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Smart & Integrated Ticketing Report for Scotland

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This report has been prepared by PricewaterhouseCoopers LLP for Transport Scotland, with the exception of *Chapter 1: Introduction* which was jointly prepared and the following sections which were prepared by Transport Scotland:

- Chapter 2: Investment Case
- Appendix 2: Estimating the Benefits and Costs of Integrated Ticketing
- Appendix 3: Sensitivity Analysis for Smart and Integrated Ticketing Options

Contents

Glossary of key terms

Term / Abbreviation	*Definition*
AFC	Automatic Fare Collection.
AMS/HOPS	Asset Management and Host Operator Processing System.
BSOG	Bus Services Operator Grant.
CRM	Customer Relationship Management.
DfT	Department for Transport.
EMV	Europay, Mastercard, Visa.
ETM	Electronic Ticketing Machine.
e-purse	A stored value balance on a smartcard intended for spend on a number of different services including transport.
FBC	Full Business Case.
FSR	First ScotRail.
GMPTE	Greater Manchester Passenger Transport Executive.
ITSO	ITSO Limited is an organisation that supports, facilitates and enables the delivery of smart, integrated and interoperable ticketing across Great Britain. The abbreviation does not stand for anything; it is the name of the brand. Initially the organisation was called Integrated Transport Smartcards Organisation, but this was changed to just ITSO, as the scope of activity had outgrown the description implied by the name.
NESTRANS	Transport Partnership for Aberdeen City and Shire.
NFC	Near Field Communications is a short-range high frequency wireless communication technology to allow cards to be read within about 10 cm of the reader.
OBC	Outline Business Case.
PFI	Private Finance Initiative.
PTE	Passenger Transport Executive.
RFID	Radio Frequency Identification is a wireless communication technology which allows goods and smart card tickets to be uniquely identified using sensors. This is applied in smart cards at ticket gates where solutions such as Oyster and ITSO cards use RFID to transact with the gate.
SESTRAN	South East of Scotland Transport Partnership.
SG	Scottish Government.
SPT	Strathclyde Partnership for Transport.
SYPTE	South Yorkshire Passenger Transport Executive.
TfL	Transport for London.
TS	Transport Scotland.
t-purse	A stored value balance on a smartcard intended for spend on transport only.

1 Introduction

1.1 Background

1.1.1 This report sets out the findings of a review conducted by Transport Scotland and PricewaterhouseCoopers LLP (PwC). The work was commissioned by Transport Scotland (TS) to advance the TS policy towards smart and integrated ticketing. As part of the work, which was primarily carried out between January and June 2010, PwC was commissioned to produce an Outline Business Case (OBC) for smart & integrated ticketing in Scotland.

1.1.2 The analysis carried out was based on HM Treasury's Green Book 5-case model[1]. PwC's work focused on the current position, an options appraisal and commercial aspects (in Sections 3-8 of the report) of smart and integrated ticketing. Transport Scotland focused on developing the strategic and investment cases and is set out in Chapter 2 and Appendices 2 and 3 of the report.

1.1.3 The analysis considered the components of smart and integrated ticketing. The terms "smart ticketing" and "integrated ticketing" are often understood in a different way by differing stakeholders, but in this report, they should be taken to mean the following, in line with DfT definitions:

- *Smart ticketing is defined by DfT[2] as where*:
  "the ticket is stored electronically on a microchip, commonly contained in a plastic smartcard[;] tickets are checked by presenting the smartcard to a smart reader"; and
- *Integrated ticketing is defined in the same report[2] by DfT as:*
  "tickets [which] are valid on more than one operator and/or mode of transport [; these] do not have to be smart tickets."[2]

1.1.4 This means, by implication, that integrated ticketing can be paper based[3].

1.1.5 *Smart, integrated ticketing* combines each of the elements described in the definition above.

1.1.6 It is important to highlight these distinctions because, as the DfT Smart and Integrated Ticketing Strategy points out:

"while smart ticketing infrastructure can facilitate better regulation, it does not guarantee it[;] however, to install smart infrastructure without further integration would not realise all of the potential benefits on offer".[4]

1.2 Policy Context

1.2.1 The wider policy context for the report is shaped by three dimensions in particular:

- The Scottish Government's wider economic strategy;
- The Scottish Government's National Transport Strategy; and

[1] The focus of the OBC was based on the HM Treasury Green Book 5 Case Model':
http://www.ogc.gov.uk/documentation_and_templates_business_case.asp

[2] Smart and Integrated Ticketing Strategy (DfT; 2009)

[3] The "Zonecard" in Glasgow is one such paper-based integrated ticketing scheme – allowing the user to travel on certain bus, rail, underground and ferry services, operated by Strathclyde Partnership for Transport within the Strathclyde region – depending on the number of travel zones purchased.

[4] Smart and Integrated Ticketing Strategy (DfT; 2009)

- The Department for Transport (DfT) Strategy for Integrated Ticketing in England and Wales.

1.2.2 At a more practical level, the report should also be seen in the context of the progress already made in Scotland in delivering elements of the infrastructure for smart and integrated ticketing.

Economic Strategy

1.2.3 The Scottish Government's Economic Strategy from 2007 states that sustainable economic growth is the central purpose of all Government activity. The Government's strategic objectives – to make Scotland wealthier and fairer; smarter; healthier, safer and stronger; and greener – are all predicated on bringing about greater economic success for Scotland.

1.2.4 More specifically, the GES states that "an efficient transport system is one of the key enablers for enhancing productivity and delivering faster, more sustainable growth." Underpinning this, a key transport objective is "to provide sustainable, integrated and cost effective public transport alternatives to the private car, connecting people, places and work, across Scotland."

Transport Strategy

1.2.5 Scotland's National Transport Strategy (NTS), published in 2006, outlines three strategic objectives which are focused on creating a world class transport system that contributes towards the Scottish Government's wider purpose of promoting sustainable economic growth:

- Improved journey times and connections;
- Reduced emissions; and
- Improved quality, accessibility and affordability.

1.2.6 The strategy outlines the role of smart and integrated ticketing in contributing towards these three outcomes:

- "We recognise the importance of the journey experience to visitors as well as commuters. Having both simple ticketing and better integrated services and interchanges themselves is vital. There have already been successful local schemes for integrated ticketing in Scotland, for example, Zonecard, Plusbus and One Ticket. We are also in the process of rolling out smart enabled ticketing machines to every bus operator in Scotland, creating a platform to develop new integrated ticketing initiatives. This will support the implementation of the concessionary travel scheme."
- "We want to go further. [Our integrated ticketing strategy] will outline how to secure seamless journeys, between bus, ferry and / or rail journeys by different operators. We will explore the possibility of introducing an integrated ticketing pilot across all modes in partnership with a regional transport partnership or local authority. We intend to harness the new technology and equipment that is already being progressively installed through funding provided by the Scottish Government across the entire Scottish bus fleet to maximise the opportunity to deliver integrated ticketing. We intend to explore the possibility of extending this technology to ferries and trains. We believe this will make public transport more attractive to users and simpler to use. We will continue to push the boundaries of current technology to make pre-paid travel even easier for passengers e.g. by exploring mobile phone technology. This will also speed up boarding times for all bus users."

1.2.7 More generally, the strategy emphasises the importance of high quality interchanges and of improving the overall journey experience. With Scotland hosting the Commonwealth Games in 2014, integrated

ticketing forms part of the Scottish Commonwealth Games Legacy Plan[5], though the form this takes may well be event-specific and separate from the options outlined in this paper.

Smart & Integrated Ticketing Strategy for England and Wales

1.2.8 The DfT published a Smart & Integrated Ticketing Strategy for England and Wales in 2009. This proposed that coverage throughout England and Wales could be achieved through a regional roll-out of ITSO infrastructure on buses, with the aim of covering major urban centres by 2015. DfT also intends to progressively build in ITSO obligations into the remaining rail franchises where they are not already specified[6]. In certain respects, this provides a parallel development to that being considered in Scotland.

1.2.9 ITSO has emerged as the only practical way to achieve a secure and interoperable (e.g. between modes, operators or scheme owners) smart ticketing system, particularly in the UK, where the bus deregulation outside London presents particular requirements for interoperability.This has been confirmed by DfT in its Business Plan for 2011-2015[7]which also addresses interoperabilitywith Oyster in London.

1.2.10 Whilst there are still risks and challenges with ITSO, the appointment of a new Chief Executive in early 2010, allied to strengthening support from DfT, has led to the formulation of a forward plan that should see ITSO expanding, restructuring and taking greater ownership of these risks and challenges. This is particularly encouraging for the Scottish Government, which has already sunk considerable sums into ITSO infrastructure to implement smart ticketing as part of the concessionary travel scheme.

Progress already made in Scotland

1.2.11 Transport Scotland (TS) has already delivered an important component of the infrastructure for smart and integrated travel ticketing through the Concessionary Fares Smartcard on buses. This includes around 1.1m smartcards, 7,100 ETMs and a back office Asset Management and Host Operator Processing System (AMS/HOPS). In addition, First ScotRail (FSR) has piloted a season ticket smartcard on its popular Edinburgh to Glasgow route.

1.2.12 Also, Strathclyde Partnership for Transport (SPT) already operates integrated ticketing products such as ZoneCard, Day Tripper and Roundabout; there are also integrated ticket offerings from OneTicket in East Central Scotland and Plusbus. However, unlike the FSR pilot, these are all currently paper tickets rather than electronic.

1.2.13 Whilst elements of the necessary infrastructure are already in place in Scotland, delivery of the policy commitment from Scottish Government around Smart and Integrated Ticketing would place Scotland at the forefront of public transport systems developments worldwide, joining a small number of other areas including London (Oyster) and Hong Kong (Octopus).

[5] See **scotland.gov.uk/gameslegacy**

[6] DfT Business Plan 2011-2015, Action 3.2, page 10, November 2010

[7] DfT Business Plan 2011-2015, Action 3.2, page 10, November 2010

1.3 Conclusion and the Way Forward

1.3.1 This document has been prepared to gather together and summarise the work carried out to date and to draw initial conclusions about the way forward. This allows an evidence-based assessment of progress and direction of travel to be made and also provides the opportunity to highlight those areas where further data gathering may be required.

1.3.2 Significant progress has been made through this project towards articulating how smart and integrated ticketing can be taken forward in Scotland, addressing the short term developments needed, the potential for a phased approach and the need to monitor ITSO development and secure buy-in to roles and responsibilities from bus operators and solution providers. In each of these areas Section 8 highlights our conclusions and next steps towards implementation.

1.3.3 A number of key issues for the business case have been identified, for example, concerning operator incentivisation in a deregulated bus market and future smartcard technology evolution, on which we have had to make assumptions. Part of our work has involved testing those assumptions through greater analysis and stakeholder engagement which in turn has highlighted other issues. The resolution of these issues, summarised further in Chapter 8, will be fundamental to the successful implementation of smart and integrated ticketing.

2 Investment Case

2.1 Introduction

2.1.1 This chapter is taken from the Strategic Business Case (SBC) which was prepared by the Transport Economics, Environment, Appraisal and Research team (TEAR) in Transport Scotland. A more detailed discussion of anticipated benefits is included at Appendix 2.

2.2 The Existing Evidence Base

2.2.1 A starting point for the development of the strategic business case was a review of the existing evidence base for smart and integrated ticketing. This evidence base is limited although two key documents are the business case that the DfT produced for smart ticketing and a report for the Passenger Transport Executive Group (PTEG) by Booz & Co. A summary of both reports is outlined below.

2.2.2 The conclusion of the DfT business case is that: "On the basis of the figures presented in the table below it would appear that taking in all the benefits that accrue to passengers, operators and road users, the introduction of smart ticketing would more than cover the up-front costs. And so long as the benefits continue for a number of years this result holds even with a low demand and high optimism bias uplift on the capital costs. However, these results are dependent on a number of important assumptions:

- Smart ticketing can achieve savings in dwell times, journey times and ticket buying times;
- Full take-up of smart ticketing by passengers and operators;
- The time gap between spending on equipment and achievement of full benefits is short;
- The risks of the project are successfully managed;
- Smart ticketing can work in a variety of market situations (or that market situations change to accommodate smart ticketing); and
- Operators and Authorities can work together to produce integrated IT and back office functions."

2.2.3 A report for the Passenger Transport Executive Group (PTEG) by Booz&Co.[8] presents the results of a desk-top review of integrated ticketing (it did not specifically address smart ticketing) in major urban areas in the last 40 years or so. Various impacts were assessed: patronage; revenue; modal shift; passenger satisfaction; boarding times; fraud reduction; and transaction and administration costs.

2.2.4 The following findings emerged:

- Substantial increases in patronage, in the range of 6% to 20%, with some transport modes experiencing increases to the order of 40%;
- Limited evidence to support increased revenues, with the reported increase varying widely from a 1% to a 12.6% increase in total revenue;
- Limited quantitative evidence to support a link between modal shift and fare integration, with some case studies suggesting an overall increase in public transport usage;
- Some evidence to suggest improved satisfaction from fare integration primary due to increased convenience and fare savings;
- Limited evidence of faster boarding times as a result of integrating ticketing, with some transport modes experiencing in order of a 10% reduction in passenger in-vehicle time; and

[8]The Benefits of Simplified and Integrated Ticketing in Public Transport; Booz & Co. For PTEG(2009)

- Limited evidence to suggest that integrating ticketing in isolation has reduced fare evasion. Rather the reduction in fraud has usually been associated with integrated fares as well as a change in fare medium;

2.2.5 There is only anecdotal evidence to support a reduction in transaction and administration costs from simplified and integrated ticketing.

Table 2.1: DfT Business Case: Summary of Benefits and Costs of Smart Card (£m)

	High demand/ low optimism bias	***Low demand/ high optimism bias.***
Bus annual benefits: Brackets indicate the inclusion of an uplift for consultancy and contingency		
Journey time savings to existing passengers	309	77
Ticket type benefits to existing passengers	55	55
Operating cost savings to operators	57	21
Carbon savings	2	1
Concessionary reimbursement	39	39
Fraud reduction	42	42
Saving in surveys	5	5
New net revenue to bus operators	101	34
Benefits to new bus users	13	2
Total	**621**	**275**
Bus annual costs	66	66
Net bus annual	**555**	**210**
Car to bus pa		
De-congestion	75	28
Carbon savings	4	2
Total	**80**	**30**
Rail benefits pa		
Time saved at gates by existing passengers	32	21
Time saved at kiosks by existing passengers	147	65
Ticket type benefits to existing passengers	86	86
Saving in ticket sales costs	250	165
Fraud reduction	56	56
New net revenue to rail operators	85	56
Benefits to new rail users	2	1
Total	**658**	**450**
Rail annual costs	191	191
Net rail annual	467	259
Car to rail		
De-congestion	53	21
Carbon	4	1
Total	**56**	**22**
Total net annual	**1159**	**520**
Bus capital costs	314	343 (521)
Rail capital costs	741	853 (1231)
Total capital	**1055**	**1197 (1752)**

2.3 Option Appraisal

2.3.1 An early, informal option appraisal process in the form of a SWOT[9] analysis was undertaken by Transport Scotland to consider the following options:

- Paper based system;
- Smartcard based system – non ITSO compliant; and
- Smartcard based system – ITSO compliant.

2.3.2 The results are shown below.

Results of Initial Option Appraisal

2.3.3 Please note this was an early, high-level assessment and it is important to note that there have been significant positive developments around ITSO since it was produced.

Table 2.2: Initial Option Appraisal

	Paper Based System	***Smartcard non-ITSO compliant***	***Smartcard ITSO compliant***
Strengths	Not reliant on technology. Deliverable subject to participating parties agreeing business and operating rules.	Technology opens up new opportunities, Oyster is proven in London, EMV is a global standard, new technology will appeal to passengers	Interoperable, secure, technology already rolled out across much of Scottish bus fleet and pilot on rail. ITSO already used by Transport Scotland for concessionary travel scheme, ITSO currently supported by DfT for both bus and rail.
Weaknesses	Difficult to administer effectively. Difficult to distribute revenue fairly or quickly. Increased risks of fraud/revenue protection. Does not realise benefits of sunk costs e.g. TS AMS/HOPS. Unlikely to have passenger appeal and so will have a limited impact on modal shift from the car to public transport.	Oyster may not be ready or appropriate for operation outside of London, EMV is not yet widespread as it is a payment system rather than a platform for integration, and does not address needs of unbanked. Both systems would require considerable investment for introduction in Scotland.	Still a fledgling standard. Concerns over whether ITSO is geared up to support a large commercial ticketing system protection. Does not realise benefits of sunk costs e.g. TS AMS/HOPS. Unlikely to have passenger appeal and so will have a limited impact on modal shift from the car to public transport.
Opportunities	Could be operational very quickly.	Enables some synergy in future with some large ticketing systems globally.	Probably the best opportunity of delivering a secure smartcard based ticketing system by 2014
Threats	Previous and current paper based schemes have not achieved appreciable market share. Due to the weaknesses outlined above, this option is not a basis to galvanise partners to co-operate and work together.	Would leave Transport Scotland and other Scottish partners dependent on a single third party supplier, which could be both expensive and constraining, would possibly help to stunt the organisational growth of ITSO.	Scotland continues to take excessive risks around unproven technology. ITSO fails to become established as a robust basis for integrated ticketing. Longer term – Oyster, EMV.

[9] Strengths, Weaknesses, Opportunities and Threats

2.4 *Rationale for Government Intervention – The Presence of Market Failures*

2.4.1 The key market failure rationale underpinning the case for public sector intervention is the existence of externalities; that is, wider social and environmental benefits, which would not solely accrue to private operators so that the incentives for the market to deliver a socially optimal level of provision may not be sufficient. These include the presence of convenience benefits to passengers in enjoying seamless, cashless ticketing across different transport modes. Stated preference work by IPSOS-MORI for the DfT which covered daily integrated tickets only, suggests that there might be some willingness to pay extra for such a ticket but that this depends on personal and other circumstances. Moreover, qualitative results suggest that people like the idea of smart and integrated tickets, would travel more if they were available, but saw them as an entitlement and were not prepared to pay more for them.

2.4.2 Despite the perceived advantages of integrated ticketing it is apparent that the market is not delivering integrated ticketing in the quantity and speed which would make the full benefits realisable for passengers. For example, bus operators see a number of barriers to participation in integrated ticketing schemes resulting in their reluctance to co-operate together to deliver such products. The DfT Smart and Integrated Ticketing Consultation Paper[10] listed the principal bus operator concerns as:

- Losing market share as passengers are not locked into one operator when buying a ticket;
- Not receiving a fair proportion of revenue from integrated tickets;
- Concerns about Office of Fair Trading fines for anti-competitive practices; and
- The lack of freedom to set all ticket prices.

2.4.3 Bus operators are likely to be best placed to assess the balance of advantages and disadvantages to their involvement in smart, integrated ticketing. But it is possible that a further market failure exists through asymmetric information where information is not available, in this case, to 'sellers', preventing profitable opportunities taking place and results in a 'co-ordination' failure, where sellers are unable to group together to 'bring a product to market' which is in their own collective interest. The DfT consultation document[11] states that "the UK Government believes that the right integrated ticket products, at the right price, are what the travelling public want. As a consequence transport operators have the ability to grow the overall public transport market and benefit all participating operators". The role of Government could be to provide the information which the market is unable to make available by itself, to take a coordinating role, or to provide funding to incentivise operators' involvement.

2.5 *Estimating the Benefits & Costs of Integrated Ticketing*

2.5.1 The economic analysis undertaken so far has been primarily to estimate the *economic and social benefits* from integrated and smart ticketing for Scotland across the following dimensions:

- Across two modes of transport – bus and rail[12]; and
- Across three integrated smart ticketing options – 'smart', 'integrated' and 'smart and integrated'.

2.5.2 This has been combined with estimates of the costs, both capital and operational, to extending existing smartcard infrastructure across the bus and rail sector in Scotland.

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[10] DfT (2009b)

[11] DfT (2009a)

[12] SPT are considering their own smart ticket scheme. There is insufficient information at present on how smart card infrastructure would operate on the ferries to warrant the sector's inclusion in this analysis.

2.5.3 Identifying the benefits (and to a lesser extent) the costs of a national smart and integrated ticketing scheme is challenging mainly because of gaps in the evidence base. In particular, there is no consensus as to whether potential journey time savings will materialise. Second, there is no evidence isolating the "convenience" benefit to passengers. The latter seem unwilling to pay for this extra benefit, yet a review of international experience finds evidence of increases in patronage which suggests such a benefit exists. Most of the remaining benefits extend from these benefits. Third, it is difficult to judge the extent to which cost savings can be realised by operators. Even where evidence is available, it does not typically exist separately for 1) smart, 2) integrated and 3) smart integrated ticketing. Therefore the benefits are subject to a large element of uncertainty, and judgement has had to be employed in calibrating benefits across the different ticket types.

2.5.4 The benefits shown in Table 2.3 reflect an appraisal period set to 11 years to reflect the technology lifespan. A standard 60 year transport appraisal period would clearly be inappropriate in this instance.

Table 2.3: Summary Table: Economic Benefits[13]

	Integrated	Smart	Smart Integrated
Bus	£ 290.4m	£ 295.4m	£ 373.2m
Rail	£ 142.2m	£ 148.9m	£ 198.8m
Total	£ 432.6m	£ 444.3m	£ 572.0m

2.5.5 The likely costs are uncertain but the best available estimates are shown below. Capital costs are lower for integrated ticketing though the difference is primarily with respect to rail since significant investment in smart card technology for buses has already been made as part of the concessionary fares programme. A key operational cost is the transaction cost charged by retailers etc for topping up cards.

Integrated ticketing

- Capital Costs – £2.0m for combined bus and rail; and
- Operational Costs – £27.4m for combined bus and rail.

Smart ticketing

- Capital Costs – £2.0m for bus; £5.5m for rail; and
- Operational Costs – £18.5m for bus; £4.4m for rail.

Smart and integrated ticketing

- Capital Costs – £2.0m combined costs; £0.5m for bus; £4.6m for rail; and
- Operational Costs – £4.0m combined costs; £15.5m for bus; £2.4m for rail.

2.5.6 Benefit-to-cost ratios (BCRs; benefits divided by costs) have been produced and are shown in Table 2.4 below. Because of a lack of concrete evidence, certain assumptions have been made, for example about take-up. These BCRs are highly sensitive to changes in assumptions, both in benefits and costs. In light of this a range of sensitivities has been modelled and the results are shown in Appendix 3. However, these provisional benefit cost ratios suggest that even with more restrictive assumptions about the extent of the benefits, there is a good case for proceeding with new ticketing arrangements in Scotland. Net present values (benefits minus costs, discounted to give lower weight to costs and benefits further in the future) are significant, reflecting in part the fact the existing availability of smart readers on buses.

[13] Discounted to 2002 in 2002 prices. Figures are rounded so may not sum.

Table 2.4: Benefit-to-Cost Ratios and Net Present Values

Ticketing Option	Benefit Cost Ratio (BCR)	Net Present Value (NPV)
Integrated	14.7	£ 403.2m
Smart	14.6	£ 413.8m
Smart Integrated	19.7	£ 543.0m

Bus

Convenience Benefits to Existing and New Passengers

2.5.7 Potential benefits include ease of use (less need to carry cash, more certain budgeting), more flexible journey choice of mode, route, timing, and easier interchange within and between modes.

Journey Time Savings to Existing Passengers

2.5.8 There is some evidence that passengers using a smartcard will board more quickly than those buying a ticket with cash. This benefits both the boarder and all passengers already on the bus.

Operator Cost Savings

2.5.9 The resulting reduction in "dwell time" at bus stops due to the introduction of new ticketing products can potentially reduce operating costs. This is possible only under certain limited circumstances, for example, if services can be reconfigured to allow the removal of a bus from service.

New Net Revenue to Bus Operators

2.5.10 Any new patronage will generate higher revenues for operators.

Marginal External Car Benefits – Modal Shift from car to bus (excl. CO2 impact)

2.5.11 Any encouragement of switching from car to bus use will result in less traffic on Scottish roads which will result in a range of benefits, including lowering congestion and accident rates at the margin.

CO_2 Savings – Modal Shift from car to bus

2.5.12 Lower car use will tend to see carbon emissions reduce at the margin.

CO_2 reduction in buses

2.5.13 Any reduction in dwell time will have an impact of marginally reducing the CO_2 emissions from buses.

Fraud disbenefit

2.5.14 Widespread take-up of (non-smart) integrated flashcards could offer increased opportunity for fraudulent travel.

Rail

2.5.15 Similar benefits as described in the section above may apply to rail: extra convenience to new and existing passengers; fraud prevention (overriding); new net revenue to rail operators; and decongestion and CO2 benefits of modal shift. In addition, the following benefits are thought to apply in the rail context.

Passenger Time Saved At Kiosks

2.5.16 Passengers holding smart cards will no longer have to wait to purchase printed paper tickets.

Savings in Ticket Sales

2.5.17 There will be savings to the operator in terms of costs of procuring and distributing paper tickets. For example, the topping up of Stored Value Rights products on smartcards could all but eliminate the cost of ticket sales agents and commission.

Subway and Ferries

2.5.18 Similar types of benefit are potentially available on the subway (in Scotland, the Subway, run in Glasgow by Strathclyde Partnership for Transport, who are currently considering roll-out of smart ticketing). Quantification of benefits for ferry travel has not been undertaken at this stage, due to uncertainties over how smart, integrated ticketing would be applied to the ferry sector.

2.6 Costs

2.6.1 The key point about costs is that much of the technology has already been deployed as part of concessionary fares policy. This gives the business case for smart, integrated ticketing in Scotland the advantage of lower cost estimates. Most of these costs are based on actual contract information and so only minimal optimism bias has been applied. However, it is noted that an allowance for rising costs through the integration of the different systems should be made.

2.6.2 To encourage high take-up in some other systems (notably Oyster in London) a policy stance of reducing fares for card-holders has been adopted. No account of these potential costs has been taken in this exercise.

Capital Costs

2.6.3 The main capital costs to be incurred to enable the use of smartcards for integrated ticket products in Scotland are detailed below.

Table 2.5: Capital Costs

Item	*Description*
ITSO[14] compliance/membership	Includes the cost of ITSO Secure Access Module: A smart-card-like chip that is needed inside ITSO readers to store secret keys which are used for cryptograghic operations with ITSO customer media (cards)
Consultancy	A significant cost indicating the immaturity of ITSO and the effort needed to achieve end-to-end integration of already-certified products. In addition to this cost, there is also the uncosted staff time of the overrun projects.
Card Issuance	Concessionary and commercial cards. Significant cost for buses scheme (Local Authorities)
Card acceptance	Installing ITSO readers
Distance charging	Installing exit readers
Upgrading sites for ITSO messaging	Central back office e-systems; Card Management Systems
Settlement systems	Needs to resolve the fares settlement. Not an ITSO cost, but essential.

Operational Costs

2.6.4 The main operational[15] costs to be incurred to enable the use of smartcards in Scotland are detailed below.

[14] An organisation formed to develop and maintain a specification for secure "end to end" inter-operable ticketing transactions (formerly the "Integrated Smart Card Ticketing Organisation")

[15] Including maintenance costs.

Table 2.6: Operational Costs

Item	Description
ITSO Compliance & Membership	Scheme and operators. Used ITSO website calculator to calculate. Rail has much higher turnover and hence higher fees.
Systems Management	Assume all systems are a managed service
Card Replacement	Significant cost for bus schemes (Local Authorities)
Agency Costs	This is incremental costs of covering cash to STRs[16] over the commission cost of selling regular tickets in less convenient places. By moving to STR, cost of sales goes up due to the retailer receiving a percentage of 5-7% making the total cost 10% or more instead of 5%. Also includes ETM costs – licenses and support.
Running the CMSs[17], HOPS[18] and related systems.	Described as "Per shell and per ISAM costs for HOPS"

2.7 Sensitivity Analysis

2.7.1 Sensitivity analysis has been undertaken, which has involved recalibrating the assumed values of the key drivers that affect the benefit-to-cost ratios (BCRs). The full analysis is shown in Appendix 2. Given that the BCRs are high (partly because many of the costs are sunk), the aim of the sensitivity analysis was to investigate under what conditions the various ticketing options would no longer represent value for money, to allow a better understanding of the risks involved with integrated smart ticketing.

2.7.2 A set of base case assumptions has been established for the three ticketing options, with a range of variations relating to the scale of capital and operating costs as well as the magnitude of economic benefits anticipated. A range of sensitivities has also been established, which focuses on the key drivers affecting the benefit cost ratios (BCRs).

Benefit Sensitivity Analysis:

2.7.3 The following sensitivities were assessed for each ticketing option:

- Lowering boarding time savings per bus passenger (from 2 seconds for smart and smart integrated ticketing and 3 seconds for integrated ticketing to zero and -2 seconds);
- Lowering the percentage of passenger take up (from 100% to 75%, 50%, 25% and 10%). The model assumes 100% take-up, in line with the DfT business case, though actual take up would undoubtedly be lower. Note that this also lowers costs;
- Lowering the percentage increase in patronage (to 2%, 1% and 0% for smart ticketing and integrated ticketing, and 3%, 2% and 0% for smart integrated ticketing); and
- Reducing the average number of people on a bus from 10 to 5. This affects the overall time saving for the boarders and people already on the bus.

Cost Sensitivity Analysis:

2.7.4 The following variations were also assessed for each ticketing option, in conjunction with the benefit sensitivities:

- Capital costs increase by 50%;
- Capital costs increase by 100%;

[16] Stored Travel Rights – An e-purse for travel purposes only

[17] Card Management Systems

[18] Host Operator Processing System

- Operating costs increase by 50%; and
- Operating costs increase by 100%.

2.7.5 The full results of the sensitivity analysis can be seen in Appendix 2. Each of the individual variations is still associated with healthy BCRs and even applying different combinations does not yield a BCR below 1. This provides comfort, given the uncertainties around some of the key assumptions, that the business case for smart and integrated ticketing in Scotland stands up even under significantly more restrictive assumptions.

2.8 Conclusions

2.8.1 A range of evidence has been reviewed relating to the benefits and costs of smart and integrated ticketing. Much of this has been produced for the Department for Transport (DfT) as part of the development of a strategy for England. This assessment has adopted the same categories of benefits though has not always adopted the same assumptions and methods used to calculate benefits. Some of the evidence derives from existing integrated ticketing schemes in the UK and abroad. The evidence suggests that there is a range of benefits associated with the provision of integrated smart ticketing, including the convenience to passengers of seamless and cashless travel, increased patronage, potentially faster journey times, potential cost savings to operators, some modal shift from cars to public transport, reduced fraud, and better planning using the rich management information generated. With widespread take-up, these benefits can significantly outweigh the costs incurred. It is important to note that the available evidence is relatively weak and the magnitude of some of the key benefits contested. The high benefit-cost ratios (BCRs) reported here are partly a function of the large element of sunk costs through delivery of an ITSO/ Smartcard platform for buses by Transport Scotland, but still they provide some reassurance that even with more restrictive assumptions the BCRs would remain above 1, meaning that benefits exceed costs.

2.8.2 However, only some of the benefits of smart integrated ticketing fall to the operators. This, combined with risk aversion as they seek to avoid operating in more open markets, means that the private incentives may, in general, not be sufficiently large for operators to invest in smart integrated ticketing of their own accord. The evident lack of a purely market-based solution and the existence of wider economic and social benefits thus justify more detailed investigation of the case for public sector intervention.

2.8.3 It should also be noted, though, that while greater benefits can be derived from the combination of smart and integrated ticketing many of the benefits can be attributed to smart ticketing alone. There is evidence that bus operators are becoming more convinced about the benefits that smart ticketing alone can bring them and there is less clear evidence of market failure for this ticketing product.

2.8.4 The strategic business case establishes the rationale for intervention to derive benefits from smart, integrated ticketing and provides enough evidence of the various benefits to justify proceeding to the next stage.

2.8.5 It is important to recognise that there are a number of challenges to the delivery of smart, integrated ticketing. Adoption by private sector operators in a deregulated bus market and achieving interoperability through ITSO technology are particular challenges which must be faced. These are assumed to be achievable in the modelling undertaken for the investment case (challenges to delivery are assessed in subsequent chapters).

3 Overview of the Current Position

3.1 Introduction

3.1.1 This chapter is written by PwC in order to provide the context of Smart and Integrated Ticketing in relation to:

- The Scottish landscape in terms of modes of travel, public transport demand, public transport operator models;
- Current operator models in Scotland;
- An overview of current ticketing practice in Scotland, the UK and other parts of the world;
- Other factors which would influence any potential smart and integrated ticketing solution in terms of technology and fares;
- Future developments such as Department for Transport strategy and delivery, industry trends and technological developments;
- Ticketing at multi-sport events;
- Existing and planned infrastructure; and
- Operators' view of smart and integrated ticketing in Scotland.

3.1.2 At the end of the chapter, an analysis of the key issues for consideration in determining the way forward for smart and integrated ticketing is given.

3.2 The Public Sector Transport Landscape

3.2.1 The Scottish landscape for public transport, and hence ticketing, is characterised by a number of key features that affect the potential success of Smart and Integrated Ticketing.

- The preferred mode of travel in Scotland by trip volume is by car with 67% of commuters using the car to travel to work[19]. This is in contrast to many other case studies on travel ticketing, where public transport is already the preferred mode of travel and where the intended strategy is to seek a critical mass to adopt Smart Ticketing i.e. the issue is to move existing passengers to a different public transport ticket type, rather than to generate more public transport passengers. This already indicates the nature of the challenge facing Scotland with a need for modal shift from cars to public transport being a key element of transport policy and also a crucial requirement to create critical mass for a sustainable business model for Smart and Integrated Ticketing;
- Only in Glasgow and Edinburgh is use of public transport of significant volume (accounting for over 80% of public transport trips in Scotland20), and even in these conurbations there is significant choice of modes or operators. As a result, though there may be certain demand for Integrated Ticketing in rural areas, it may only achieve significant volumes in Glasgow and Edinburgh. Most ticketing case studies to date have focussed on the benefits of Smart and Integrated Ticketing in urban environments – previous case studies and an available case for a national ticketing strategy which includes rural areas is less clear. This may mean that the stated

[19] STS2009, published December 2010.

[20] Passenger Boardings in 2006-07 in Lothian and Strathclyde accounted for approximately 80% of passenger boardings in Scotland.

aim for full national coverage of Smart and Integrated Ticketing may not be deliverable in the near term albeit this could remain as the ultimate goal;

- The predominant public transport mode in Scotland is bus travel (accounting for approximately 80% of public transport trips). This means that addressing bus ticketing is a key component of any strategy for Scotland; and
- Bus services in Scotland are deregulated, meaning that operators can determine their fares and ticketing solutions. A key challenge will be to identify how a strategy may be affected when Scottish Government does not have direct control over bus fares and ticketing approaches and pricing. Rail ticketing is subject to rail industry agreements and the terms of the franchise agreement which is specified by Scottish Government.

Demand for Public Transport in Scotland

3.2.2 Current demand for transport ticketing in Scotland is concentrated in the major cities of Glasgow and Edinburgh. In total there are some 563 million trips (excluding air and non-local coach/bus services) per year on public transport (Scottish Transport Survey for 2009, Scottish Government, December 2010) for which a ticket or pass would be required. These trips were analysed as follows:

Table 3.1: Public Transport Usage Distribution

Mode	*Passenger Trips In Year (2009) Million*	*Percentage of Trips*	*Ticket Revenue £ Million*	*Percentage of Known Revenue*
Local Bus Services	467	82.8%	626[21]	67%
Rail	77[22]	13.7%	307[23]	33%
Subway	14	2.5%	Not available	-
Ferry	6	1.1%	Not available	-
Total	**565**	**100%**	**933**	

Source: Scottish Government STS2009, published December 2010.

3.2.3 For the purposes of developing the approach to Smart and Integrated Ticketing, passenger trips would need to be analysed by region in order to determine whether there is the sufficient public demand. On the basis that Glasgow and Edinburgh account for over 80% of passenger trips, these areas would be the most viable in the short term.

3.3 The Operators

Operator Models

3.3.1 The key current modes of public transport in Scotland are subway, rail, ferry and bus. Each operates in a different environment as follows:

- **Subway:** the only subway system in Scotland is in Glasgow and is operated by Strathclyde Passenger Transport. The subway carries some 14 million passengers per annum[24];
- **Rail:** rail services are operated by First ScotRail through a franchise agreement managed by Transport Scotland on behalf of Scottish Ministers. It was awarded by SRA, with rail powers transferred after the award. In addition there are the following cross-border operators: East Coast, Virgin, Arriva and First Trans Pennine;

[21] Source STS 2009

[22] Source STS 2009

[23] Excludes rail subsidy – amount for 2009/10 to be confirmed.

[24] Para 2.8, Tender for Design, Supply and Installation of Replacement Ticketing System, SPT, Oct 2009.

- **Ferries:** most ferries operate on the basis of contracts awarded by Scottish Government; and
- **Bus:** the bus industry is de-regulated with multiple operators operating in direct competition throughout Scotland.

3.4 Overview of current ticketing practice

Paper-Based Tickets

3.4.1 Transport ticketing has traditionally used paper-based media. Paper tickets are inexpensive to issue, their printed nature means they can be understood easily by travellers and inspectors without complex equipment and they can be processed through an automated gate where a magnetic stripe is also printed on the paper ticket. The terms and conditions can also be incorporated onto the ticket. This type of ticket has been in use for over 20 years in the UK and many other countries.

3.4.2 Transport ticketing in Scotland relies primarily on magnetic stripe paper tickets which are accepted on buses, rail and the subway. Very few railway stations are gated and the primary means of ticket inspection is manual. Any move away from paper based tickets will require investment in infrastructure on rail and some enhancement to the already deployed bus ticketing infrastructure.

Smart Ticketing

3.4.3 Smart card tickets are essentially plastic cards with a "chip" embedded – the "chip card". They have evolved from the first "chip card" designed in 1968 through a series of parallel market developments in channel automation, access control and improved payment security.

3.4.4 A key difference for the transport customer is that smart cards rely on an electronic reader to check the account balance and usage, or on the customer being able to view usage and the remaining balance on the web or a paper statement. To date, there has been limited investment in Scotland in platforms of this nature. As a result, the smart cards in use in Scotland are used primarily for simple fare products such as season tickets and fixed passes such as Lothian Buses proprietary smartcard system for season tickets which has been operational since 2002 and has some 60,000 customers with cards; and the concessionary fares scheme which has issued smart cards to 1.2 million customers.

3.4.5 There are many potential benefits of a smart card in comparison with a paper-based ticket. Appendix 2 provides a more detailed statement of benefits, but they include:

- Faster processing of customer transactions;
- The ticket is more robust;
- The value on the ticket can be more secure. If the card is lost it can be deactivated and the stored value transferred;
- The ticket has the potential to store more complex information such as information about trips. However, a reader or web-based account is needed for the customer to be able to access the information gathered;
- The smart card can transact in an automated way reducing the need for staff to view the ticket; and
- Because plastic cards are less prone to becoming caught in machines, they increase life of the infrastructure thereby reducing maintenance costs.

Integrated Ticketing

3.4.6 Integrated ticketing, in a general sense, refers to ticketing that is valid on more than one operator and/or mode of transport[25]. Within this broad definition it can take a number of forms, including the use of a common payment mechanism; a single ticket on different operator services; a single ticket

[25] As defined by DfT (see 1.15)

[27]Source Strathclyde Partnership for Transport

across different modes; or combinations of these three elements. Examples of each are discussed below.

3.4.7 Integrated tickets have been in place for over 30 years, largely in paper form. They have operated mostly where a single transport authority has sufficient control to oblige operators to accept a common ticket or where the authority has negotiated with private operators to have a single ticket accepted. There are a number of examples of integrated tickets operating internationally. Details of these are provided at Appendices 4 and 5.

3.4.8 The primary benefit of an integrated ticket is for the end–user who can choose from multiple modes or operators to take the most convenient travel route without having to purchase a new ticket at each interchange. Because of this convenience, tickets are often priced at a premium meaning the total cost may in fact be more than for single journeys (depending upon journey numbers).

3.4.9 The integrated tickets currently in operation within Scotland are as follows:

- The "SPT ZoneCard" operates within the Strathclyde area and serves bus, train and subway. The ZoneCard is a pre-pay period ticket and operates alongside proprietary operator tickets. The ZoneCard take up is low at only 4% of public transport trips within the SPT area using the ZoneCard;
- "Oneticket" provides bus and rail travel within one ticket independently of operators. It is priced at a premium according to a set of rail based zones and is available in weekly, monthly or annual forms. It is provided by a partnership between SEStran and the operators in the Edinburgh area;
- Daytripper is a one day pass valid after 9am and operates on all SPT services - rail, bus and subway. It is priced as a premium product but allows 2 adults or 1 adult and 2 children to use the ticket;
- "Plusbus" provides a bus ticket as an addition to a rail ticket. The bus ticket is valid on bus routes connecting with each end of the rail journey and offers savings on individual rail and bus fares. It offers day tickets and season tickets;
- Roundabout is valid on rail and subway and is also a one day ticket valid after 9am. It works cross operator;
- The "Highland Rover" provides a period ticket (i.e. a ticket which is valid for a specified period of time) which is valid on specified routes for rail, ferry and bus/coach. It covers multiple bus operators. It is a premium product with a defined start and end date; and
- The "Freedom of Scotland" pass provides a period pass which is valid on specified routes for rail, ferry and bus/coach. It covers multiple rail and bus operators. It is a premium product with a defined start and end date.

Smart and Integrated

3.4.10 There are few examples of smart and integrated ticketing schemes where the card is a dedicated transport card and serves multiple operators and modes. The schemes with most scale include:

- Oyster in London – operating in a regulated fares environment (except for the rail element); and
- OV Chipkaart in Holland – still in the process of being implemented (operating in a regulated fares environment – see Appendix 5 for more detail).

3.4.11 However, where the card used is a more general payment card issued by a bank or payment card operator, there are many more examples of Smart and Integrated Ticketing including:

- In Buenos Aires, Monedero (meaning wallet in Spanish) is a payment card for use on buses, subway and trains. It can also be used in shops with low value transactions: for example, coffee shops, pharmacies, bookshops/newsagents. It serves over 2.5 million users and has been in place since 2002;

- In Hong Kong, Octopus has migrated from being a transport specific payment card to being a more general payment card with many retail and service outlets accepting the card. It handles over 15 million transactions per day; and
- The Suica & Pasmo payment cards in Japan, which serve rail and bus travel in the Tokyo metropolitan area, as well as allowing the purchase of other products and services at retail outlets.

3.4.12 In these cases, the applicable fare is regulated, but the smart card payment element is only defined to the extent required to be recognised by ticketing gates or readers. In all three cases, the development was led by a payments industry-focused organisation (rather than transport-focused organisation) willing to become both card issuer and back office transaction processor, and by taking the lead in managing customer outlets and payment and collection risks.

3.5 *Technological Solution*

3.5.1 The Department for Transport developed ITSO initiative is intended to deliver secure and interoperable smart and integrated ticketing across operators and geographical boundaries. The Scottish Government has already invested in ITSO-based technology to operate the Concessionary Fares Scheme, which means that all buses used for public transport in Scotland already have ITSO-compliant technology in place. In addition, First ScotRail is in the process of trialling an ITSO compliant smart card between Edinburgh and Glasgow. This investment, along with the public support of DfT for ITSO technology makes an ITSO-based solution an obvious technology option.

3.5.2 Elsewhere in the UK, bus operators are increasingly investing in ITSO technology to promote smart commercial ticketing. Stagecoach for example, is playing a leading role in this, which further helps evolve ITSO to a robust, commercial ticketing platform.

3.5.3 However, ITSO is a developing solution that is mature for some types of ticketing product but has yet to be proven on a large scale with other types. To date, it has been used for relatively simple transactions such as:

- Concessionary fare ticketing in Scotland and England – this is a relatively simple transaction and is mature; and
- Season tickets – a simple transaction involving start and end dates and is relatively mature.

3.5.4 The ITSO standard is designed to enable interoperability between ticketing schemes, though on balance it is focused primarily on the card transaction with the reader, rather than the back-office processing model. In our view back office and inter-operator clearing design is also important to enabling interoperability. Back-office and clearing between operators are key drivers of the cost of collection; the immaturity of the ITSO back-office development means that there are also no mature economic models for ITSO covering typical costs of collection, back office processing and inter-operator clearing to use as a reference for an ITSO-based solution in Scotland.

3.5.5 Though the latest version of ITSO is 2.1.4 (published in February 2010), the version installed on bus ETMs and on ticketing systems for the First ScotRail trial is largely version 2.1.3 which does not provide the same degree of interoperability that would be required for a national multi-modal scheme. The installed equipment is progressively being upgraded to meet version 2.1.4.

3.5.6 ITSO's capacity to overcome the issues highlighted above is the subject of a new business plan being developed by the ITSO Board. Much of the outcome of this plan will rest on DfT's sustained commitment to the standard and preparedness to provide funding as well as ITSO's ability to deliver its development plan.

3.5.7 Whilst other technologies exist they do not offer the same level of interoperability. Given the level of investment in and support for ITSO, ITSO remains the most obvious solution.

3.6 Fares Structure

3.6.1 The nature of the fares structure in operation has a direct impact upon the technology needed for smart and/or integrated ticketing:

- **"Single touch" card transactions:** Lothian's smart ticket scheme operates on a flat fare basis. This means a "single touch" transaction on boarding is all that is needed to deduct the correct fare from the smart card. In London, bus services also have a flat fare structure meaning the Oyster transaction on board is a relatively simple single touch on entry also. In Glasgow, fares vary depending upon the length of the journey which would require the fare due to be stated on boarding to allow it to be deducted if a smart card was to be used. Touch out technology is not currently in operation on buses in Scotland;
- **Premium priced products:** integrated tickets are typically priced at a premium compared with the price of a single mode or trip ticket to reflect the convenience of the card, as with the SPT ZoneCard. The price premium is a key driver of potential take-up. If the premium is relatively small, customers may be more likely to buy the integrated multi-trip/multi-mode product. In the case of the ZoneCard, take up is for only 4% of trips, suggesting that the premium may be pitched too high; and
- **Touch on/touch off transactions:** In comparison, distance-based fares have been implemented for the Dutch OV Chipkaart scheme (Appendix 5) with a requirement for customers to touch out on all modes. One of the key reasons for the Dutch implementing the smart card was to introduce a fare structure that better reflected journey distance than the existing "strip card" scheme which has fare stages in zones that are on average 4.5km wide. In the Dutch case, the requirement for exit readers is within the control of the transport authority to specify as the ticketing arrangements are regulated.

3.7 Ticketing at Multi-Sports Games

3.7.1 There is an increasing trend for the use of smart card technology for a wide range of purposes. In particular, multi-sports games events such as the Olympic Games and the Commonwealth Games are considering the increased use of technology for access and travel to events. Given the hosting of the Commonwealth Games by Glasgow in 2014, there is a potential opportunity to use the event as a stepping stone for the implementation of a national ticketing strategy.

Table 3.2: Multi-sport Event Ticket Approaches

Games Event	*Number of Venues*	*Spectators (Million)*	*Transport Ticketing Approach*
London 2012 (OG)	29	7	Paper based ticketing for events. Free travel on the day on public transport
Delhi 2010 (CG)	18	1.7 (estimated)	Event tickets separate from transport tickets. Event tickets accepted on metro and buses.
Beijing 2008 (OG)	37	8	First RFID based Olympic ticket. 1,000 RFID readers in place. Separate AFC card for metro and buses + Beijing SuperPass
Melbourne 2006 (CG)	16	2	Free travel on the day of the event based on presentation of the games ticket
Athens 2004 (OG)	35	3.6	Paper-based ticket. Free travel on the day on public transport.
Manchester 2002 (CG)	15	1	Paper-based ticket. Free travel/park & ride on the day on public transport.
Sydney 2000 (OG)	19	6.7	Paper-based ticket. Free travel on the day on public transport.

3.7.2 Further details of four Games Events are provided at Appendix 6 (Delhi 2010, London 2012, Beijing 2008 and Torino 2006).

Glasgow 2014 (Commonwealth Games)

3.7.3 The 2014 Games in Glasgow will draw significant numbers of spectators and visitors to the city, creating a significant spike in public transport demand for a concentrated period and also affording Glasgow the opportunity to showcase its public transport network.

3.7.4 Initially, there was an aspiration to introduce integrated transport and event ticketing as a means of offering an improved customer experience at the Glasgow Commonwealth Games (Appendix 1, Ref 26). However, Glasgow 2014 has since stated that smart travel ticketing is not central to their ticketing strategy for the Games. They have also expressed concerns over the risks associated with new technology and consider that their aspirations can be delivered in a more appropriate way, perhaps along the lines envisaged for the London Olympics in 2012.

3.8 Existing and Planned Infrastructure

3.8.1 Concessionary Fares infrastructure has already been implemented throughout Scotland on some 6,300 buses with 7,128 ITSO electronic ticket machines (ETMs) and 1.2 million Concessionary Fare ITSO smart cards issued. Lothian Buses has implemented a smart card scheme based on the 1k Mifare card (the same card type as Oyster) and has 60,000 customers using a proprietary ticket format.

3.8.2 However, the current framework contract for supply and maintenance of the on-bus ticket readers has expired and may need to be re-procured, as will the existing AMS/HOPS contract (assuming TS continues to be responsible for the installed Electronic Ticketing Machine equipment). This presents a key opportunity to bring together the supply and maintenance activity with other ticketing needs within a wider ticketing operation.

3.8.3 The main established plans for future smart card infrastructure are:

- The First ScotRail Pilot on the main Edinburgh and Glasgow route commenced initially with staff testing the infrastructure. The pilot has been expanded to include customers (from May 2010) with the trial of weekly and then monthly season ticket products on Smartcards. The existing ticket gates at Waverley, Haymarket and Queen Street have been smart enabled and platform validators have been installed at interchange platforms and other stations along the route enabling customers to 'hold and hover' over the yellow smart card target to record the start and end of their journeys and pass through the gates where applicable. After initial testing, the intention is to expand the scheme to up to 10,000 Smartcard holders. As of Jan 2011, there are understood to be 400 season ticket customers signed up. The infrastructure and contracts in place are compliant with ITSO version 2.1.3. The outcome of this pilot and indeed TS's ticketing strategy will need to form part of the consideration for the specification of the re-procurement of the ScotRail franchise, with re-procurement starting in 2011 and commencement of the new franchise from 2014;
- The procurement by SPT of a new ITSO-compliant ticketing system and gates and barriers for the Glasgow subway, serving 15 stations. This tender has been re-issued. The specification requires that the ticketing gates and systems are implemented within 2 years of contract award. The contract has not yet been awarded; and
- SPT has also submitted an OJEU notice for the procurement of a new back office (AMS/ HOPS) serving not only the Subway, but potentially other areas. This project is understood to be running in parallel with the procurement of gates however plans have yet to be confirmed.

3.8.4 Other plans are more tentative and include:

- Individual local authorities are considering what services they will provide on ITSO-based entitlement cards. These include Dundee and Dumfries and Galloway;

- Lothian Buses may refresh its infrastructure as part of a migration away from the current 1k Mifare proprietary card towards a more robust smart card system within the next 2 years. It may also take the opportunity to implement a CRM system so that customers can have access to their usage history and accounts; and
- SPT has approved a programme of investment over thirty years in the Subway for new rolling stock, ticketing, gates and barriers, and refurbishment of stations. It is understood to be liaising with Scottish Government on these plans. However, the extent and precise timing of the investment that will be made is not yet clear.

3.9 Operators' Views of Smart and Integrated Ticketing

Subway

3.9.1 The Glasgow Subway is operated by SPT, which already has an integrated ticketing product (the SPT ZoneCard) in place, albeit paper-based. Following discussions with SPT, the prospect of Smart and Integrated Ticketing within Strathclyde has been considered already. Indeed SPT is progressing its plans to implement Smart Ticketing on the Subway, with a view to making the ZoneCard smart at some point in the future. This may provide SPT with the opportunity to increase patronage, potentially through a higher number of multi-modal journeys, although the driver for the change is the need to replace an outdated magnetic stripe ticketing system.

3.9.2 On the basis of our understanding of SPT's position, there does not appear to be a need to undertake any further development of the commercial case for inclusion of the Subway as it is already supported.

Rail

3.9.3 Rail services throughout Scotland are operated by FSR, with the current franchise operating until 2014. FSR is currently trialling a Smart product on the Edinburgh to Glasgow route and as such is gathering experience on the costs and benefits of such technology.

3.9.4 In terms of the rail commercial case, it is important to note two points. First, there is only one rail operator in Scotland (with the exception of cross-border services). Second, rail services are delivered through a franchise which is controlled by TS. TS could therefore initiate negotiations to bring about variations to the franchise to include Smart technology. Alternatively, this could be included as part of the next rail franchise.

3.9.5 Taken together, it is clear that there are available mechanisms to facilitate the participation of FSR in a smart and integrated ticketing scheme. Clearly, there may be financial implications for TS of varying the existing franchise terms, as there would be with any contractual variation. However, the key point to note is that it is within the gift of TS (perhaps at additional cost) to achieve FSR/next operator buy-in and hence availability of rail to the scheme.

Ferry

3.9.6 This mode has been excluded from further evaluation at this stage at the request of TS, as there are some unique issues around using smartcard equipment in a marine environment.

Bus

3.9.7 Within the bus mode, a significant number of commercial bus operators would need to be involved in the scheme.

3.9.8 Given that a deregulated bus market is in place within Scotland and based on interviews with certain operators, it is clear that operators will only participate willingly where there is a clear commercial rationale for them to do so. The challenge then in developing a Business Case for smart and integrating ticketing is to explore how these operators can be brought on board. This requires a detailed understanding of the operators' commercial concerns regarding Smart and integrating ticketing and of how these concerns can be addressed, drawing on wider experience of models that have been used elsewhere.

3.9.9 This element is critical - in order for integrated ticketing to be multi-modal and multi-operator in a way that can truly deliver benefits, full commitment must be secured from the commercial bus operators. However, it is possible that buy-in from one of the major operators (e.g. First Glasgow) could be enough to trigger others to follow suit, such is the effect that this participation in a smart and integrating ticketing scheme could have on the wider market.

3.9.10 To gauge views in the Scottish market, a series of interviews with two major operators was undertaken. Prior to engaging with operators, the potential aspects of the operator case were tested with senior industry advisers at Scottish Government Transport Directorate. Interviews were held with the following bus operators to understand their reaction to potential options for Smart and integrating ticketing:

- Lothian Buses; and
- First (Glasgow).

3.9.11 Whilst certain other operators were approached, they were unable to make time available because of other pressures they were facing, particularly in relation to responding to the ongoing Competition Commission review into the bus market[26]. Detailed discussions with both the named operators have added an additional dimension to the bus operator knowledge base, allowing the potential benefits and principal concerns regarding Smart and integrating ticketing from an operator perspective to be identified.

Potential Operator Benefits:

3.9.12 A number of potential benefits are set out with the DfT's Smart and integrating ticketing Strategy (See Section 2 and Appendix 2). Those which are most pertinent to bus operators are as follows:

- The potential to increase the use of public transport, and by implication bus usage, through a modal shift from cars;
- The potential to achieve cost savings through reduced journey and dwell times; and
- The potential to access detailed passenger journey information.

Emerging Operator Concerns:

3.9.13 In spite of the potential benefits identified, views expressed by some bus operators (see Appendix 7) suggest that bus operators are generally sceptical of the concept of integrated ticketing. Neither of the operators who were engaged in the process indicated plans to implement smart integrated ticketing themselves. Key concerns were as follows:

- Integrated ticketing would increase competition between bus operators and other modes of transport thereby threatening market share;
- Loss of the direct relationship between operators and customers; and
- Depending on the source of funding, the costs of introduction and maintenance would outweigh the benefits from a commercial perspective.

3.9.14 The operation of a deregulated bus market in Scotland means there are limited levers available to encourage or compel operators to participate in any Smart and integrating ticketing scheme.

3.9.15 In addition the bus market is currently under review by the Competition Commission and the outcome of that review is not yet known. Operators are unlikely to consider radical changes until the implications of the review are known.

[26] A draft report was due in October 2010, with the final version to be published in June 2011.

3.9.16 Certain operators already have their own multiple trip tickets or Smart tickets in place and do not want to lose their market share or invalidate their original investment in these products. The competitive nature of the bus market also means that fares vary between operators. This would make revenue allocation challenging, given that operators are reluctant to share their fare information, albeit this would not be insurmountable.

3.9.17 Bus operators are also sceptical of some of the key benefits cited, particularly on boarding time savings, reduced dwell time and cash handling, where no directly comparable evidence of achievement could be identified or cited.

3.9.18 At a wider strategic level, operators have concerns that national and local transport policy and planning do not consistently promote bus travel and that as a result potential bus users are using cars. Bus priority and other measures would need to be applied consistently across Scotland to encourage a modal shift.

Addressing Operator Concerns

3.9.19 To address some of these concerns and also to identify how it might be possible to motivate operators to participate, the potential measures that may overcome these barriers have been considered. These measures are set out in greater detail in Appendix 8 where the nature of the measures and their potential applicability are described in a Scottish context. In essence, the incentivisation models we have identified fall into one of the following five groups:

- Provide subsidies;
- Promote operator products;
- Provide ticketing infrastructure;
- Mitigate costs; and
- Introduce disincentives for non-participation using levers such as Bus Service Operator Grant

3.9.20 There are a range of potential ways of incentivising available across these five areas. However the levy by the public sector, in essence, all require either direct public sector investment and a clear articulation of the benefits to operators or some form of disincentive for non-participation.

3.9.21 Further assessment by TS will be required to confirm the availability of public sector funding and validate that these measures would have the desired outcome in terms of participation by operators.

3.10 Analysis of Key Issues

3.10.1 This chapter has set out the landscape for smart and integrating ticketing. This analysis and information has highlighted a number of factors that will need to be considered in terms of determining the way forward for smart and integrating ticketing in Scotland.

Scottish Transport Experience (section 3.2)

- The majority of journeys in Scotland are undertaken by car, meaning that a modal shift to public transport will be required to maximise uptake of smart and integrating ticketing;
- The majority of public transport journeys are in Edinburgh and Glasgow (and close surrounding areas). This may make these areas more suitable for initial implementation of a smart and integrating ticketing policy; and
- Over 80% of journeys by public transport in Scotland are by bus. The bus market in Scotland is de-regulated with multiple operators working in competition. A smart and integrated scheme will require the full support and participation of the bus operators if it is to succeed.

Ticketing Practice (section 3.4)

- Smart ticketing is well established in urban centres around the world where there are multiple public transport modes, trip options and high volumes of usage. However, it is not yet proven as cost effective solution in national, rural or low usage scenarios;

- Smart and integrating ticketing has been most successful when a single authority has taken the lead by implementing or setting a technical and fares standard in a regulated rather than a de-regulated environment. It has been most successful where the ticketing provider has had a payment industry rather than transport provider focus; and
- In Strathclyde, SPT has taken the lead role in establishing an integrated ticket (the ZoneCard) through dialogue with each operator. As with other integrated ticketing products, it has been priced at a premium. This has limited take-up to 4% of trips in the area, illustrating the importance of the pricing strategy in optimising usage of integrated ticketing products.

Technological Solution (section 3.5)

- The Scottish Government has invested in ITSO technology for the concessionary fares scheme on the basis that it could also provide the interoperable platform required to support smart, integrated ticketing for commercial ticket products in the future. However, while this is a clear strategic objective the ability of ITSO to deliver to the requirements of a wholly smart and integrated scheme of the scale required has not been fully tested and should be factored into any decision making process.

Fares Structure (section 3.6)

- Smart and integrating ticketing that is wholly automated requires technology to allow passengers to "touch on" on boarding and "touch off" on disembarking. This would require investment in exit readers on buses and buy in from operators.

Ticketing at Multi-Sports Games (section 3.7)

- No multi-sports games have yet chosen to use a smart and integrated transport and event ticket. To do so for Glasgow 2014 may represent an unnecessary and riskier development than required or sought by the 2014 Operating Company.

Existing and Planned Infrastructure (section 3.8)

- There are a diverse set of smart card projects on the horizon which result in a number of infrastructures. This will need to be considered in deciding a future delivery model for smart and integrated ticketing.

Operator Views (section 3.9)

- Bus operators, whose active participation is essential, remain to be convinced of the benefits of or commercial case for integrated ticketing. However, they are already introducing smart technology for their own products and a case for a smart rather than smart and integrated solution may be viewed as more viable at this time.

3.11 Conclusions

3.11.1 The analysis of the current landscape in relation to smart and integrated ticketing has highlighted some key issues in relation to the way forward. In particular:

- Whilst G2014 was originally seen as a driver for a smart and integrated ticketing scheme, the aspirations of the Organising Committee can be met in a less ambitious manner;
- The deregulated nature of the bus market in Scotland and its dominance in terms of public transport journeys means that the commitment of bus operators to smart and integrated ticketing is vital to its success. Bus operators, whilst supportive of smart ticketing, are less convinced by the arguments in favour of integrated ticketing;
- The investment already made in ITSO infrastructure and the commitment shown to it so far by DfT and TS, supports its choice as the obvious technological solution for a smart and integrated ticketing scheme. However, it is not yet fully proven on a scheme of this scale and complexity;
- The total number of journeys by public transport in Scotland is 563 million, equating to an average of 1.5 million journeys per day in Scotland. This is significantly lower than the 10 million daily journeys in London, of which 75% are Oyster-based. A key issue for further consideration is whether the benefits of a smart and integrated ticketing scheme can be delivered in a cost effective way with this volume of transactions and across such a wide geographic area; and
- The number of Smart schemes is likely to expand locally (e.g. through the FSR pilot and Lothian scheme). The range of services that can also be provided through a Smartcard continues to grow, thereby making the product increasingly attractive.

4 Options Appraisal and Key Risks

4.1 Introduction

4.1.1 This chapter was written by PwC and it summarises the findings of an Operations Appraisal and Validation Workshop which focused on:

- Achieving and confirming a shared long-term vision for smart and integrated ticketing in Scotland; and
- Agreeing a short-list of feasible options, focussing on the Strathclyde area as the first phase of delivery of the national framework.

4.1.2 A paper prepared earlier by Transport Scotland regarding its vision for smart and integrated ticketing was used as a starting point for the workshop. The initial consideration was whether the vision articulated within that paper was valid and evidence-based. Whilst the paper focused on the possible technical solutions, other dimensions were considered as follows: modes, geography, technical solution and functionality. There was broad agreement on the basis of the evidence presented at the workshop and the subsequent discussion that the vision articulated by TS was indeed a valid way forward for Smart and Integrated ticketing in Scotland.

4.1.3 This overall vision for Smart and Integrated ticketing was articulated as ultimately operating on all modes of transport, supported by Europay, Mastercard, Visa and ITSO on the basis of an "e-purse", covering a number of services (travel, retail and parking), operating on a Scotland-wide basis and eventually cross-border.

4.2 A Phased Approach

4.2.1 As set out in the introduction, the strategic goal for smart & integrated ticketing is to eventually achieve roll-out across Scotland, thereby delivering benefits on a national basis. This reflects a desire to make public transport a more attractive option, representing a genuine alternative to car travel.

4.2.2 However, while the strategic direction is towards a scheme that is available nationally, there are clear arguments in favour of approaching this ultimate aim in a staged fashion, rather than attempting to implement a scheme across Scotland in one single move. The key arguments in favour of the staged approach are as follows:

- A staged approach offers scope to better manage risk and financial exposure;
- The DfT is adopting a similar approach in England, focusing first on urban centres. This offers the possibility of learning lessons from experience elsewhere and also drawing on high journey volumes to drive the realisation of benefits; and
- A proof of concept can be developed at a local level and then potentially rolled out across the country.

4.2.3 In a Scottish context, therefore an initial focus on urban centres to create a blueprint and/or feasibility assessment for the remainder of the country appears to be sensible. In addition to the arguments set out above – which could potentially be applied to any urban centre – two factors suggest that Glasgow should be the primary focus.

4.2.4 Firstly, Glasgow already has an integrated ticketing scheme, through the SPT ZoneCard. This covers bus, rail and Subway and is available for different zones within the Strathclyde area. Although this is paper-based, it does represent an important step in relation to operator cooperation and to operator revenue sharing in particular.

4.2.5 Secondly, while Edinburgh does also have an integrated ticket ('Oneticket', as discussed in section 3), the Commonwealth Games will be held in Glasgow in 2014. This event will draw substantial numbers of spectators and other visitors to the city and could provide an important opportunity to showcase what the city has to offer. In this context, it may be possible to use the Games as a driver for the implementation of some form of Smart and Integrated ticketing. If delivered in time, this could deliver a further positive legacy for the city and could be an important stepping stone towards the strategic goal of a national scheme.

4.3 Defining the Glasgow-based Options

4.3.1 Building on these arguments, the Options Validation Workshop explored the parameters of the Glasgow-based options.

Glasgow-based Options

4.3.2 Within the framework of the national vision, the Options Validation Workshop identified three options for further evaluation. A short-list of options is key to allow for cost and benefit quantification and to ensure programme design can operate to a defined target. These three options provide a range of scenarios, with 2014 as a reference date.

Option One – Smart and Integrated Transport and G2014 Event Ticketing in Strathclyde (Ambitious)

4.3.3 The ambitious vision is for a Smartcard "travel purse" which integrates transport and events and permits travel on rail, bus and Glasgow Subway within the full SPT ZoneCard area, including specific corridors beyond this, being Edinburgh and satellite Games venues. If a Waterbus is introduced by Games time, this could also be included. Reflecting existing investment in the Concessionary Fares Scheme, the scheme would be ITSO-compliant[27]. This reflects a desire to future–proof the scheme against technological developments and ties into the long-term vision set out earlier in this document.

Option Two – Smart and Integrated Transport Ticketing in Strathclyde (Full inclusion of rail) (Mid-Point)

4.3.4 There is a separate subsidiary option which does not include event ticketing; the smart card solution would serve only transport ticketing. It is the same in all other respects to option one. Based on stakeholder meetings with Glasgow 201428, we understand that event ticketing could be delivered through a traditional paper ticket under this option.

Option Three – Smart and Integrated Transport Ticketing in Strathclyde (Partial inclusion of rail) (Safe)

4.3.5 The third option is the 'do minimum' option. This is a Smartcard-based "travel purse" covering bus and Subway travel within the SPT area. In addition, this option would allow travel on specific rail corridors within the city, including for example to Mount Florida (for Hampden Park which will host the athletics events at the Glasgow 2014 Games). This reflects emerging thinking on how spectators are likely to travel to events but does require assumptions to be made about the stations that should be covered. There is no intention to cover all the stations where journeys may originate at this stage. The "do minimum" approaches event ticketing in the same manner as option two.

[27] It should be noted that there is currently no ITSO option that enables migration to EMV or NFC (Near Field Communications using a device integrated with a mobile phone as a smart card).

[28] Glasgow 2014 is the Organising committee for the XX Commonwealth Games in Glasgow.

Fall-back Positions

4.3.6 As a contingency, fall-back positions have been identified as follows:

***Fall-back** 1 - Non-smart card based fallback*

4.3.7 The existing paper-based ZoneCard is considered to represent the ultimate fall-back option if new technology should fail or prove infeasible to implement within the required timescale. This paper-based fall-back is the mitigating strategy for the new technology risk which applies to all three options.

***Fall-back 2** - To simpler ticketing product*

4.3.8 If it became unfeasible to provide a travel purse on a Smartcard, a fall-back position could include a less complex Smartcard product, such as a season ticket, as is currently being piloted by FSR[29]. A season ticket would operate over a defined period and could in theory serve any period of time, including for travel only on a single day.

***Fall-back 3** - Use of a non-ITSO smartcard solution*

4.3.9 If the ITSO solution is determined to be unfeasible and a smart solution considered essential for G2014, a third option would be to use a non-ITSO solution, such as Oyster.

4.4 Illustrative Options Scoring

4.4.1 The three noted options (paragraphs 4.3.3, 4.3.4 and 4.3.5) were subjected to a scoring exercise to identify the preferred "first step" option. The outcome of the options scoring exercise, details of which are provided at Appendix 9, was as follows:

Weighted Score

Table 4.1: Scoring Exercise for "First Step Option"

Assessment Factor	*Option1 – Ambitious*	*Option 2 – Mid-Point*	*Option 3 – Safe*
Strategic Fit (x8)	64	64	56
Ambition (x5)	45	40	30
Pre-conditions to delivery (x9)	9	18	27
Feasibility (x8)	8	24	32
Existing Investment (x4)	24	24	16
Passengers (x7)	42	42	35
Political Acceptability (x9)	81	72	63
Total Score Weighted	**273**	**284**	**259**

4.4.2 The three fall-back positions (paragraphs 4.3.7 – 4.3.9) have not been scored as these are not investment options but rather represent contingency actions which will only be considered for implementation should the preferred option not prove feasible or deliverable.

Commentary on Scoring

4.4.3 The result of this scoring exercise highlights that there is relatively little between the three options final weighted scores. Option 2 (the midpoint) scores highest largely because it reflects a greater ambition than option 3, whilst reducing the risk of delivery associated with option 1.

[29] FSR had originally intended to pilot the Flexipass ticket - a carnet of either 10 or 50 trips on the Edinburgh – Glasgow line. However, due to a lack of ticket gate compatibility, the pilot is currently limited to season tickets – this is a simpler ticket product and has defined start and end dates so can be set to be valid for one day or other period of time.

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4.4.4 The ambitious option has a slightly lower score principally because of the pre-conditions and challenges likely to be involved in delivering such a complex scheme. Combining transport and events ticketing on a single Smartcard is an unprecedented offering which carries an inherent level of technology risk. This affects the scores for the ambitious option on both the 'Pre-conditions' and 'Feasibility' factors. The scoring acknowledges, however, that it is ambitious and therefore has the potential to deliver a more significant legacy. As such, this may make it more politically attractive.

4.4.5 The safe option has scored less well because it fails to build on the FSR pilot which is an important component of existing infrastructure and recognises the important passenger flows between Scotland's two major cities. In addition, it may also be deemed insufficiently ambitious from a political standpoint. However, it is the least complex and hence potentially the most deliverable of the three options. It may also prove most attractive to Glasgow 2014 in view of its appetite to reduce risk wherever possible.

4.4.6 The mid-point option scores highest of the three, principally because it builds on existing investment and demonstrates ambition through its wider geographical coverage, but does not include the extra risks associated with integrating travel and event ticketing.

Key Risk Analysis

4.4.7 The analysis of the smart and integrated ticketing landscape in Section 3 was supplemented by a risk workshop at which the key risks pertaining to the options were analysed.

4.4.8 The output of that workshop was a risk register which is contained in Appendix 10.

4.4.9 Following the risk workshop, each risk was assessed in terms of its probability and impact, resulting in a combined score which was used to prioritise the risks identified. On the basis of that exercise, the key risks (i.e. those with the highest probability and impact rating) identified were as follows:

- Scotland may be a trail blazer for a complex project and therefore will be watched closely by DfT;
- Due to lack of investment in the new Business Plan, ITSO does not deliver a workable standard to enable the ticket product in terms of customer load, interoperability and hotlisting;
- The preferred option cannot be delivered within the envelope of available funding;
- The existing equipment becomes obsolete during the implementation process for Smart and Integrated Ticketing;
- Operators do not wish to co-operate with integrated ticketing – they perceive a weak commercial position for their business; and
- Competition Commission review into the bus industry is yet to be published. The impact on market structure is therefore unknown at this stage.

4.4.10 The risks identified from this process have a clear linkage with those identified through the information gathering phase of the project. The risks identified are strategic in nature and any of them could endanger the whole scheme.

4.4.11 The number of high likelihood/high impact risks underlines the challenge surrounding the successful implementation of a Smart and Integrated ticketing scheme at this stage. It is important to note that these key risks stem principally from Integrated, rather than smart ticketing. Consequently, it is clear that a Smart approach would carry less risk to the public sector.

4.4.12 In addition to those risks noted above, a further issue is the risk appetite of the Organising Committee of the 2014 Games, which considers that its aspirations for the Games can be met without taking an unnecessary risk on a technological ticketing solution that they do not consider is central to their own strategy for the Games.

5 Preliminary Conclusions

5.1.1 In identifying the way forward for smart and integrated ticketing in Scotland, a number of reference points have been established in terms of:

- The transport landscape in Scotland;
- Policy commitments in both Scotland and England;
- Available and emerging technologies;
- Existing and planned infrastructure investment;
- The appetite of operators for smart and integrated ticketing;
- The appetite of the G2014 Organising Committee to act as a platform for smart and integrated ticketing; and
- International experience of smart and integrated ticketing products.

5.1.2 These reference points support the long term vision of the Scottish Government to implement smart and integrated ticketing on a national basis. However, they have also highlighted some key risks which if occurred could have a significant adverse impact upon any implementation in the short-term. In particular:

- Whilst ITSO appears to be the logical technological platform given the investment to date and also DfT's support, it is not yet proven in a project of the scale and complexity of that envisaged by Transport Scotland; and
- Whilst a number of benefits have been highlighted in relation to smart and integrated ticketing, bus operators in particular appear sceptical and have yet to be convinced of the arguments for implementation. Given the de-regulated nature of the bus market in Scotland, securing the buy-in of key operators will be vital for delivering the smart and integrated ticketing vision. In addition to this, many of the benefits of smart and integrated ticketing can be derived from smart ticketing alone; it is the integrated element which carries with it the greatest risk.

5.1.3 Given the above, along with an identified caution on the part of the G2014 Organising Committee, it seems sensible to take stock of how the long-term vision can be achieved. This process has highlighted that much can be achieved in the short term on the back of initiatives which will happen in any event such as:

- Investment in smart technology by operators and SPT; and
- Continued development and testing of ITSO, backed on a UK basis by DfT.

5.1.4 In addition, many of the benefits of smart and integrated ticketing would be delivered by a Smart only solution. This therefore supports an incremental approach based on realising the benefits from ITSO based smart ticketing while tracking the development of the technical standard to deliver inter-operability. This approach would have the further benefit of awaiting the outcome of the Competition Commission review.

5.1.5 In short, this approach would entail:

- Rolling out smart infrastructure on an ITSO platform across modes in a phased manner. This could mean specifying smart ticketing in the next rail franchise as well as supporting SPT's plans for smart ticketing on the subway;
- Supporting operators to further utilise and develop the ITSO infrastructure already rolled out for the Concessionary Travel Scheme to support commercial ticketing. Means of providing incentives to bus operators could be considered further;
- Supporting the progression from smart to smart integrated ticketing where the opportunity arises. An early opportunity could also be to transform the SPT Zonecard to smart ticketing. SPT is already considering this; and
- Proceeding with procurement of a replacement AMS/HOPS (back office system), building in the ability to accommodate more complex integrated ticketing schemes. The AMS/HOPS replacement is integral to running the Concessionary Fares Scheme.

6 Affordability – the Financial Case

6.1 Introduction

6.1.1 In a traditional business case for investment, forecast financial implications for the preferred options in terms of required capital expenditure, operating costs and any additional revenues generated would be established. This forms a key component of the case for any public sector investment. In this instance, the preferred way forward is generally based largely upon existing expenditure commitments and indeed investment by the private sector. This reduces the need for an in-depth financial analysis at this stage.

Cost Drivers

6.1.2 A number of issues will impact upon the overall cost of any implementation of a Smart and Integrated ticketing scheme as follows:

- The nature of the back office which will be used to process transactions;
- The nature of the front office and how it will interact with customers;
- The nature of the ticket product (whether distance based etc);
- The volume of passengers and individual journeys, given the impact upon front and back office costs;
- The technology requirements; and
- The need to improve infrastructure.

6.1.3 However, in this instance, the preferred way forward requires little in the way of new investment. Rather, the investment referred to in this instance is a mixture of existing commitments by TS (for example, the procurement of AMS/HOPS replacement) or the continuance of plans by third parties such as SPT and private operators. A further point of note is that much of the required technology is already in place as part of the Concessionary Fares Scheme.

6.1.4 Transport Scotland has undertaken an analysis of the likely costs of a nationwide Smart scheme (see Section 2). This analysis has estimated the additional costs to be:

Table 6.1: Estimated costs of a nationwide Smart scheme

	Bus	Rail
Capital (one off)	£2.0m	£5.5m
Revenue (per annum)	£18.5m	£4.4m

6.1.5 Clearly, the most significant costs identified here is in relation to upfront capital costs for rail. This is something that TS will be able to incorporate into the rail franchise when it is tendered. This means that a key aspect of the additional cost will be subject to detailed analysis and market testing.

6.1.6 It should be noted that these costs do not include the costs of any future integration of different systems or back and front office requirements. This is something that will need to be costed and assessed once the integration phase of this overall approach is reached. This will allow for a full investment case to be constructed.

7 Achievability – the Management Case

7.1 Introduction

7.1.1 For any project to proceed, it is essential that it is actually achievable and has been properly planned and resourced from the outset. This will involves consideration of the following areas:

- Programme/project management arrangements;
- Project roles and resources;
- Use of specialist advisors;
- Methodology for tracking benefits;
- Procurement routes and timetables;
- Risk management arrangements; and
- Contingency planning arrangements

7.1.2 The preferred way forward as articulated in Section 5 involves an incremental approach to the implementation of Smart and Integrated ticketing, with an initial focus upon Smart projects which are already in process. Many of these projects are being driven by different parties with no one organisation in overall control. This therefore spreads the overall risk at this stage and reduces the risk of overall project failure.

7.1.3 However, once the integration phase of the process is reached, this will require a more structured approach with the potential requirement for one organisation in overall control.

7.2 Delivery Approach

7.2.1 It is worth considering the stakeholders within public transport in Strathclyde who could potentially become involved in delivering the integrated element of the scheme. This is important because the shape of the delivery model is likely to influence operators' views on whether or not to participate in the scheme. The structure of the delivery model has a significant bearing on where the balance of risk lies between the delivery partners.

7.2.2 The key players in the public transport market are SPT, FSR and a host of commercial bus operators. With responsibility for delivering the Scottish Government's national transport policy, TS sits at a level above this. All of these key stakeholders may potentially seek a role in the delivery of Smart and Integrated ticketing, particularly as each currently has control over part of the infrastructure.

7.2.3 If a ticketing solution is to be implemented on a region-by-region basis, there are clear arguments for the actual delivery also to be led at a regional level:

- A regional delivery model would help to ensure that front and back office structures are proportionate to what is required for a regional scheme;
- Only the costs of regional infrastructure need to be weighed against the regional benefits. If a national delivery model were adopted, it may become difficult to achieve a satisfactory benefit: cost ratio due to the impact of setting national costs against regional benefits; and
- Regional delivery partners will understand the local market and the key players within it. This should make it easier to put in place revenue allocation arrangements which are satisfactory to local operators.

Table 7.1: Various possible delivery models for the Strathclyde based options

Delivery Model	Partners Involved	Description	Potential Drawbacks	Advantages
Regional Transport Partnership	SPT only	SPT could take the delivery lead, in partnership with TS. Responsible for front and back office systems and for administering revenue allocation (similar to existing ZoneCard forum).	Operators not directly involved, hence operators may have concerns over sharing commercially sensitive data.	SPT already has the lead role in delivering transport services and has excellent relationships with operators.
Separate legal entity	SPT and operators	Separate company set up, perhaps as a Joint Venture, to ensure all parties are fully bought in.[30] Company could take responsibility for front and back office systems.	May be unwieldy if all operators involved. May create distrust among operators if only some are involved.	Will ensure risk is jointly shared.
Central Government	Transport Scotland	TS could take the delivery lead[31], starting first with Glasgow and moving on to other regional schemes. TS would be responsible for front and back office and would therefore retain the option of scaling these up to a national model.	Places TS at the forefront of delivery which may not fit with strategic direction of TS itself.	Fits with TS' role in delivering national strategy. Will minimise the risk of regional aspects being incompatible with each other.
Central Government Partnership	Transport Scotland, SPT and operators	TS could take the lead but could enter into some form of partnership (perhaps JV) on a regional basis. Could achieve a mix of central government control and local delivery knowledge. May also offer the possibility of hosting front and back office and scaling up to a national level. The impending re-procurement of the ScotRail Franchise in 2011 may provide a key opportunity to bring a significant operator with critical mass on-board.	Operators may perceive this as unwieldy – involves too many partners.	Ensures maximum buy in and participation from key players.
Partnership with Other UK Bodies	Transport Scotland, one or more English PTEs	TS could enter into some form of partnership with other PTEs in England who are also implementing schemes[32]. Could share the risk of central design and implementation and local delivery knowledge. Could draw on framework contracts set up by DfT. May also offer ticketing front and back office services at marginal cost to TS and still allow gradual scaling from Glasgow-focused to the long-term vision. Could enable cross-border ticketing operation anticipated within the options.	May require the ticketing strategy in Scotland to be similar to that at the PTEs.	Knowledge and experience can be shared allowing lessons to be learned. May result in economies of scale.

[30] Translink in the Netherlands was setup as a joint venture between operators and a separate legal entity, to provide the OV Chipkaart ticketing system nationally. See case study at Appendix5.

[31] TS has already acted as the delivery lead for the successful Concessionary Fares scheme, negotiating agreements with bus operators, procuring the infrastructure on buses and the back-office and managing implementation and operation.

[32] A number of PTEs are in the process of designing and procuring their own smart and integrated infrastructure, including GMPTE and SYPTE to serve local needs.

Possible Delivery Models

7.2.4 For Strathclyde-based options, the delivery model should include some combination of SPT, FSR and the bus operators, potentially with TS in a coordination or oversight role, given that the intention is to move towards national implementation.

7.2.5 There are a wide range of possibilities for the delivery vehicle – this vehicle is essentially the solution that will deliver the preferred option. For illustrative purposes, it could take a number of different forms as set out in Table 7.1.

7.2.6 The table illustrates a number of possibilities but it is not intended to present an exhaustive list. It does, however, offer suggestions as to how stakeholder involvement could be achieved and leadership taken in an incremental regional delivery approach.

8 Conclusion and the Way Forward

8.1 Introduction

8.1.1 This final section draws together the analysis contained in the previous sections of the document, recognising that whilst there are some challenges, there is a real drive to see the progress towards Smart and Integrated ticketing continue. This section is therefore used to signpost a number of actions which can be taken in the short, medium and long term to deliver the overall vision for Smart and Integrated ticketing.

8.2 Current Position and Inherent Challenges

8.2.1 Smart and integrated ticketing has the potential to offer a range of benefits to passengers, the public sector and private sector operators. This has been recognised by the DfT, which is providing seed funding to help a range of regional public transport authorities develop Smart and Integrated ticketing products. Furthermore, achieving these benefits is a fundamental component of the Scottish Government's policy commitment to the concept of Smart and Integrated ticketing. Many of these benefits can be derived from smart ticketing and integrated ticketing in isolation although greater benefits are derived from the combination of smart and integrated ticketing.

8.2.2 However, there are a series of challenges to a credible national business case for smart and integrated ticketing at the present time. In particular, operators are sceptical of the benefits of integrated ticketing and have expressed concerns that it could harm their market share by eroding the brand loyalty built up when customers purchase operator-specific tickets. Uncertainty surrounding the real value of benefits means it is not possible to convince operators that the potential benefits of smart and integrated ticketing outweigh required investment levels and the threat to their business model.

8.2.3 In addition, though ITSO can provide a platform for interoperable smart ticketing and much has already been invested in ITSO technology, there is a degree of risk relating to its future development and its ability to support a project of the size and functionality required by Transport Scotland.

8.2.4 These two significant issues limit the strength of any business case for Smart and Integrated ticketing at the present time.

8.3 Maintaining Momentum in the Short Term

8.3.1 Although the time is not currently right for a wholescale implementation of smart and integrated ticketing in Scotland, it is possible to maintain a degree of momentum towards this as a long-term vision. This can be done by taking advantage of developments towards smart ticketing that are already taking place.

8.3.2 As discussed within section 3 (Overview of the Current Position), a number of the building blocks for Smart infrastructure have been or are planned to be put in place. Smart ticketing equipment has been rolled out across the Scottish bus fleet through the Concessionary Fares Scheme and several large commercial operators have made moves to introduce Smart ticketing for commercial purposes (e.g. Lothian and Stagecoach).

8.3.3 In addition to this, FSR is trialling a Smartcard product on the Glasgow – Edinburgh service. To keep this momentum going, Smart technology could be factored into the next franchise agreement and should be built into the franchise consultation which is due to begin in Spring 2011.

8.3.4 In Strathclyde, SPT is procuring new Smart ticketing and gating equipment for the Subway to replace existing equipment which is nearing the end of its useful lifespan. The timing of and funding for this

procurement are, however, uncertain at present. Nevertheless, it is important to note that SPT does already operate an integrated ticket in Strathclyde through its ZoneCard product.

8.3.5 Assuming these developments do proceed as is currently intended, it appears that significant elements of the public transport network in Scotland will become Smart-enabled. The precise timescale is difficult to ascertain at present – particularly because several of the developments are being undertaken by commercial operators who are reluctant to share details for reasons of commercial sensitivity.

Focusing on a phased approach

8.3.6 It is sensible for Scottish Government to have an overall strategic vision for the long-term migration to a Smart and Integrated environment. A series of stepping stones towards this vision can be laid out:

- **Short-term (2011 – 2013)** – Continuing with the roll-out of Smart technology in Strathclyde and the rest of Scotland;
- **Medium-term (2013 – 2018)** – Taking steps towards the integration of modes in Strathclyde; and
- **Longer-term (2018 onwards)** – further integration of Smart-enabled modes, beyond Strathclyde and progressing to other areas, leading to nationwide coverage.

8.3.7 The arguments presented within section 4 (Options Appraisal) for an initial Strathclyde focus for Smart and Integrated ticketing apply equally to a phased approach that would see Smart roll-out, followed by integration.

8.3.8 The majority of current known Smart developments (bus, rail and subway) will affect Strathclyde, meaning that the region will begin to benefit from technological advances before other regions. In light of this, it makes sense to integrate the different modes first in Strathclyde – where the size of benefits is potentially greatest – and then to look to roll out the model to other parts of the country once a proof of concept has been established. However, this approach will not preclude advancing smart and integrated ticketing elsewhere should the opportunity and the demand arise.

8.3.9 Focusing on making the case for integration in Strathclyde first would allow TS to concentrate on a defined area which accounts for a significant proportion of total public transport journeys in Scotland and also offers scope for a modal shift. It therefore offers the highest potential benefits, which should help to make the case overall.

8.3.10 However, before the case for integration can start to be made, work needs to be undertaken in the short to medium term in order to remove some of the challenges that currently exist for the investment case for a Smart and Integrated product.

8.4 Building the case over the Short Term

8.4.1 In essence, if smart ticketing continues to be rolled out (whether through Concessionary Fares, by private investment or through the rail franchise) the key issue is for the Scottish Government to make the case for integration.

8.4.2 However, there are a number of key business issues which create difficulties for the case for integrated ticketing. The most significant of these relate to the development of the ITSO technology solution and the robustness of the case for bus operator involvement. Further related challenges also relate:

- What the real level of demand is for integrated ticketing across operators and modes and its dependency on the customer increasing travel by these modes and within what fare structure;
- What incentives can be offered to passengers to drive high levels of take-up;
- Who is best placed to take the lead delivery role if the programme of change is to proceed effectively; and
- What the scale of and responsibility for funding the significant investment would be and whether this is feasible against a backdrop of public sector spending constraint.

8.4.3 In order to construct a credible case for integration in the long-term, it will be necessary to address these uncertainties. This work should be initiated in the short-term and developed further in the medium-term, in parallel with other market-driven developments such as commercial bus Smartcards.

Monitoring the Development of ITSO

8.4.4 TS's presence on the Board of ITSO means it is well placed to monitor the ongoing developments and to assess the evolving DfT approach. TS should also use its presence on the Board to shape the direction of travel and to ensure that solutions proposed will meet the requirements of TS.

Estimating Passenger Demand

8.4.5 Realistic passenger demand for Smart and Integrated ticketing must be established, focusing on the incremental demand generated by the integrated aspect. This will allow more accurate estimation of benefits on offer and will quantify the potential growth in the market, thereby providing a useful foundation for the commercial case.

8.4.6 This will require work to design the intended ticketing product(s), to estimate take-up and to evaluate the optimum fares structure.

Achieving Bus Operator (and other Operator) Commitment

8.4.7 Building on a more accurate estimation of passenger demand, it will be possible to better quantify and articulate better the potential benefits for individual operators through projected growth in passenger numbers, impact on market share and ability to realise other possible benefits. This will become a crucial component of the case for bus operator participation in integrated ticketing.

8.4.8 The outcome of the Competition Commission's review will also have an impact on bus operators' willingness to engage in further discussions around integrated ticketing. The Commission plans to publish its report in Autumn 2011.

Defining future roles and responsibilities

Strategic Coordination

8.4.9 As part of the overall assessment of the feasibility of a Smart and Integrated ticketing solution, it will be important to explore how it might eventually be delivered. From the outset, there will be a need for a strategic oversight and coordination role covering:

- Liaison with commercial operators;
- Liaison with DfT and ITSO; and
- Assessment of emerging Smart developments across the public transport network in Scotland and internationally.

Operational Delivery

8.4.10 Moving towards the integration phase, there will be a need for a clear delivery lead that can coordinate the technological and commercial aspects of integration. Operational delivery will also include provision of front and back office services and administration of revenue allocation structures.

8.4.11 It is sensible for the Scottish Government, through TS, to maintain the strategic coordination role at the outset to ensure that developments can be aligned with policy objectives. Over the medium term, TS should assess what level of involvement it wishes to have in operational delivery and the extent to which the public sector will need to take delivery risk. This assessment should also cover which partners are best placed to lead on operational integration of each of the Smart-enabled modes.

Identifying Costs and Funding Sources

8.4.12 Early on, high-level costs will be needed to gauge the scale of funding commitment that is being sought. This will allow an early decision to be made on whether public sector funding for integration is likely to be feasible against the current backdrop of reducing spending in the sector.

8.4.13 It is important to note, though, that by adopting a phased approach which builds on planned Smart developments, TS would be seeking to make an investment case for the incremental spend required to make the scheme integrated, rather than making a case for the full investment in a one bid scenario.

Soft Market Testing

8.4.14 Building on the additional analysis suggested above, an early approach could then be made to test the market's view of likely costs for integrating the modes in a manner that would meet the output specification defined by TS and its partners. Assuming Smart developments proceed as planned, TS would be approaching the market to discuss likely costs for integrating known Smart technology across a defined set of modes. This degree of clarity should help ensure responses from the market are accurate and credible.

8.5 The Medium and Longer Term – rolling out integrated ticketing

8.5.1 The long-term aspiration is to roll out Smart and Integrated ticketing across Scotland. The phased approach set out here suggests that Smart developments should be promoted first in Glasgow (where several are planned to happen anyway), followed by the rest of Scotland. However, this will not preclude development being delivered elsewhere should the need / desire arise.

8.5.2 This means that significant elements of the required Smart infrastructure should be in place across Scotland. While it will undoubtedly be challenging to integrate the disparate elements effectively, this will provide a helpful foundation for integration work.

8.5.3 Efforts should initially focus on integrating the modes in Glasgow, drawing on experience with existing integrating ticketing products to develop a model for Smart and Integrated ticketing that could be rolled out nationally.

8.6 Conclusion

8.6.1 Fundamental uncertainties around the achievability of benefits – in a deregulated market – mean that the commercial case for operators for Smart and Integrated ticketing cannot be made at present. Operators have also shown limited appetite for discussions about integrated ticketing while the outcome of the Competition Commission review is pending. In addition, there remains a risk relating to the future suitability of ITSO as a platform for a fully integrated Smartcard product on a large scale.

8.6.2 However, existing planned developments suggest that individual modes will become Smart-enabled within the short- to medium-term horizon regardless, thereby allowing TS to concentrate on making the case for integrating the Smart infrastructure on these modes. Indeed many of the stated benefits of smart and integrated ticketing can largely be achieved by smart ticketing alone.

8.6.3 It is important to note that a phased approach creates the risk that integration ultimately cannot be achieved either for commercial or for technological reasons. To mitigate this risk, it is essential for TS to adopt an oversight role from the outset. This will ensure that it can maintain an awareness of important emerging developments with ITSO and with commercial operators, thereby ensuring that the path to integration can be managed effectively.

8.6.4 Assuming this risk can be managed effectively, adopting a phased approach will allow TS to maintain short-term momentum through planned technological developments, while taking time to progress the robust case for integration at a more appropriate and viable point in the future. Building on the Smart technology that is expected to be put in place, TS can then move forward to develop a model for integration in Glasgow that can, in turn, be rolled out to deliver the long-term vision of Smart and Integrated ticketing for the whole of Scotland.

Appendices

Appendix 1: Further Data Sources and References Used and Reviewed

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2. Scottish Government Social Research Report on "Understanding why Some People Do Not Use Buses", 2010
3. Integrated Ticketing Strategy for Scotland Consultation Document, 2008.
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5. Research on Octopus:
    - PwC team experience working with Octopus
    - Reference data on Octopus, www.octopus.co.hk
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7. First Scot Rail Pilot: http://www.scotrail.co.uk/content/smart-tickets-cards.html
8. SPT ITT on Subway ticketing procurement, October 2009
9. Framework contract for supply of ETMs between Transport Scotland and Almex, ERG, Parkeon, 2006
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    - ITSO Board meeting on 28th April 2011 is due to consider a new business plan
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14. Scottish Government Initial Submission to the Competition Commission Review into Local Bus Markets, 19th April 2010
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    - NoWcard trial - http://www.dft.gov.uk/itstoolkit/CaseStudies/nowcard.htm
    - Yorcard trial conclusions - http://www.scnf.org.uk/presentations/Transport/Mike%20Duncombe.pdf
    - Research on Bolton Bus Squid trial - http://www.scnf.org.uk/webpages/casestudies/documents/Bolton%20payment%20card%20case%20study%2020070927.pdf
    - Stagecoach smart card pilots and trials - Ref (http://www.stagecoachgroup.com/scg/about/smartertravel)
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21. Consult Hyperion experience of Netherlands OV Chipkaart project
22. Japanese Suica scheme http://www.jreast.co.jp/e/pass/suica.html
23. Japanese Pasmo scheme http://www.pasmo.co.jp/en/
24. Argentinian Monedero scheme http://www.monedero.com.ar/

25. Research on Sydney smart card

    - PwC experience of procurement of smart card ticketing for Sydney, 2009

26. Research on games and transport ticketing:

    - PwC team experience of smart cards used during Turin 2006
    - PwC experience of ticketing for Beijing 2008, and supporting research, e.g. at http://kn.theiet.org/magazine/issues/0814/rfid.cfm
    - PwC experience of Melbourne 2006
    - PwC experience of Sydney 2000
    - Plans for London 2012 ticketing – and Locog announcement in Jan 2010 that games tickets will not be used as Oyster cards.

Appendix 2: Estimating the Benefits & Costs of Integrated Ticketing[33]

The economic analysis undertaken so far has been primarily to estimate the *economic benefits* from smart and integrated ticketing for Scotland across the following dimensions:

- Across two modes of transport – bus and rail34; and
- Across three smart and integrated ticketing options – 'smart', 'integrated' and 'smart and integrated'.

This has been combined with estimates of the costs, both capital and operational, of extending existing smartcard infrastructure across the bus and rail sector in Scotland.

Identifying the benefits (and to a lesser extent) the costs of a national smart and integrated ticketing scheme are challenging mainly because of gaps in the evidence base. In particular, there is no consensus as to whether potential journey time savings will materialise. Secondly, there is no evidence isolating the "convenience" benefit to passengers. The latter seem unwilling to pay for this extra benefit, yet a review of international evidence shows increases in patronage which suggests such a benefit exists. Most of the remaining benefits extend from these benefits. Thirdly, it is difficult to judge the extent to which cost savings can be realised by operators. Even where evidence is available, it does not typically exist for smart, integrated and smart integrated ticketing. Therefore the benefits are subject to a large element of uncertainty, and judgement has had to be employed in calibrating benefits across the different ticket types.

The benefits shown in Table A2.1 reflect an appraisal period set to 11 years to reflect the technology lifespan. A standard 60 year transport appraisal period would clearly be inappropriate in this instance.

Table A2.1: Summary Table: Economic Benefits[35]

	Integrated	*Smart*	*Smart Integrated*
Bus	£ 290.4m	£ 295.4m	£ 373.2m
Rail	£ 142.2m	£ 148.9m	£ 198.8m
Total	£ 432.6m	£ 444.3m	£ 571.0m

The likely costs are uncertain but the best available estimates are shown below. Capital costs are lower for integrated ticketing though the difference is primarily with respect to rail since significant investment in smart card technology for buses has already been made as part of the concessionary fares programme. A key operational cost is the transaction cost charged by retailers, etc. for topping up cards. Costs have been estimated as follows:

Integrated ticketing

- Capital Costs – £2.0m for combined bus and rail; and
- Operational Costs – £27.4m for combined bus and rail.

Smart ticketing

- Capital Costs – £2.0m for bus; £5.5m for rail; and
- Operational Costs – £18.5m for bus; £4.4m for rail.

[33] Produced by the Transport Economics, Environment and Appraisal team in Transport Scotland.

[34] SPT are separately considering roll-out of smart ticketing for the Glasgow Subway. There is insufficient information at present on how smart card infrastructure would operate on the ferries to warrant the sector's inclusion in this analysis.

[35] Discounted to 2002 in 2002 prices. Figures are rounded so may not sum.

Smart and integrated ticketing

- Capital Costs – £2.0m combined costs; £0.5m for bus; £4.6m for rail; and
- Operational Costs – £4.0m combined costs; £15.5m for bus; £2.4m for rail.

Benefit-to-cost ratios (BCRs; benefits divided by costs) have been produced and are shown in Table A2.2 below. Because of a lack of concrete evidence, certain assumptions have been made, for example about take-up. These BCRs are highly sensitive to changes in assumptions. In light of this, a range of sensitivities has been modelled and the results are shown in Appendix 3. However, these provisional benefit cost ratios suggest that even with more restrictive assumptions about the extent of the benefits, there is a good case for proceeding with new ticketing arrangements in Scotland. Net present values (benefits minus costs, discounted to give lower weight to costs and benefits further in the future) are significant, reflecting, in part, the fact the existing availability of smart readers on buses and thus the existence of significant sunk costs.

Table A2.2: Benefit-to-Cost Ratios and Net Present Values

Ticketing Option	*Benefit Cost Ratio (BCR)*	*Net Present Value (NPV)*
Integrated	14.7	£ 403.2m
Smart	14.6	£ 413.8m
Smart Integrated	19.7	£ 543.0m

Breakdown of Economic Benefits[36]

Bus

All benefits are calculated over the 11 year[37] *appraisal period and discounted at 2002 prices.*

Journey Time Savings to Existing Passengers (B1)

This benefit arises because with a smartcard, the boarding time of passengers is quicker in comparison with a boarding action requiring a cash transaction. Research by Newcastle University on the Yorcard pilot on certain Sheffield bus routes found a three second time saving per passenger between adult cash transactions and adult smart-cards following regression-based analysis. This research was spread over peak and non-peak periods but made no attempt to weight these for the higher passenger numbers in the peak hours. It has been pointed out by the Transport Scotland Smart and Integrated Ticketing Steering Group that any time savings are less likely to transpire at peak times when buses are subject to congestion delays. Therefore, it has been assumed for the purposes of this work that a two second time saving per passenger can be achieved, apart from the case of integrated ticketing for which a saving of 3 seconds per boarder using a simple flash card has been assumed.

Transport Scotland Concessionary Fares have conducted their own analysis in 2008 following the adoption of smartcards for concessionary travel. This compared users and non-users and found no difference in boarding times, with even the suggestion that card-holders took slightly longer. It has to be noted that holders were from a particular demographics i.e. they were over 60, and that since the machines were relatively newly installed people may still have been getting used to them. This supports anecdotal evidence that there will be no impact on journey times, which has been applied as a sensitivity to test the impact on the BCR. It has also been suggested that boarding with a smart card will actually take longer than paying by cash due to the time taken for the electronic reader to read the card. As a further sensitivity the impact on the BCR of marginally increasing journey times has been tested.

[36] Future benefits have yet to be discounted and expressed as Net Present Values.

[37] This is driven by the likely life-span of the technology.

The key assumptions required in calculating this benefit are:

- Time savings per (non-concessionary) passenger boarding (in seconds) – upper limit of 2 seconds ('smart' and 'smart integrated' ticketing) and 3 seconds ('integrated' ticketing)[38];
- Average number of people on a bus at any given time – 10[39];
- Average journey time saving for existing passengers – upper limit of 40 seconds and a lower limit of zero seconds;
- Average bus passenger value of time (per hour) – £7.60 in the assumed opening year of 2014 [from STAG; increases over time];
- Number of passenger journeys per annum – 515m[40];
- Number of concessionary fare passenger journeys per annum – 157m; and
- All passengers switch to using the new ticketing product[41].

Estimate:

- Smart – £140.4m;
- Integrated – £210.6m; and
- Smart Integrated – £140.4m.

Convenience benefits to Existing Passengers of Smart Tickets (B2)

Potential benefits include ease of use (less need to carry cash, more certain budgeting), more flexible journey choice of mode, route, timing, and easier interchange within and between modes. However there is no simple read across from a ticket type effect to time savings or a cash fare equivalent. Ticketing schemes tend to be introduced at the same time as other changes, such as simplified fare structures, so isolating their effect is not easy. There is also a wide range of existing ticket types.

Research for Passenger Transport Executive Group[42] assessing the impacts of integrated (not smart) ticketing found a range between 6-20% in terms of increased patronage. Taking the lower bound of this, a 6 per cent increase in patronage following the introduction of new ticketing products has been assumed. This conservative approach has been reinforced by assuming this represents the convenience effect for smart *and* integrated ticketing, with lower increases assumed for smart only and integrated only (4% for each). To quantify this, the equivalent fare reduction to achieve this increase in patronage using a long-run bus elasticity (-1[43]) has been calculated. This gives a convenience benefit per journey of the equivalent of an 8p reduction in the average bus fare, for smart and integrated ticketing, and is then applied to Scotland bus revenue and passenger numbers (for 2006/07)[44].

Estimate:

- Smart – £67.3m;
- Integrated – £67.3m; and

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[38] The upper limit of 2 seconds is taken from the DfT Business Case.

[39] This is based on evidence from South Yorkshire which had an average of 10-15 passengers with the upper limit of 15 being more likely in a predominantly urban area and the lower limit of 10 being more likely in a mixed rural/ urban area.

[40] Only applies to the Scotland wide option – currently awaiting statistics for (i) Glasgow City Centre Boundary Area (ii) SPT Zonecard Area

[41] An implicit assumption.

[42] Booz&Co "The Benefits Of Simplified & Integrated Ticketing in Public Transport" for the Passenger Transport Executive Group (2009).

[43] Transport Research Laboratory (TRL) "The Demand for Transport" Report 593 (2004)

[44] This result is 1p higher than estimated in the DfT Business Case on Smart Integrated Ticketing. Bus passenger numbers were 515m and Bus revenue was £424m.

- Smart Integrated – £101.0m.

Operator Cost Savings

The reduction in "dwell time" at bus stops due to the introduction of new ticketing products can potentially reduce operating costs. This benefit is based on the estimated reduction in boarding time and the number of trips within Scotland. The saving is derived from the average bus operating cost per kilometre[45] in Scotland. Following discussions with bus companies it is clear that savings can be made only in limited circumstances so the assumption is that operators can realise 10% of the potential cost savings on offer. Of course, with a lower bound journey time saving of zero, no cost savings will be possible.

For Transport Scotland, the key assumption required in calculating this benefit is the time savings per passenger boarding (in seconds) – upper limits of 2 seconds ('smart' and 'smart integrated' ticketing) and 3 seconds ('integrated' ticketing).

Estimate:

- Smart – £1.9m;
- Integrated – £2.8m; and
- Smart Integrated – £1.9m.

CO_2 reduction in buses

The reduction in dwell time has an impact of marginally reducing the CO_2 emissions from buses. This benefit is calculated from the reduction in fuel consumption for buses (Scottish Transport Appraisal Guidance) and the value of CO_2. This calculation does not take account of increase in bus vehicle mileage to cater for additional demand.

Estimate:

- Smart – £0.4m;
- Integrated – £0.6m; and
- Smart Integrated – £0.4m.

New Net Revenue to Bus Operators (B6)

This is calculated from applying the estimated increase in patronage (see convenience benefits) to bus and rail revenues. The net revenue effect is estimated from using a power rule for costs. The power rule allows an adjustment from gross to net revenue by assuming an increase in costs halves revenue accruing to operators.

Estimate:

- Smart – £44.5m;
- Integrated – £44.5m; and
- Smart Integrated – £66.8m.

Benefits to new bus passengers (B7)

This is calculated by applying the convenience and journey time benefit per passenger to the estimated number of new passengers, and applying 50% (the "rule of half", standard in transport appraisals. This avoids double-counting).

Estimate:

- Smart – £4.2m;

[45] Scottish Government Statistical Bulletin Bus and Coach Statistics: table 13, (March 2009).

- Integrated – £5.3m; and
- Smart Integrated – £7.7m.

Marginal External Car Benefits Modal Shift from car to bus - excluding CO2 (B9)

The introduction of a new ticketing product, which makes travelling easier, is likely to encourage some switch from car to bus use, resulting in less traffic on Scottish roads. The extent of this switch is estimated and the marginal external benefits of the reduction in car use, such as congestion and accident benefits, applied. Greenhouse gas benefits have been calculated separately.

Estimate:

- Smart – £34.9m;
- Integrated – £34.9m; and
- Smart Integrated – £52.3m.

CO_2 Savings – Modal Shift from car to bus (B10)

To the extent that there is less car traffic on Scottish roads, the level of carbon emissions will reduce.

Estimate:

- Smart – £1.8m;
- Integrated – £1.8m; and
- Smart Integrated – £2.7m.

Fraud disbenefits

Expanding paper-based flashcards to non-concessionary users of bus would likely see increases in opportunities for fraudulent use. This has been estimated at around 5% of current revenues.

Estimate:

- Integrated – £77.4m (negative benefit).

Rail

Passenger Time Saved At Kiosks (R2)

This benefit reflects the easier purchasing experience of passengers no longer having to wait for printed paper tickets; instead tickets are uploaded onto a card. Evidence of this benefit was found in the Dutch rail system where around 30 seconds was saved following the switch from paper tickets to smartcards.

Estimate:

- Smart – £42.6m;
- Integrated – £42.6m; and
- Smart Integrated – £42.6m.

Convenience benefits to Existing Passengers of Smart Tickets (R3)

The same calculation is applied here as for bus travel, i.e. working out using the established price elasticity what equivalent ticket price reduction would generate an observed rise in patronage. Assuming a 6 per cent increase in patronage following the introduction of new ticketing products[46] (the assumption for 'smart integrated

[46] Booz&Co "The Benefits Of Simplified & Integrated Ticketing in Public Transport" for the Passenger Transport Executive Group (2009).

ticketing only; 'smart' and 'integrated' ticketing was 4%) and a price elasticity of -0.9[47] produced an equivalent 13p reduction in the average bus fare, which is then multiplied by the number of (non-season ticket holding) return passenger journeys (for 2006/07).

Estimate:

- Smart – £22.2m;
- Integrated – £22.2m; and
- Smart Integrated – £33.2m.

Savings in Ticket Sales (R4)

This benefit arises from the recognition that there will be reduced costs of procuring and distributing paper tickets. For example, the topping up of Stored Value Rights products on smartcards could all but eliminate the cost of ticket sales agents and commission. Savings accrue to the operator. These figures are not yet available but are likely to be small (for example, the DfT business case quotes total costs of £500,000 so the figure for Scotland is likely to be significantly smaller).

Estimate:

- Smart – £1.1m;
- Integrated – £1.1m; and
- Smart Integrated – £1.1m.

Fraud Prevention (Overriding) (R5)

The benefit is based on the observation that the introduction of smartcards often lowers the likelihood of passengers travelling beyond the point that they have already paid for; but requires the presence of gates. The calculation is based on evidence from Transport for London and elsewhere used in the DfT business case of a 1% uplift in revenues; this is applied to annual ticket revenue per annum.

Annual revenue for Scotland was in £210.1m 2009.

Estimate:

- Smart – £6.7m; and
- Smart Integrated – £6.7m.

New Net Revenue to Rail Operators (R6)

This benefit, as for buses, is based on the assumption of the extent to which rail travel will be more attractive, given the extra convenience offered by new ticketing systems; more passengers will use the railways.

Estimate:

- Smart – £44.1m;
- Integrated – £44.1m; and
- Smart Integrated – £66.2m.

Benefits to New Rail Passengers (R7)

This is calculated from the increase in patronage noted above, and applying 50% (the "rule of half", standard in transport appraisals) of the benefit per existing passenger from ticket effects.

[47] Interpolated from Passenger Demand Forecasting Handbook

Estimate:

- Smart – £0.8m;
- Integrated – £0.8m; and
- Smart Integrated – £1.8m.

Marginal External Car Benefits Modal Shift from Car To Rail - excl CO2 (R9)

The introduction of a new ticketing product, which makes travelling easier, encourages a switch from car to rail use, resulting in less traffic on Scottish roads and connected reductions in external car impacts such as congestion and accidents.

Estimate:

- Smart – £30.0m;
- Integrated – £30.0m; and
- Smart Integrated – £44.9m.

CO_2 Savings – Modal Shift from car to rail (R9)

To the extent that there is less car traffic on Scottish roads, the level of carbon emissions will reduce.

Estimate:

- Smart – £1.5m;
- Integrated – £1.5m; and
- Smart Integrated – £2.3m.

Costs

The key point about costs is that much of the technology has already been deployed as part of concessionary fares policy. This gives the business case for smart and integrated ticketing in Scotland the advantage of lower cost estimates. Most of these costs are based on actual contract information so optimism bias has not been applied. However, it is noted that an allowance for rising costs through the integration of the different systems should be made.

To encourage high take-up in some other systems (notably Oyster in London) a policy stance of reducing fares for card-holders has been taken. No account of these potential costs has been taken in this exercise.

Capital Costs

The main capital costs to be incurred to enable the use of smartcards in Scotland are detailed in Table A2.3 below.

Figure A2.3 – Capital Costs

Item	Description
ITSO[48] compliance/membership	Includes the cost of ITSO Secure Access Module: A smart-card-like chip that is needed inside ITSO readers to store secret keys which are used for cryptographic operations with ITSO customer media (cards).
Consultancy	A significant cost indicating the immaturity of ITSO and the effort needed to achieve end-to-end integration of already-certified products. In addition to this cost, there is also the uncosted staff time of the overrun projects.
Card Issuance	Concessionary and commercial cards. Significant cost for buses scheme (Local Authorities).
Card acceptance	Installing ITSO readers.
Upgrading sites for ITSO messaging	Central back office e-systems; Card Management Systems.
Settlement systems	Needs to resolve the fares settlement. Not an ITSO cost, but essential.

Operational Costs

The main operational[49] costs to be incurred to enable the use of smartcards in Scotland are detailed in Table A2.4 below.

Table A2.4 – Operational Costs

Item	Description
ITSO Compliance & Membership	Scheme and operators. Used ITSO website calculator to calculate. Rail has much higher turnover and hence higher fees.
Systems Management	Assume all systems are a managed service.
Card Replacement	Significant cost for bus schemes (Local Authorities).
Agency Costs	This is incremental costs of covering cash to STRs[50] over the commission cost of selling regular tickets in less convenient places. By moving to STR, cost of sales goes up due to the retailer receiving a percentage of 5-7% making the total cost 10% or more instead of 5%. Also includes ETM costs – licences and support.
Running the CMSs[51], HOPs[52] and related systems.	Described as "Per shell and per ISAM costs for HOPs".

Range of benefits across each transport mode

The aim of this simple matrix is to summarise how the different benefits may fall differently between (i) smart only, (ii) integrated only and (iii) smart and integrated ticketing. Some benefits will fall only to one or two of these ticketing types (such as fraud prevention), but in most cases it will be a question of the degree of benefit.

It should be read as follows: the first row shows the assumption that journey time savings are potentially highest for integrated ticketing, then smart ticketing, then finally, smart integrated ticketing, since there is some evidence that ITSO enabled cards take slightly longer to process. For fraud prevention (overriding), there is assumed to be no saving for integrated ticketing.

[48] An organisation formed to develop and maintain a specification for secure "end to end" inter-operable ticketing transactions (formerly the "Integrated Smart Card Ticketing Organisation")

[49] Including maintenance costs.

[50] Stored Travel Rights – An e-purse for travel purposes only

[51] Card Management Systems

[52] Host Operator Processing System

Table A2.5 – Benefits of Various Transport Modes

Bus benefits	*Smart*	*Integrated*	*Smart Integrated*
Journey Time Savings to Existing Passengers	X+	X++	X
Convenience Benefits to Existing Passengers	X	X	X++
Operator Cost Savings	X+	X++	X
Fraud Prevention (Overriding)[53]	X		X
CO_2 mitigation actions	X+	X++	X
New Net Revenue to Bus Operators (derived from a combination of 1 and 2)	X	X	X
Benefits to new bus passengers (ditto)	X	X	X
Savings due to removal of surveys	X		X
Decongestion Benefit (modal shift: car to bus)			
CO_2 Saving from modal shift of car to rail			

Rail benefits	*Smart*	*Integrated*	*Smart Integrated*
Passenger Time Saved At Gates	X+		X
Passenger Time Saved At Kiosks	X	X	X
Convenience Benefits to Existing Passengers	X	X	X++
Savings in Ticket Sales	X+		X+
Fraud Prevention (Overriding)	X+		X+
New Net Revenue to Rail Operators (1+2)	X	X	X
Benefits to new rail passengers	X	X	X
Decongestion Benefit (modal shift: car to rail)	X	X	X++
CO_2 Saving from modal shift of car to rail	X	X	X++

Allocation of benefits

This table shows to whom each benefit is likely to fall. It is assumed that there are three categories of beneficiary:

P = Passengers

O = Operators

G = Government

W = Wider Benefits

[53] Assumes exit readers on buses which is not currently possible with single door buses.

Table A2.6 – Recipient of Benefits

Bus benefits	*Smart*	*Integrated*	*Smart Integrated*
Journey Time Savings to Existing Passengers	P	P	P
Convenience Benefits to Existing Passengers	P	P	P
Operator Cost Savings	O	O	O
Fraud Prevention (Overriding)[54]	O		O
CO_2 mitigation actions	W	W	W
New Net Revenue to Bus Operators (derived from a combination of 1 and 2)	O	O	O
Benefits to new bus passengers (ditto)	P	P	P
Savings due to removal of surveys	O/G		O/G
Decongestion Benefit (modal shift: car to bus)	W	W	W
CO_2 mitigation action (modal shift: car to bus)	W	W	W

Rail benefits	*Smart*	*Integrated*	*Smart Integrated*
Passenger Time Saved At Gates	P		P
Passenger Time Saved At Kiosks	P	P	P
Convenience Benefits to Existing Passengers	P	P	P
Savings in Ticket Sales	O	O	O
Fraud Prevention (Overriding)	O		O
New Net Revenue to Rail Operators (1+2)	O	O	O
Benefits to new rail passengers	P	P	P
Decongestion Benefit (modal shift: car to rail)	W	W	W
CO_2 Saving from modal shift of car to rail	W	W	W

[54] Assumes exit readers on buses which is not currently possible with single door buses.

Appendix 3: Sensitivity Analysis for Smart and Integrated Ticketing Options[55]

Introduction

As the base case relies upon certain assumptions for which the evidence is not fully conclusive, a sensitivity analysis is particularly important for this business case. This focuses on the key drivers that affect the benefit-cost-ratios (BCRs). Mostly these BCRs were found to be high. This means that the aim of the sensitivity analysis has been to investigate under what conditions the various ticketing options would no longer represent value for money, to allow a better understanding of the potential risks involved with smart and integrated ticketing.

Sensitivity analysis

The BCRs in the base case are as follows:

- Smart ticketing – 14.6;
- Integrated ticketing – 14.7; and
- Smart Integrated ticketing – 19.7.

The table below shows the key base case assumptions for the three ticketing options which have been included in the sensitivity analysis:

Table A3.1 - Base Case Assumptions

	Smart	*Integrated*	*Smart Integrated*
Time savings per passenger (bus)	2 Seconds	3 Seconds	2 Seconds
Percentage of passengers using the new ticketing product	100%	100%	100%
Increase in patronage following introduction of new ticketing product	4%	4%	6%
Average number of people on a bus	10	10	10

Benefit Sensitivity Analysis

The following sensitivities were assessed for each ticketing option:

- Lowering boarding time savings per bus passenger (to zero and -2 seconds). Some in the industry are sceptical about the likelihood of there being any boarding time savings; some go further to argue that smart cards will lead to slightly longer boarding times. This is significant because any time saving per boarder will also apply to those already on the bus;
- Lowering the percentage of passenger take up (to 75%, 50%, 25% and 10%). The model assumes 100% take-up, in line with the DfT business case, though actual take up would undoubtedly be lower. Note that this also lowers costs;
- Lowering the percentage increase in patronage (to 2%, 1% and 0% for smart ticketing and integrated ticketing, and 3%, 2% and 0% for smart integrated ticketing) ; and
- Reducing the average number of people on a bus from 10 to 5. This affects the overall time saving for the reason set out in the first bullet.

[55] Produced by the Transport Economics, Environment and Appraisal team in Transport Scotland.

N.B. the international evidence, set out in the PTEG report[56], does not link evidence of overall patronage increase with take up. This means that it cannot be said, for example, that a 6% increase in patronage would be associated with 50% take up. This has presented a problem for the sensitivity analysis: because these two factors are not connected in the evidence there is no robust way to connect them in the model. This initially had the effect that, when take up was varied, the benefits associated with patronage increase were independent and thus unchanged, while the variable costs fell, and so the BCRs for lower rates of take up were actually higher than the BCRs for higher rates of take up (though the NPVs were lower).

Because it seemed anomalous that patronage and take up would not be in some way correlated, it was decided for the sensitivity analysis, to vary the assumed patronage increase for each ticket type by the take up rate. Thus, in the sensitivity assessment of a 10% take up, the patronage increase is actually 0.6% for smart, integrated ticketing, as opposed to 6% in the base case (and 0.4% compared with 4% for the other ticket types). This is probably too restrictive an assumption, but the adoption of this highly conservative approach gives further confidence in the figures produced under the sensitivity analysis.

Cost Sensitivity Analysis

The following variations were also assessed for each ticketing option, in conjunction with the benefit sensitivities:

- Capital costs increase by 50%;
- Capital costs increase by 100%;
- Operating costs increase by 50%; and
- Operating costs increase by 100%.

Results

The results of the sensitivity analysis can be seen overleaf. Each of the individual variations was still associated with healthy BCRs and even applying different combinations did not yield a BCR below 1. This provides comfort, given the uncertainties around some of the key assumptions, that the business case for smart and integrated ticketing in Scotland stands up even under significantly more restrictive assumptions.

Results Tables

(overleaf)

[56]The Benefits of Simplified and Integrated Ticketing in Public Transport; Booz & Co. For PTEG (2009)

Table A3.2 – Sensitivity Analysis

	SMART TICKETING SENSITIVITY ANALYSIS	***Core***		***Capital Costs + 50%***		***Capital Costs + 100%***		***Operating Costs + 50%***		***Operating Costs + 100%***	
		NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR
0	Base case	414	14.6	410	13.0	406	11.7	402	10.6	391	8.3
1	Bus boarding time: no time saving	269	9.8	265	8.7	261	7.9	257	7.1	246	5.6
2	Bus boarding time: two seconds slower	124	5.1	120	4.5	116	4.1	113	3.7	101	2.9
3	Passenger take up of smartcards is 75%	308	13.4	304	11.8	301	10.5	299	9.9	290	7.8
4	Passenger take up of smartcards is 50%	202	11.7	199	10.0	196	8.7	196	8.7	189	7.0
5	Passenger take up of smartcards is 25%	97	8.3	94	6.9	91	5.8	93	6.5	89	5.3
6	Passenger take up of smartcards is 10%	34	4.5	32	3.5	29	2.9	32	3.7	30	3.1
7	Patronage increases by 2% (base case = 4%)	333	11.9	329	10.6	325	9.6	321	8.7	310	6.8
8	Patronage increases by 1% (base case = 4%)	292	10.6	289	9.4	285	8.5	281	7.7	270	6.1
9	Patronage increases by 0% (base case = 4%)	252	9.3	248	8.2	244	7.4	241	6.7	229	5.3
10	Reduce number of people on a bus to 5	340	12.2	336	10.8	333	9.7	329	8.8	317	6.9
11	Combination of sensitivities: no time saving and 10% take up	20	3.0	17	2.4	15	2.0	18	2.5	15	2.1
12	Combination of sensitivities: 2 seconds slower to board and 10% take up	6	1.6	3	1.2	0.4	1.0	3	1.3	1	1.1

NPVs are expressed in £millions.

Table A3.2 – Sensitivity Analysis Continued

	INTEGRATED TICKETING SENSITIVITY ANALYSIS	***Core***		***Capital Costs + 50%***		***Capital Costs + 100%***		***Operating Costs + 50%***		***Operating Costs + 100%***	
		NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR
0	Base case	403	14.7	402	14.2	401	13.8	390	10.0	376	7.6
1	Bus boarding time: no time saving	186	7.3	185	7.1	184	6.8	172	5.0	159	3.8
2	Passenger take up of smartcards is 75%	299	13.5	299	13.0	298	12.7	288	9.2	277	7.0
3	Passenger take up of smartcards is 50%	196	11.5	196	11.2	195	10.9	187	7.8	179	5.9
4	Passenger take up of smartcards is 25%	94	8.1	94	7.9	93	7.8	87	5.5	81	4.1
5	Passenger take up of smartcards is 10%	33	4.3	33	4.2	32	4.2	28	2.9	23	2.2
6	Patronage increases by 2% (base case = 4%)	322	11.9	321	11.5	320	11.2	308	8.2	294	6.2
7	Patronage increases by 1% (base case = 4%)	281	10.6	280	10.2	279	9.9	267	7.2	254	5.5
8	Patronage increases by 0% (base case = 4%)	240	9.2	239	8.9	238	8.6	227	6.3	213	4.8
9	Reduce number of people on a bus from 10 to 5	293	11.0	292	10.6	291	10.2	279	7.5	265	5.7
10	Combination of sensitivities: no time saving and 10% take up	11	2.1	11	2.1	11	2.1	6	1.4	1	1.1

NPVs are expressed in £millions.

The potential negative time saving applied to the other ticket types as sensitivity is associated with the time taken for electronic readers to read smart cards so is not applied to (non-smart) integrated ticketing.

Table A3.2 – Sensitivity Analysis Continued

	SMART INTEGRATED TICKETING SENSITIVITY ANALYSIS	***Core Case***		***Capital Costs + 50%***		***Capital Costs + 100%***		***Operating Costs + 50%***		***Operating Costs + 100%***	
		NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR	NPV	BCR
0	Base case	543	19.7	539	17.6	540	17.9	532	14.3	521	11.2
1	Bus boarding time: no time saving	397	14.7	393	13.1	390	11.8	386	10.7	375	8.4
2	Bus boarding time: two seconds slower	251	9.7	247	8.6	244	7.8	240	7.0	229	5.5
3	Passenger take up of smartcards is 75%	404	18.1	400	15.9	397	14.2	395	13.3	387	10.5
4	Passenger take up of smartcards is 50%	265	15.6	262	13.4	259	11.7	259	11.7	253	9.3
5	Passenger take up of smartcards is 25%	128	11.0	126	9.1	123	7.7	125	8.6	121	7.0
6	Passenger take up of smartcards is 10%	47	5.9	44	4.6	42	3.8	45	4.8	42	4.0
7	Patronage increases by 3% (base case = 6%)	421	15.5	417	13.8	414	12.5	410	11.3	399	8.8
8	Patronage increases by 2% (base case = 6%)	380	14.1	376	12.6	373	11.3	369	10.2	358	8.0
9	Patronage increases by 0% (base case = 6%)	298	11.3	295	10.1	291	9.1	287	8.2	276	6.4
10	Reduce number of people on a bus to 5	469	17.2	465	15.3	462	13.8	458	12.5	447	9.8
11	Combination of sensitivities: no time saving and 10% take up	32	4.4	30	3.4	27	2.8	30	3.6	28	3.0
12	Combination of sensitivities: 2 seconds slower to board and 10% take up	18	2.9	16	2.3	13	1.9	16	2.4	14	2.0

NPVs are expressed in £millions.

Appendix 4: Additional Examples of Smart Ticketing Schemes

Examples of Smart Card Ticketing Schemes

These examples have been selected to illustrate common practice for smart and integrated ticketing and inform the ticketing strategy.

Australia – Sydney PTTC

The Sydney public transport network is regulated by the NSW Ministry of Transport. Fares are controlled by an independent pricing regulator. An automatic fare collection (AFC) system based on magnetic stripe ticketing is used on bus, trains and ferries and has been in operation since 1988.

The public ticketing authority, PTTC, sought to procure a smart card ticketing solution in 2002 but the project had significant implementation problems and was re-procured in 2008-2010. The new system is due to start implementation in 2012, to be delivered by the Pearl Consortium led by Cubic Transportation (who also provide the Oyster service in London).

The contract will cover trains, buses, and ferries across Greater Sydney, including Newcastle and the Hunter region, Wollongong, the Illawarra and the Blue Mountains. Passengers will top-up their ticketing accounts online or at shops, or link their smart cards to bank accounts or credit cards, similar to the current Oyster Auto-Top-up used in London.

Key points for Transport Scotland

Integrated ticketing was introduced within a regulated fares environment and has operated successfully based on paper tickets for many years:

- The procurement of smart card ticketing can take an extended timescale to complete;
- The smart card strategy needs to be closely linked to the fare and zone structure;
- Links between smart card accounts and bank accounts to enable top-up are being adopted as good practice; and
- The relevance of this example is limited by Scotland's deregulated bus environment.

Japan – Suica & Pasmo

Suica is a pre-pay re-chargeable contactless card using in Japan on train, bus and tram. It was launched in 2001. There were 30 million Suica cards in circulation in late 2009. It can also be used at retail outlets. Suica was developed by JR East, a quasi-public sector rail operator which passed into private sector ownership in 2002. JR East cooperated with other rail, bus and tram operators to develop the card. The fares are regulated.

Suica has been incorporated into mobile phones using NFC technology. Phones with Suica were launched in 2006.

In 2007 a new Pasmo smart card was launched that provided greater coverage of mode and ticket types on bus, rail and tram.

Key points for Transport Scotland

- Cross operator cooperation is required to successfully deliver a smart ticketing solution;
- The operators involved need to be motivated to implement an interoperable ticketing solution; in some cases they are willing to take the lead in implementing and operating the scheme;
- Though the operators involved are now in the private sector, it has been possible to implement smart and integrated payment cross operator with inter-operator agreements;
- A t-purse can evolve into an e-purse; and
- A smart card based solution can evolve into an NFC based mobile phone solution.

Paris – Carte Orange

The Carte Orange was launched in Paris in 1975 to make ticketing between different metro lines, bus and rail lines simpler. It provided unlimited access to the transport network at effectively a flat rate. It used a magnetic strip paper ticket. Within a year of launch 900,000 tickets had been issued. Its convenience meant that the overall volume of public transport users is estimated to have increased by 20% between 1975 and 1985. The carte had a different fare structure and the flat rate allowed travellers from outside the city to take advantage of lower costs for their long journeys. The carte was personalised with a picture of the user and could not be used multiple times in sequence through a gate.

The Carte Orange is now being replaced with a smart card ticket, the Navigo.

Key points for Transport Scotland

- The fare used did not seek to emulate the existing ticket fare structure; to aid take up and simplify fares the interoperable ticket had a flat rate fare across all modes;
- The carte orange addressed a key problem of interchange between modes – the high volume of interchange opportunities and number of different lines meant that the ticket released a substantial volume of suppressed demand. TS should consider whether there is the same level of suppressed demand for inter-modal and operator travel;
- The overall volume of usage increased creating an increase in revenue and enabling modal shift;
- The carte addressed potential fraud through limiting the frequency with which it could be used through a gate and by having a photocard; and
- The integrated ticket can be migrated successfully to a smart and integrated ticket. The key issue is the attractiveness of the fare and ticket to the user rather than the type of medium used.

Swiss Pass

The Swiss Pass was launched in 1989. It is paper based and now provides a period pass on the majority of Swiss railways, buses and boats with discounts on use of cable cars and mountain trains. It works in 41 Swiss Cities and also provides access to Museums and other facilities. The pass also allows children under 16 to travel free with a parent. As an integrated ticket, the primary objective was to encourage take up of travel capacity and make the ticket product attractive to the customer. The ticket has a set price for a period. It is issued by the Swiss Travel Centre, a ticketing operator that is also a subsidiary of a railway operator, but whose core business is selling tickets and trips to customers.

There is now a smart card version of the Swiss Pass available.

Key Points for Transport Scotland

- The ticket was designed to serve multiple modes, operators and trips at a set price meaning that its simplicity encouraged take up;
- It had wide validity and coverage building on the investment made in making commercial agreements with each operator and facility provider involved;
- Its take-up is driven by its wide access to services;
- It is provided not by a transport operator but by a dedicated ticketing company focused on meeting customer travel needs; and
- It can be migrated to a smart card product.

London Travel Card

The Travel Card was launched in 1983. It provided unlimited travel for a defined period within a set zone structure on London Underground, and Buses. The card used a paper medium with a magnetic stripe. It has evolved through a series of iterations, the most popular of which are now the One day Travel Card and Off Peak Travel Card. It is now valid on London Overground Rail and provides discounts on river services.

The travel card product can be placed on the Oyster smart card and that is now the preferred way that the ticketing product is used in London. Rail operators can also add a London Travel Card to a rail fare to provide unlimited use within a zone of London's public transport facilities.

The buses and underground are controlled by TfL creating a regulated fares environment within London. More recently London Rail was established giving TfL control of some rail fares.

Key Points for Transport Scotland

- The Travel Card met demand for multi-modal travel where there was already high existing usage of public transport where there were multiple service choices;
- A simple fares structure with zoning was applied so that customers understood the restrictions and where they could travel. The included services have increased over time improving the attractiveness of the card; and
- The product has been migrated onto a smart card along with other pay as you go ticketing products which have been developed in parallel as smart card technology has matured.

Argentina – Monedero

Monedero or "wallet" is smart payment card operated in Buenos Aires. It serves bus, subway and tram. It can also be used to buy other goods and services. It can be loaded with credit for use in a pay as you go fashion. Public transport fares are regulated. It has been in operation since 2002 and there are over 2.5 million card users.

Key points for Transport Scotland

- The fares and ticketing technical infrastructure are regulated in this example;
- A private sector smart card and payment organisation has led the establishment of the e-purse Monedero; and
- A system with a user base of 2.5 million card users can be made to be economic in this environment.

Appendix 5: Case Study on Netherlands – OV Chipkaart

This case study is provided as a reference on how a recent national smart and integrated ticketing project involving bus and other transport operators has proceeded.

Current Paper Integrated Ticketing

The Netherlands (NL) has had national integrated ticketing since 1980, through the "Strippenkaart" system which applies throughout the country on buses and trams (but not trains). The passenger either validates the ticket themselves in a machine, or gets it stamped by the driver or conductor. The number of strips to be cancelled is always the number of zones travelled through plus one, up to a maximum of 20 strips; therefore in the example in the image below, the user has made two journeys, the first through three zones, and the second in a single zone. Once validated, the ticket is valid for a certain duration dependent on the number of zones used, from 1 hour for 2 to 4 strips, to 3.5 hours for 17 to 20 strips. Strippenkaart tickets are available in denominations of 2, 3, 8, 15 and 45 strips. Reduced tariff tickets are only available in 15 strip versions. An 8-strip ticket can be used as a one-day ticket in Den Haag, Rotterdam and Utrecht if specially validated (at the same cost).

The Netherlands has also been a leading country in the deployment of electronic cash. In the late 90's more than 20 million Chipper/ChipKnip cards were issued for a population of 15 million. It was intended that these e-purse cards would be used for small value transactions, but they have had limited success, perhaps because they are contact based, rather than contactless.

The current OV Chipkaart initiative is at least the fourth attempt to introduce a national multi-modal smart ticketing scheme. For some years MOBIS, the former association of Dutch transport operators which was disbanded 4/5 years ago, tried to co-ordinate efforts to introduce smart ticketing. There was also a scheme known as "Tripperpas" in the city of Groningen, which went live in 2001. Although this was backed by the Ministry of Transport and was considered successful, it was short lived because it did not have the backing of any of the major operators in the country.

Trans Link Systems

The current, successful, project is led by Trans Link Systems (TLS), which was an entity established in 2002 by Connexxion, GVB (Amsterdam), HTM (Den Haag), NS-R (Dutch Railway Company) and RET (Rotterdam). Together these five companies provide 80% of public transport services in the Netherlands. TLS co-operates with all other public transport organisations. A tender process was started in 2002 to select a supplier that can build the central system, and this was awarded to the East-West e-Ticketing B.V. consortium in 2003. This consortium consists of: Accenture, Thales and Vialis with the following Thales subcontractors: MTR Corporation and Octopus Cards Ltd (both companies established in Hong Kong). The solution that East-West has designed is based on the existing "Octopus" smart card system for public transport used in Hong Kong.

Connexxion is the largest public transport bus company in the Netherlands, operating in the west, middle, east and far northern part of the country. It was formed in 1999.

Current Status

TLS is now owned by the 4 largest operators: GVB, RET, HTM, and NS-R. Connexxion withdrew for reasons related to its French parent, Transdev, which is a subsidiary of France's state-owned Caisse des Dépôts, and which acquired Connexxion in 2007.

The current status is that TLS has developed a nationwide smart card system for transport, covering various products – t-purse and passes, and allowing different price mechanisms and 'concession areas' (this is the Dutch term for bus franchise) and all modes. Cards are either personalised or anonymous; there are also Limited Use tickets for incidental users, with a typical life of 2 days, in Amsterdam (using a lower cost Mifare Ultralight ticket).

Several million cards have been issued to date, and 60K "front end devices" (validators, rail, metro gate readers, and vending machines) have been deployed. Across the country, few cities are not now using the scheme; Rotterdam and Amsterdam have gone fully smart, and Rotterdam has phased out legacy means of payment. The cards only have a public transport journey functionality – they do not currently handle taxis, parking, or bike rental and parking. Strippenkaart is due to be phased out, pending implementation of the Mifare upgrade migration.

Delivery Model

TLS has the role of card issuer and central processor. Cards are procured by individual operators and issued to customer, but transactions are processed by TLS's central processing facility. Operators benefit from having their own brands on the card. The scheme is known as OV-Chipkaart, and the interoperability is achieved through a 3 part set of definitions: 1) technical specification; 2) rules and regulations; and 3) registrar documentation containing the global parameters.

Concessionary Travel Product

Concessionary travel is not free in NL, but is rebate based and is handled in 2 ways:

- An explicit product on the card; or
- A profile is written to the card – readers then apply concessionary tariffs automatically. The amount of fare reduction depends on the situation, e.g. NS-R allows 3 free journeys per year.

Key Challenges

One of the issues has been "stakeholder management", especially related to NS-R changing its mind on how it wanted to see smart cards used. Originally, the rest of the network wanted to have a "Touch In/Touch Out" system, but NS-R did not, and wanted to allow travel as long as there is a valid product on the card – this meant there was no consistent behaviour required from users. However, in 2007 NS-R decided to accept Touch In/Touch Out and changed the operating model.

Another reason for delay was that system integration capability was insufficient within the operators, and TLS had to source this from the East-West consortium. Also, TLS decided on a procurement model where the selected implementer also wrote the specification (unlike ITSO which has been defined by Government). This has made it difficult for other suppliers to enter the market quickly as they have not had the skills and facilities to deliver the integrator defined solution.

Fare Operation, Payment Accounts and Customer Channels

TLS wants to see customers travelling with the t-purse so they don't have to buy new tickets for each leg of a journey – each extra paper ticket issued generates cost. For non-rail journeys, typically 70 cents are deducted at the start and a zone-based price calculated on exit (like Oyster on underground). The concern in the UK about rail fares being of a potentially high transaction value is not as applicable; the maximum Dutch rail fare is

currently only €70. As a result, the collection risk is lower and NS-R is willing to take a risk by deducting only €15 at the start of a journey, because 50% of travel either starts or ends in a closed station.

TLS prefers to see all tickets operate with Touch In/Touch Out be either t-purse with auto reload linked to a payment account or season tickets. It would also like to see a "National Action List" – an internet site where tickets can be purchased on-line then "picked up" electronically at a device located at a place of the passenger's choice (similar to Oyster). This is expected to speed up journey times. Buying on the internet is considered to be more secure than in public where payment card PINs can be observed.

Internet kiosks are located in convenient places. Shops losing out on paper card sales are thought to be keen to house them so that they do not lose footfall.

These payment channel related efficiencies are expected to reduce staff costs. The Netherlands has already moved away from manned ticket offices to electronic ticket vending machines.

Regulatory Environment

The regulatory regime is very consensual, in line with the democratic and liberal culture of the country. The government sets no standards and requires no compliance. Use of OV-Chipkaart is entirely voluntary and the scheme has been developed with much seeking of input from interested parties. Its strength is derived from the power of the participating operators and their collective dominance of transport ticketing.

Within cities such as Amsterdam and Rotterdam, operators are subsidiaries of the transport authorities, such as RET and GVB. They are not independent commercial entities and have no discretion on whether to accept OV-Chipkaart or not.

Motivation of Operators

The motivation for the Netherlands to be the world's first national smart ticketing country has its roots in the oil crisis of the 1970's and the consistent movement since then to advocate environmentally friendly means of transport. It is a country which is minded to work together (after much discussion – "the Polder model"), and has the legacy of a national interoperable ticketing scheme in Strippenkaart.

Connexxion, the major bus operator, is fully committed to OV-Chipkaart, despite there being many challenges and considerable effort for it. It likes the performance level of smart ticketing – reduced transaction times - and there have been numerous design considerations over type and placement of validators on board bus. There are no financial incentives to take part; to date Connexxion has been a net contributor.

The notion of providing an incentive to operators to adopt OV-Chipkaart was not considered during the project, but there are still discussions about who should pay for what element of the service.

New business cases are being built around the scheme by operators. For instance, new operator Q-Bus built its business case around the card. TLS expects that once large operators adopt the scheme, smaller adjacent operators will follow. Unlike in the UK, there are not large numbers of small operators.

Operator Benefits

The t-purse is favoured, the most important expected benefit being the time it takes to buy a ticket; NS-R has calculated this saves 20 seconds per journey, or 4m hours per year. They said "most non-t-purse products have been scrapped" in favour of the t-purse.

Fraud reduction is the next most important expected benefit, especially for smart cards in conjunction with a closed network. This comes in 2 parts:

- Security "incidents" from unwanted people on the network making others feel unsafe: TLS expects this to be 15% less. Some have argued this has nothing to do with cards since it is a result of more closed stations; and
- Ticket Fraud reduction by 1% leading to additional revenue of €20m.

Getting better data on transport usage is a key driver, which is why operators have back office systems. They expect to be able to optimise lines, routes and frequencies. A potential side effect in the future could be the provision of better information to passengers.

Reducing cash handling is very important – operators are in the process of stopping accepting cash on vehicles.

To gain the maximum benefits from smart cards, deployment needs to be 100%.

Minimising Costs and Risk

There has not been significant attention on minimising project risk. The main effort has been to keep operators' internal systems isolated from each other and not to allow them to interfere with overall interoperability. They do not overly influence the overall design but their views are understood.

Role of a Central Body

National interoperability is key; this is multi-layer, the front end is offline and transactions are sent to a central processor for each operator, then data is forwarded to the single TLS clearing and settlement system. TLS has been established to secure this national interoperability; it is a private company, funded by its shareholders. It is still losing money, but this is getting better and break even is being approached.

The TLS Specification and Comparison with ITSO and Oyster

Compared to ITSO, the TLS system specification has 1.500 pages compared to ITSO's 1,200. TLS likes the fact that ITSO supports multiple media types – this is helpful given the security concerns over Mifare Classic cards. However, they feel that the ITSO requirements for all readers to read all media is costly. The ITSO clearing and settlement process (not being provided centrally) is also perceived to be onerous, with 'on us'/'not on us' transactions being a big task. TfL's Oyster on the other hand is regarded as quite similar to the Dutch system – multi tickets (changing products during a journey, e.g. part on t-purse, part on a fixed product) is not supported by ITSO but required in the Netherlands.

The Dutch specification is open; there is apparently no lack of vendors given the country size; there are currently 20 vendors. The specification is owned and edited by TLS, and is freely available upon registration. It (or something with a very similar technology specification) is currently implemented in Toronto, Oslo, and Denmark.

TLS likes the idea of a common European specification but doesn't see it as a high priority since not many travellers use public transport internationally. They like the idea of increasing purchasing power by having more countries do the same.

Key Lessons for Transport Scotland

This example is relevant to Scotland as it has the following common issues:

- Multiple operators each with their own desire to differentiate their services;
- An existing set of paper tickets issued by operators;
- A need to minimise back office processing costs; and
- A desire to make smart ticketing interoperable on a national basis.

There are many lessons to be learned from this case study, but the key lessons include the following:

- There needs to be a central body willing to own and drive the specification and oversee the implementation of the ticketing solution including leveraging economies of scale for example in back office – to achieve interoperability in Scotland a central body is needed to take the lead in the specification as ITSO by itself does not provide a sufficient specification for inter-operator clearing;
- The specification needs to focus on the desired ticketing products and the enablement of efficient customer payments and fare collection not just re-producing the existing paper system. Delivering

efficiencies in ticketing for both operators and the central body is important – there needs to be a clear specification for the ticketing products that would be paid for by an interoperable payment account;
- It is not advisable to allow the supplier of the system to overly influence the specification – though TS has to date specified ITSO as the requirement, this is not by itself a means of avoiding proprietary supplier restrictions;
- It is necessary to have strong operator support and adoption for the system particularly on issues such as Touch In/Touch Out and interoperability with operator systems – given the deregulated bus market in Scotland the lead operators need to support the operating model and interfaces; to date the operators have not had significant access to ITSO future plans and are not represented on the board;
- Placing integration risks on the operators should be minimised – where integration issues can be resolved centrally in Scotland for all operators, they should be dealt with centrally. It may be challenging to persuade individual operators to take on integration risks unless there is a clear reason for them to take responsibility individually;
- An open specification that is freely available is preferable – the current ITSO specification is open but not comprehensive and requires payments; and
- The procurement and implementation can take a long time – over 5 years. It is necessary to keep all stakeholders on board over this period. – where there is strong regulation and technical control, the project can proceed at a quicker pace. There is not strong regulation or technical control in Scotland and there are many stakeholders. It may therefore be more practical to focus on a single large operator and geographical region for an initial implementation.

The Netherlands differs from Scotland in the following key respects:

- Population density and use of public transport is higher than in Scotland;
- The ticket supplier market is more mature; and
- There are fewer operators involved.

Appendix 6: Multi Sports Analysis

Delhi 2010 (Commonwealth Games)

Based on our research to date, we understand that:

- Event tickets were be sold separately in advance of transport ticketing through country-based Commonwealth Games Associations;
- Transport on the metro and buses were free to holders of event tickets on the day of the event – access was provided on presentation of the event ticket; and
- Volunteers and games family were provided with tickets to use on public transport.

We are seeking to validate these outcomes with the Delhi Integrated Multi Modal Transit (DIMTS) Company.

London 2012 (Olympic Games)

PwC's research indicates that the London 2012 Olympic and Paralympic Games is to use paper-based ticketing for spectators attending events with no travel element on the same ticket (Source: TfL). The rationale for this is that:

- Much of the travel to the events will be on dedicated coaches procured to take spectators to the events not on public transport;
- In many cases the spectator trip will be a one-off visit. Oyster in comparison is intended to serve as a multi-trip card. It initially costs £3 and then a top up is required for it to operate. This creates an upfront cost that would make it expensive for limited travel requirements, albeit Oyster cards may be provided to the Olympic family and volunteers supporting the games; and
- The venue security mechanisms differ and cannot accept a single access control card. Also, there are expected to be special access security cordons at which the high value event tickets will need to be shown to a marshal/inspector.

Beijing 2008

Beijing was one of the first games events to use RFID based tickets for games ticketing. Both paper and RFID chipped tickets were used for event access. The RFID tag was used to hold personal details including passport, email and home address.

However, the transport smart card was not scoped to provide the same functionality. Key challenges included:

- It could not store event booking and seat details for the customer – bookings and travel were planned in different timeframes;
- There were separate venue access control mechanisms and checks on entry; and
- There were complex anti-fraud measures against event ticket counterfeiting. The event tickets were high value.

As a result, the selected approach to transport ticketing was for the event ticket to be accepted in Beijing for transport on the day of the event with no integrated transport and venue smart ticket used. Smartcards were therefore not used for transport, with spectators simply showing the event ticket in order to use public transport.

Torino 2006

The winter Olympics in Turin sought to integrate transport payment channels through a smart card based system. Turin had a complex transport environment – tolls, tunnels, public transport, parking etc and wanted a solution for the event and to provide a longer term legacy.

They developed a contactless smart card and contactless paper ticket (C.ticket – used by RATP in Paris) system for:

- Public transport; and
- Road tolls and parking.

This was designed and developed by GTT, the public transport operator and SITAF, the highway and tunnel operators. Their Winter Olympics event tickets were still separate and paper based.

For mobility, the smart travel card was issued to all Olympic family and VIPs for payment of tolls, parking and public transport including the Frejus alpine tunnel.

As a legacy, the full roll-out of the solution was envisaged to include:

- School children – a travel pass;
- Multi-modal pass;
- Tourists; and
- Museums and galleries

It was also used to pay for ski passes. Not all elements initially envisaged were implemented.

Appendix 7: Meeting Notes from Stakeholder Interviews

Meetings were held with a series of stakeholders. Notes from these meetings may hold commercially sensitive data so they are held separately. The meetings were with:

- Transport for London – 25 January 2010
- First Bus – 20 April 2010
- Lothian Buses – 31 March 2010
- Passenger Focus – 16 April 2010
- SPT – 1 April 2010
- ITSO – 15 March 2010
- Glasgow 2014 OC – February 2010
- First Scotrail regarding ITSO pilot – 9 Feb 2010

Appendix 8: Possible Bus Operator Incentivisation Models

This appendix considers potential means of motivating bus operators to participate in an integrated ticketing scheme, while bus fares are unregulated. It has been developed drawing on lessons from other ticketing schemes and the concerns that operators have raised in meetings. Further analysis is needed to quantify their potential attractiveness to operators, assess their costs to the public sector and consider their feasibility.

Table A8.1 – Possible Bus Operator Incentivisation Models

No	*Description*	*Benefit to operator*	*Notes / Examples*	*Issues Affecting Feasibility in Scotland?*
1	**Providing Subsidies**			
1a	Direct subsidy for accepting an integrated ticket, which is priced at a premium.	Protects margin for minimum usage with potential upside.	Ticket premium could be used to generate the subsidy. The ticket premium would need to be comparable with the operator cost and margin per passenger carried. Already in place for SPT ZoneCard.	Further work required before conclusion could be drawn about passenger demand price sensitivity.
1b	Fixed subsidy independent of volume of integrated tickets accepted	Reliable margin increase	A fixed level of income that was not volume dependent would provide a reliable revenue stream and be cheap to administer	Availability of public sector funding unclear.
1c	Subsidy per ticket for accepting an integrated ticket, which is not priced at a premium	Protects margin with potential upside	Encourages operators to carry more passengers.	Availability of public sector funding unclear.
1d	Subsidy to cover cost of exit readers, ticket product changes and customer education to use them	Introduces distance measurement for smart card customers	Already operational on OV Chipkaart scheme in the Netherlands and on Der Lijn tram in Belgium	Further work required to establish if exit readers are practical on Scottish buses.
1e	Increase in Bus Services Operator Grant for taking an integrated ticket	Introduces a reliable revenue stream	In England BSOG increase of 8% for buses carrying smart card ticketing machines. Submission by Scottish Govt to Competition Commission considers an increase in BSOG.	Scale of incentive needed to be sized against potential demand and take up of an integrated ticket
2	**Promoting Operator Products**			
2a	Advertising or brand promotion of the operator	Creates potential demand for the linked product	In Government marketing campaigns on modal shift, identify operator brand.	Unclear if this would be possible (c/f Competition Commission review).

No	Description	Benefit to operator	Notes / Examples	Issues Affecting Feasibility in Scotland?
2b	Encouraging bus usage through measures that discourage use of motor vehicles where there are available bus services	Potentially increases levels of patronage.	Customer education to encourage bus take up – see Scottish Government Social Research Report on "Understanding why Some People Do Not Use Buses".	Requires linkage of Smart & Integrated ticketing strategy with wider cross-modal transport policy.
2c	Linking integrated ticketing to other products	Promotes other operator services.	Relate integrated ticket to the operator and their travel products, for example through branding.	Risk that Government is seen as preferring selected operators and not acting independently
3	**Providing ticketing infrastructure**			
3a	Provision of retail and customer channel with the integrated ticket	Takes the cost of retail and customer channels for the integrated ticket away from the operator	This may save cost.	This may also reduce ownership of the customer which operators perceive as important for brand differentiation.
3b	Provide a central system for each operator to use	Reduces risk of having to design, implement operate and refresh a ticketing system	Could be administered by the lead delivery partner, thereby offering control over the Scheme.	Some operators have already invested in their own systems or may have concerns about protecting their commercial data.
3c	Provide access to customer data in way that boosts operator market access but does not invade customer privacy	Enables operator to promote their services to a wider customer base.	Understanding customer journey data would allow tailored / targeted products.	May be complex to administer
3d	Act as card issuer and back office clearer	Reduces risk of having to design, implement operate and refresh tickets and a back office	Could be administered by the lead delivery partner, thereby offering control over the Scheme.	Places significant responsibility on one delivery partner.
4	**Procurement of a central ticketing system**			
4a	Favour an operator-backed consortium to implement system/back office	Allows operators control over back office infrastructure	Trans Link (a consortium of operators) in the Netherlands has sourced the new OV Chipkaart system	Achieving operator buy-in difficult at present when benefits remain un-quantified.
4b	Provide access to multi-modal back office (e.g. ATOC) for rail	Builds on existing operator facilities	Potentially minimises additional cost to public sector, but may need UK-wide cooperation	Ability to achieve UK-wide cooperation unclear

No	Description	Benefit to operator	Notes / Examples	Issues Affecting Feasibility in Scotland?
5	**Mitigating Costs**			
5a	Provide transition relief for a change project	Protects operator margins	Costs could be met by lead delivery partner.	Public sector funding availability unclear
5b	Remove ITSO fees	Protects operator margins	Costs could be met by lead delivery partner.	Public sector funding availability unclear
6	**Introducing Disincentives for Non-participation**			
6a	Reduction in BSOG	Reduces revenue and margin	Affects operators' key financial parameters – could be a powerful disincentive.	Political appetite unclear
6b	Reduction in Concessionary Fare Payments	Reduces revenue and margin	Affects operators' key financial parameters – could be a powerful disincentive.	Political appetite unclear
6c	Introduce Quality Partnerships	Removes flexibility that operators currently have	Considered by SG's response to the Competition Commission	Political appetite unclear

Appendix 9: Options Appraisal

The work to date has identified a series of success factors that will be critical to the successful implementation and delivery of any Smart & Integrated ticketing scheme. The extent to which each option addresses these factors can be used to distinguish between the options.

There are a series of success factors that will be critical to the successful implementation and delivery of any Smart & Integrated ticketing scheme. The extent to which each option addresses these factors can be used as a means of assessing each option.

Table A9.1 sets out the 7 key factors that have been identified and explains how these have been applied within section 3 as Assessment Criteria, illustrating the considerations that have been taken into account for each.

In addition, the table illustrates the weighting that has been applied, reflecting our view of the relative significance of each of the Assessment Criteria.

Table A9.1 – Success Factors

Assessment Criteria	*Key Considerations*	*Weighting (out of 10)*
Strategic Fit	How does the strategy fit with long-term future aspirations? National scheme beyond 2014 – is it a stepping stone? Is it compatible? DfT strategy for the UK?	8
Ambition	How ambitious is the option in the context of the approach in other cities? Could it deliver a solid legacy after the Commonwealth Games?	5
Pre-conditions to delivery	How significant are the pre-conditions that need to be met for the option to be deliverable? (e.g.) • ITSO maturity • SPT readiness • Operator commitment • Back-office structures • Modes (rail, subway, bus) • Vent venue fit out / temporary operating approach (installation of gates, ETMS etc)	9
Feasibility	How feasible is the option? (e.g.) • Timescale – design, procurement, implementation, testing, operation • Technology – maturity, availability, expertise • Integrated / smart functionality – extent of multi-operator acceptance, operation of stored value, revenue protection feasibility • Operators – ability to roll out implementation	8

Assessment Criteria	Key Considerations	Weighting (out of 10)
	• Risks – existing track record of delivery from elsewhere	
Existing Investment	To what extent does the option build on existing investment? (Readers on buses, rail pilot etc.)	4
Passengers	How attractive is the option likely to be to passengers? Are the desired high levels of take-up likely to be achieved by the product?	7
Political Acceptability	How does the option to meet stated political objectives for Smart & Integrated ticketing?	8

The weighting applied to each assessment criterion should reflect the strategic objectives for the scheme which are defined as part of the Strategic Case. For illustrative purposes, an indicative scoring matrix has been proposed for later amendment. This is designed to reflect a suggested relative weighting of the assessment factors as follows:

Table A9.2a – Success Factor Scoring

Assessment Criteria	Weighting (out of 10)
Strategic Fit	8
Ambition	5
Pre-conditions to delivery	9
Feasibility	8
Existing Investment	4
Passengers	7
Political Acceptability	9

Using these assessment factors, each option will be scored on the basis of the following sliding scale:

Table A9.2b –Success Factor Scoring

Range	Scoring for Assessment Criteria
0 – 2	Option falls significantly short of requirement.
3 – 4	Option fails to meet the requirement.
5 – 6	Option broadly meets the requirement.
7 – 8	Option exceeds the requirement.
9 – 10	Option significantly exceeds the requirement

Basic Options Scoring

An indicative scoring exercise has been carried out to give an early indication of the relative qualitative ranking of the three Glasgow-based investment options. The results for each option are presented in the Table A9.3 below:

Table A9.3 – Investment Option Scoring

Assessment Factor	*Option 1 – Ambitious*	*Option 2 – Mid-Point*	*Option 3 – Safe*
Strategic Fit	8	8	7
Ambition	9	8	6
Pre-conditions to delivery	1	2	3
Feasibility	1	3	4
Existing Investment	6	6	4
Passengers	6	6	5
Political Acceptability	9	8	7

Appendix 10: Output of Risk Workshop

Table A10.1 identifies the risks that were discussed at a risk workshop on 30 March 2010. The risks have since been through a preliminary scoring process for probability and impact using a grading structure as follows:

- Score of 1 – Low
- Score of 2 – Medium
- Score of 3 – High

The risks have then been ranked according to the combined score of *probability x impact*. An initial set of risk mitigations have been developed for the top scoring risks (down to a combined score of 4 or greater).

Table A10.1 – Risk Workshop

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
Political	1.6	Scotland may be a trail blazer for a complex project with new technology and a new ticket product – will be watched closely by DfT.	3	3	9	Consider strategy carefully to avoid becoming first mover without clear support.
Technical	3.3	ITSO does not deliver a workable standard to enable the intended ticket product.	3	3	9	Define the ticket product desired and test with latest ITSO plans. Consider an alternative solution, for example Oyster could provide a t-purse but would need a single ticketing authority to define how it was used and the business rules, similar to how TLS has operated in the Netherlands
Financial & Commercial	4.3	Preferred option cannot be delivered within envelope of available funding.	3	3	9	Consider less functionally rich options
Existing Investment	5.2	The existing equipment becomes obsolete during the implementation process for Smart & Integrated ticketing.	3	3	9	Build in funding for upgrade of equipment. Test ability of existing equipment to support planned ticket product
Operator/ Commercial	6.1	Operators do not wish to cooperate with integrated ticketing - they perceive a weak commercial position for their business.	3	3	9	Build a robust economic case that identifies all benefits and can be articulated to operators.
Operator/ Commercial	6.6	Competition Commission review yet to be published and it may impact the structure of	3	3	9	Assess outcome of Competition Commission review to understand impact on the shape of the market.

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
		the bus industry in Scotland.				
Programme	2.1	Transport Scotland and its delivery partners cannot muster the resources to deliver the programme.	2	3	6	Early planning and sourcing of skills and resources.
Programme	2.3	Risk that workstreams cannot be coordinated together – budget, milestones etc – to deliver efficiently.	2	3	6	Put in place effective programme management.
Technical	3.2	The ticketing product needs to be downgraded late in the design process to overcome technical difficulties.	2	3	6	Early planning and testing of the ticket product on readers and with business rules
Technical	3.4	Proposed solutions do not work with readers already installed on buses.	2	3	6	Early testing of the readers with prototypes of the intended ticket products
Technical	3.5	Solution cannot be future-proofed adequately and does not contribute positively to the long-term vision as a result.	2	3	6	Map out a long term technical evolution path and validate the path annually
Technical	3.6	Risk that ticketing products may not be technically interoperable	2	3	6	Complete the design of the products early
Technical	3.9	Risk that RTP's may adopt different regional strategies – fragmentation possible through regional approaches that are not compatible/interoperable. Interoperability needs to be built into the intended product to achieve the objectives of integrated ticketing	3	2	6	Adopt a national strategy building on a regional pilot
Financial & Commercial	4.2	Public sector subsidy required for infrastructure is beyond a level the public sector is comfortable with.	2	3	6	Early discussions to understand likely funding sources and availability.
Financial & Commercial	4.4	Suppliers are unable to deliver within the terms of their contract, causing delays to delivery timetable.	2	3	6	Robust procurement process and subsequent contract management.

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
Operator/Commercial	6.2	The preferred option does not deliver the expected benefits to operators, thereby weakening the commercial case for their involvement.	3	2	6	Conduct a programme of operator consultations to better understand motivations and concerns and also plans for Smart ticketing.
Operator/Commercial	6.3	Operators lose market share and hence revenue as a result of greater opportunities for customers to switch between operators.	2	3	6	Engage with operators early on the potential reduction in revenue and consider the need for a subsidy and how that might be funded
Operator/Commercial	6.5	Subsidies to bus operators need to increase to maintain services.	2	3	6	Assess the potential scale of subsidies needed and consider whether an integrated ticket could be charged at a premium
Operator/Commercial	6.7	Risk that current bus regulatory arrangements are sub-optimal	2	3	6	Review the emerging findings from the Competition Commission due in draft in Oct 2010 and consider how this affects the Scottish bus industry.
Operator/Commercial	6.9	Operators may take their own approach to ticketing strategy, thereby undermining the wider approach to Smart & Integrated ticketing.	3	2	6	Introduce as early as possible guidelines and a framework for convergence on compatible and interoperable ticketing products and systems
Legal	8.3	Changes are required regulatory / statutory requirements / provisions to make the Preferred Option possible	2	3	6	Robust procurement process and subsequent contract management
Procurement	9.6	Procurement process yet to be determined – must allow adequate due diligence on the ticketing solution and its fit with the wider strategy.	2	3	6	Design potential procurement process for systems. Collaborate with DfT on planned framework procurements referred to in DfT Strategy published in Dec 2009
Passengers	10.3	Passengers do not take up the new ticket in the required numbers to make the commercial case work	2	3	6	Early modelling of propensity to take up the new ticket considering fares and fare structure
Economic	13.5	Benefit dependent on take-up by customers – risk that we cannot estimate take-up effectively and that take-up assumptions dominate the Benefit: Cost Ratio	2	3	6	Early modelling of propensity to take up the new ticket considering fares and fare structure
Political	1.1	Leadership and policy changes during the	2	2	4	Ensure Ministers are fully briefed on challenges throughout in order to manage expectations of what

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
		procurement and implementation phases.				is deliverable
Political	1.2	The preferred option does not meet evolving political aspirations.	2	2	4	Ensure Ministers are briefed on the planned strategy
Political	1.5	Political leadership does not understand the challenges for Smart & Integrated ticketing and results in poor decision-making.	2	2	4	Prepare briefing document on the key challenges and present to Ministers
Programme	2.2	The related vision of travel information to the customer is not delivered and does not deliver modal shift	2	2	4	Develop a plan to implement the travel information elements of the strategy and embed it within the programme.
Technical	3.8	Risk of non-compliance with FSA regulations re stored financial balances above a threshold	2	2	4	Research FSA regulations around stored financial balance (maybe a need for an ATOC-like role re FSA in back office).
Financial & Commercial	4.1	Fares for integrated smartcards need to be reduced/ subsidised to achieve required levels of take-up.	2	2	4	Detailed analysis of passenger demand to establish relationship between fares and take-up.
Existing Investment	5.1	The existing investment in Concessionary Fares Smartcards cannot be leveraged for Smart & Integrated ticketing.	2	2	4	Testing on existing equipment to establish suitability for commercial use and likely lifespan to replacement.
Operator/Commercial	6.4	Fares increase required for the passenger in order to maintain operators' margin.	2	2	4	There may be no mitigation as an integrated ticket may command a premium. The size of the premium needs to be modelled early.
Operator/Commercial	6.8	Commercial issues re value for money, contracting, IPR	2	2	4	Consult early with the operators on the intended design of the ticketing specification
First Scotrail Franchise	7.1	Franchise ends in 2014 – current operator is not motivated to contribute positively to Smart & Integrated ticketing.	2	2	4	Early scoping of the requirements of the franchisee and mechanisms that can be used to ensure full cooperation.
First Scotrail Franchise	7.3	Network Rail may not carry out upgrades for the stations they operate within required timescale.	2	2	4	Early engagement with Network Rail around the feasibility of the programme and timing of their work.

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
First Scotrail Franchise	7.4	Scotrail pilot – New reader hardware due in March 2011 from Cubic. SW upgrade in May 2010. Decision yet to be taken whether to go ahead	2	2	4	Monitor upgrade plans regularly
First Scotrail Franchise	7.5	May prove difficult to impose a strategy on the franchise operator:	2	2	4	Build in options to franchise tender process for the bidders to price. Consider adopting a negotiated procedure.
First Scotrail Franchise	7.6	Lack of powers to mandate change	2	2	4	Consider building in commercial mechanisms into the franchise terms that allow changes to the ticketing approach to be directed by SG
First Scotrail Franchise	7.7	Difficult to put in place an agreement that can be re-negotiated based on certain conditions being met	2	2	4	Put in place a change control process which draws on ticketing price benchmarks for good value to maintain value for money under contract change
Legal	8.2	Issues related to transfer or ownership of assets are encountered	2	2	4	Engagement of legal advice early in the procurement phase to identify and deal with other potential constraints
Legal	8.4	Delivery Partners fail to comply with relevant laws / regulations, causing public sector partners to be in breach of laws or regulations	2	2	4	Identify early potential legal issues
Legal	8.5	Insufficient time to change the law re competition	2	2	4	Take advantage of DfT's work to clarify block exemption on ticketing
Procurement	9.2	The baseline requirement / specification for the Preferred Option is unacceptable to suppliers	2	2	4	Soft market testing prior to formal procurement process to establish market appetite
Passengers	10.1	Passengers do not perceive value in the benefits that are expected to accrue to them	2	2	4	Gather input from passenger groups to understand passenger issues and motivations
Passengers	10.5	Privacy risk – customers concerned about being tracked – may load customer channels with queries	2	2	4	Review precedent established for other ticketing schemes on privacy and adopt best practices
Passengers	10.6	Value on a card very important – system needs to work – if it does not work likely to affect takeup and customer confidence.	2	2	4	Test the system thoroughly before launch. Design the ticketing product early and test key transaction processes.

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
Modal Shift	12.1	Modal shift does not occur as anticipated	2	2	4	As above – this issue relates primarily to achieving appropriate levels of take-up
Economic	13.1	Anticipated benefits are not real or have been double-counted.	2	2	4	Detailed research required to test the robustness of the assumptions underpinning the benefits.
Economic	13.2	Benefits cannot be accurately quantified in a Scottish context.	2	2	4	Detailed data on volumes required to be able to quantify benefits accurately by geographical area.
Economic	13.3	Benefits need to be measured as a whole in terms of economic benefit to Scotland not just SG – risk that we cannot measure the whole benefit.	2	2	4	Review Green Book guidelines on how to consider national benefit vs. benefit to SG and seek potential measurement indicators
Economic	13.4	Benefit baseline may be needed – risk that we cannot set a baseline accurately	2	2	4	Using indicators established re risk 13.3, seek measurements
Economic	13.6	Different fares policy may deliver the same benefits as Smart & Integrated ticketing	2	2	4	Once the order of magnitude for the potential benefit of smart and integrated is understood, compare that with other potential changes to fare and ticketing and model options
Political	1.3	The preferred option cannot be delivered in time to meet 2014 aspirations.	3	1	3	
Political	1.4	Risk that the preferred option is regarded as Glasgow-centric and not serving all of Scotland.	3	1	3	
Technical	3.1	The ticketing product does not work.	1	3	3	
Procurement	9.1	Unrealistic processes and milestones are developed	1	3	3	
Procurement	9.3	Procurements fail to recognise business critical factors	1	3	3	
Procurement	9.4	Robust contracts are not drawn up to underpin all aspects of the project	1	3	3	

	ID	Risk Description	Probability	Impact	Combined Score	Mitigations
Procurement	9.5	There is insufficient expertise to conduct the procurement in accordance with regulatory and policy framework	1	3	3	
Passengers	10.4	Need for a new retail/front office network – not in place now	3	1	3	
Technical	3.7	Ferries not equipped – simple process and infrastructure	2	1	2	
First Scotrail Franchise	7.2	Assets/services/contracts/tickets are not handed over from existing franchisee to new franchisee, particularly for fares, front and back office – mechanism in place to transfer assets so not a big risk	1	2	2	
Legal	8.1	Legal constraints (e.g. procurement, data protection) prevent or delay project implementation	1	2	2	
Passengers	10.7	Who owns the customer? LA vs. operator. LA issues the NEC	1	2	2	
Passengers	10.8	What is the role of a Citizen card? Access to services.	1	2	2	
Environmental	11.1	Perceived complexity of smart & integrated ticketing leads some passengers to revert to car use	1	2	2	
Passengers	10.2	Bus passenger numbers in Scotland are falling – preferred option may not reverse the trend	1	1	1	

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