation. The total ticket sales since the project started is around 90k.

Based on the fact that there are around 14 million bus journeys per year by bus in Norwich, it is clear that the proportion of these journeys made using tickets purchased from the ticket machines is very low. Some machines are selling very few tickets a week – an example of this would be at the N&N Hospital where less than 10 tickets are sold each week. Total ticket sales at the bus station amount to around 300 tickets in a typical week and this reflects the largest number of tickets sold.

Indicator 15 (*Accuracy of PT timekeeping*)

On time bus punctuality data is available from our bus tracking system, BusNet. The major bus operators in Norfolk are partners in the BusNet scheme and a significant % of journeys operating in Norwich are monitored. During 2007 and 2008 (to date), nearly 1 million journeys have been tracked. Overall, the proportion of bus services running on time (using a time window of 1 minute early to 5 minutes late) has increased from 2007 to 2008.
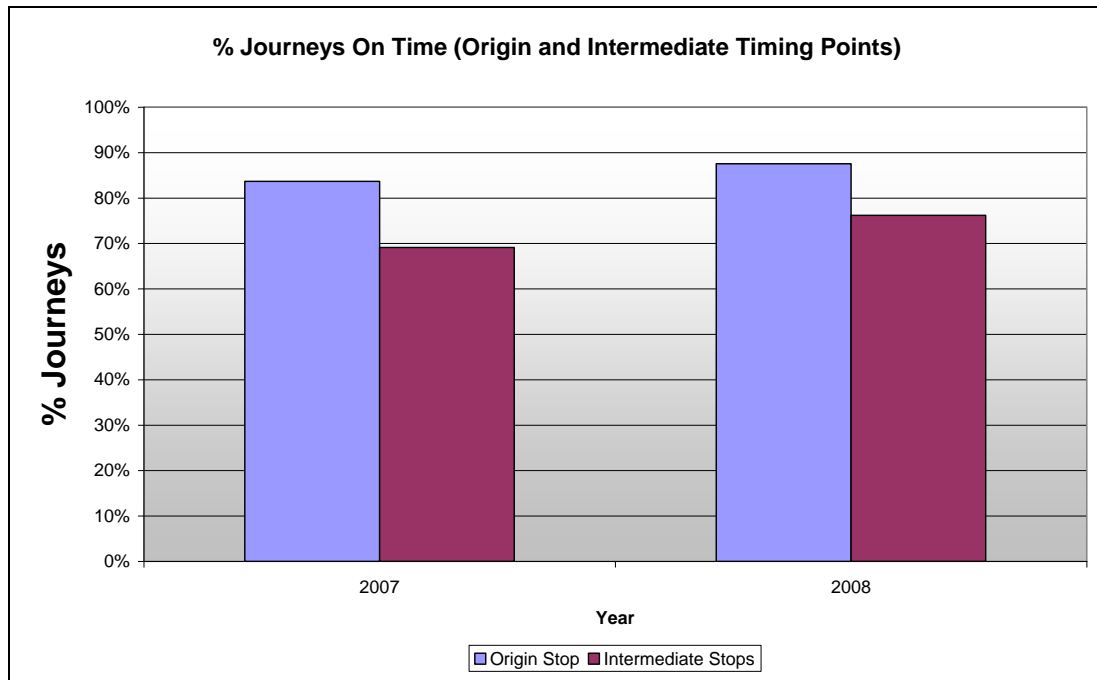
% Journeys On Time (Origin and Intermediate Timing Points)

Indicator 18 (*Quality of PT service*)

Regular surveys provide an overall value of passenger satisfaction, although questions are not specifically asked to determine satisfaction with ticket machines.

Questions are asked about the level of satisfaction with buses for users and non-users. Results for recent years are outlined below:

	% of respondents		
Description	**2003/04**	**2006/07**	**2008/09**
Fairly or Very Satisfied with the provision of public transport information overall	44	49	Not yet available
Fairly or Very Satisfied with the local bus service overall	46	55	

Indicator 23 (*Bus boarding times - peak*)

Surveys were conducted during the evening peak (1630-1800). In total 459 passenger boardings were monitored. Key findings are the following:

	Before TVM installation	After TVM installation
Average boarding time per passenger	8.0 secs	7.7 secs
Minimum boarding time per passenger	Not known	4.0 secs
Maximum boarding time per passenger	Not known	20.0 secs
Average boarding time per passenger (all passengers purchasing ticket from driver)	Not known	14.8 secs
Average boarding time per passenger (all passengers already having a ticket)	Not known	5.5 secs
% passengers purchasing a ticket from the driver	n/a	28%
% passengers boarding with a ticket	n/a	72%

The average boarding time per passenger (7.7 secs) is less than that reported in surveys prior to the project implementation (around 8 secs). This is a marginal decrease and it is difficult to state that this difference has been caused solely by the introduction of the ticket machines.

The surveys indicate that the majority of people boarding the bus had already got a travel ticket (type of ticket not known). It is not known exactly how many of these tickets would have been purchased from the TVMs.

In cases where all boarding passengers bought a ticket from the driver, the average boarding time per passenger was around 15 seconds – this compares to a time of just 5-6 seconds where all passengers already had a ticket. From this, it is clear to see the reduced boarding time when passengers already have a ticket.

Indicator 24 (*Bus boarding times – off peak*)

Surveys were conducted during off-peak periods (1030-1630). In total, over 750 passenger boardings were monitored on over 100 different bus journeys. Key findings are the following:

	Before TVM installation	After TVM installation
Average boarding time per passenger	8.0 secs	6.4 secs
Minimum boarding time per passenger	Not known	2.0 secs
Maximum boarding time per passenger	Not known	10.0 secs
Average boarding time per passenger (all passengers purchasing ticket from driver)	Not known	10.3 secs
Average boarding time per passenger (all passengers already having a ticket)	Not known	7.2 secs
% passengers purchasing a ticket from the driver	n/a	23%
% passengers boarding with a ticket	n/a	77%

In a similar pattern to that seen for the peak period, the average boarding time per passenger after TVM installation is less than that prior to the machines being installed. A similar % of passengers already had tickets prior to boarding and boarding times were significantly lower in cases where all boarding passengers already had their travel ticket.

Indicator 26 (*Average modal split*)

Modal split surveys are no longer conducted by Norfolk CC. An alternative source of comparable information has not been identified. On reflection, it is felt that this statistic will not provide a meaningful indication of the impact the TVMs have had.

Indicator 28 (*Average occupancy*)

An appropriate source for this information has not been identified. On reflection, it is felt that this statistic will not provide a meaningful indication of the impact the TVMs have had.

C3 Achievement of quantifiable targets

No.	Target	Rating
1	Journey time and wait time savings for public transport users	★★
2	Improved efficiency and reliability of bus services, contributing to increased bus patronage and Local Transport Plan targets	★★
3	Potential for additional revenue and operating cost savings for bus operators	0
4	Increased capacity of on-street stops to accommodate additional departures	0
NA = Not Assessed 0 = Not achieved ★ = Substantially achieved (at least 50%)		
★★ = Achieved in full ★★★= Exceeded		

C4 Up-scaling of results

At present, approximately 4,000 tickets are sold each month across 15 machines. This is approx. 250 per machine. There are several key public transport corridors in Norwich as well as several large market towns from which people commute on a regular basis.

If ticket machines were to be provided at key interchanges along these routes and in these market towns, this would require up to an additional 100 machines. On a simple pro-rata basis, this could indicate total sales of around 28,000 – 30,000. However, this is a simplistic assumption and assumes any new machines would operate in a similar way to existing and there would be no increase in sales. In reality, large variations in ticket sales across existing machines has been found (see graphs shown earlier in the report), with some machines selling significantly more tickets than other machines. In addition, it is envisaged that further marketing and promotion of the machines will lead to an increased use of the machines to at least match increases seen over the last couple of years. A policy of only accepting tickets purchased off-bus, even if applied in individual areas, will have a significant impact on the number of tickets sold.

Machines away from the city centre are likely to sell fewer tickets as there is a lower footfall. In view of this, careful consideration would be needed regarding future siting of machines to ensure they are in the most popular locations.

Overall, it is difficult to state exactly how many tickets could be sold in a future scenario as there are many factors that are applicable.

Bus service performance has improved significantly during the period of time that the machines have been installed. However, it is difficult to identify what impact the machines have had on this. Over this time, bus operators have had increasing access to detailed bus performance reports and have regularly updated timetables to improve punctuality. In general, these timetable changes have led to an improved reliability without any significant increase in the number of ticket sales from the machines being reported.

Evidence from the bus boarding time surveys would indicate that there is further scope for bus boarding times to fall further. This can be seen from the

fact that up to 25% of boarding passengers are still purchasing a ticket from the driver and there is some evidence to show that boarding times are lower in scenarios where all boarding passengers already have a travel ticket. Should this happen, it is likely that there will be a further increase in bus service reliability as variability in boarding times (and consequently journey times) reduces.

C5   Appraisal of evaluation approach

It is proving difficult to identify benefits / impacts of this measure when a significant number of complementary schemes are being delivered at the same time.
The number of ticket sales at present is generally insufficient to make a significant impact on performance.

Changes to the routing and timetabling of services have meant that some potential benefits from the Measure have been reduced. For example, a key boarding point is the University of East Anglia, which, at the start of the Measure, had the main services calling at the stop as intermediate stops along the route. However, this has changed and the main high-frequency service now starts at this point, which means layover time is allocated to this stop, therefore negating the need for minimising dwell time at this stop.

Changes to the concessionary travel scheme for those over 60 have meant that free travel is available throughout the majority of the day. Overall, bus patronage has increased. Overall impacts on boarding times of this specific issue have not been quantified but this has likely to have reduced boarding times as not fare is charged and customers simply show their pass to the driver.

It would have been more helpful and accurate if more detailed boarding time surveys had been conducted at specific stops rather than generally across a large number of stops. It would have been easier to then compare boarding time changes before and during the Measure implementation.

Consistent measurement of average boarding time per passenger is difficult to achieve across different surveyors. The proposed methodology was to calculate the boarding time based on the time taken for the first person to board the bus until the time that the last person boarded. This time would then be divided by the total number of people boarding to identify the average per person. In reality, surveyors interpret the boarding in different ways and there are several other factors that have an influence. For example, the driver may not close the door as soon as the last person has boarded, there may be a problem with the ticket machine, the person may ask a driver for travel advice, etc. The impacts of this can affect the variability of bus boarding times.

C6   Summary of evaluation results

The key results are as follows:

- **Key result 1** – An increasing number of people are using the machines, which is shown through increases in revenue and ticket sales. There was a 15% increase in monthly ticket sales from Jan 07 to Dec 07. Since the machines were installed, over 100,000 tickets have sold, which equates to over £270k in ticket sales revenue.

- **Key result 2** – Awareness of the machines greatly exceeds the use of the machines and the reasons for this need to be fully understood. Despite 52% of people interviewed at the hospital being aware of the machines, only 8% of these people had actually used the machine.

- **Key result 3** – There are large variations in usage of the machines across different sites. The most popular machines sell an average of around 1,000 tickets per month whilst the least popular machines only sell around 50 – 100 tickets per month. Siting of machines is therefore important when considering any future installations.

- **Key result 4** – Usage of the machines is significantly influenced by ticket promotions / developments of individual bus operators. An example of this is at the UEA where significant numbers of tickets were sold. However, the introduction of a new ticket for students by the main bus operators, which could only be bought from the Students Union, meant a significant reduction in use of the machine. The number of tickets sold from the machine reduced from an average of 1,000 tickets per month to around 500 tickets per month.

- **Key result 5** – It is important to ensure that the service & maintenance of the machines is carried out by a competent authority. The complexity of the machines was not fully understood and the scheme has benefited by engaging a new contractor that has a wider skills base. Prior to the new contractor being appointed, the availability of the machines was around 75-80% (ie. up to 20% of machines were out of service at any one time). After the new contractor was appointed, the availability has consistently been 95-100%, which represents a significant improvement.

- **Key result 6** – The machines needed to be more visible on the street for use to be made of them. Usage of the machines increased significantly once new large and highly visible vinyls were applied to the sides. Monthly ticket sales increased from an average of around 2,200 tickets prior to new vinyls being added to around 2,600 after the vinyls were added.

- **Key result 7** – External factors play a significant part in identifying the effectiveness of this Measure. Other elements, such as bus priority, bus shelters, passenger information, changes to bus routes and timetables and concessionary fares all play a part in influencing peoples travel patterns and behaviour.

D   Lessons learned

D1   Barriers and drivers

D1.1   Barriers

- **Barrier 1** – Technical faults with the machines have affected public confidence in the machines. Faults related to software issues were difficult to diagnose and repair and some machines were out of action for several months. Where this was the case, engineers from the machine suppliers travelled to Norwich from Germany to fix the problem. This was a costly approach to solving the problem but was successful, at least in the short term, in overcoming this barrier. Machines that were out of action for more than a few days attracted graffiti and other anti-social behaviour, which further dented public confidence. The new service & maintenance contract awarded late-2007 has overcome this barrier as the engineers appointed have strong technical skills and have been able to resolve all faults within a very short timescale.

- **Barrier 2** – There have been problems with late notice of fare changes from operators and a lack of information. On several occasions, this has meant that machines were not updated with revised fares in time for the fare change. Different fares were then charged on the machines and on-bus for a period of several weeks. Where tickets from the machine were cheaper, we made this a positive situation and reported this in the press as a way of promoting machine usage. This was done with the agreement of the operators and resulted in some short term increase in ticket sales. However, bus operators have not agreed to this policy of cheaper fares on the machines as a permanent arrangement. Where tickets on the machine were more expensive, we found there were several complaints from the general public. We have tried to overcome this barrier by stressing to operators the importance of them communicating any fares changes with us as far in advance as possible for changes being made. However, this has not removed this barrier and recent increases in fuel prices during 2008 has made this situation worse as operators are keen to change fares on a frequent basis in response to economic conditions.

- **Barrier 3** – Timescales involved with updating software on the machines has been longer than anticipated.

D1.2   Drivers

- **Driver 1** – Congestion in Norwich continues to worsen and there is an important need to address this.

- **Driver 2** – There is a growing need to encourage use of public transport and access to high quality public transport facilities is key.

D2   Participation of stakeholders

- **Stakeholder 1 (Bus operators)** – Input from bus operators has largely been co-operative but improvements are needed in terms of communications about service and ticketing changes.

- **Stakeholder 2 (Machine maintenance)** – We have struggled to some degree with the complexity of the machines and insufficient skills in terms of machine maintenance.

D3   Recommendations

Overall, implementation of a similar type of technology to apply in other cities is recommended. This would need to be delivered as part of an overall commitment to provide off-bus ticketing in partnership with bus operators. These machines raise the profile of public transport and are an important element in making travel by sustainable modes easier and more attractive.

- **Recommendation 1** – Earlier involvement of bus operators in the planning phase – this will need to include elements such a clear understanding that fare chart information will need to be made available in a timely manner and agreement as to the design of ticketing and paper formats

- **Recommendation 2** – The service and maintenance contractor used should be one that has a wide skills base which includes software as well as engineering capabilities

- **Recommendation 3** – Careful attention should be made to the siting of machines to ensure maximum visibility and use. Where possible, machines should be located as close as possible to main boarding points and not simply located so they are equally spaced between boarding points

- **Recommendation 4** – Make the machines as visible as possible so they 'stand out from the crowd' and there is no uncertainty as to what the machines are for

- **Recommendation 5** – Try to include as many operators as possible on the machines with as many different ticket options as you can

- **Recommendation 6** – Ensure procedures are in place for convenient update to fares on the machines. Despite best efforts, little advance warning may be provided that there are changes to fares and it should be possible to amend fares with as little warning as possible

D4   Future activities relating to the measure

We are looking to work with a supplier of electronic information systems to see if it is possible to add additional functionality to the machines. They will then become an 'information kiosk' as well as an outlet for selling tickets.

We are looking to increase the number of machines in Norwich