1 INTRODUCTION

tie Limited was established in April 2002 as a limited company with the primary objective of delivering Edinburgh’s Integrated Transport Initiative. This included the congestion charging scheme and its associated investment package along with the tram project. The company is wholly owned by The City of Edinburgh Council and the Board of Directors comprises three elected members from the council, three members from the private sector and a private sector chairman.

Despite congestion charging coming to an end in Edinburgh the company continues to deliver an expanding range of diverse public sector transport projects. Amongst these are the introduction of two tram lines in the city, a rail link to Edinburgh Airport, the reopening of a rail link between Stirling and Alloa, Edinburgh Fastlink guided busway system, Ingliston Park and Ride Site, the development of an Integrated Transport Initiative for the Forth Estuary Transport Authority which will include a road user charge on the Forth Road Bridge, the feasibility study for a new cross Forth ferry service as well as running a multi operator travel ticket for the south east of Scotland. The projects portfolio is in excess of £1 billion.

In its role as delivery agent tie provides multi disciplinary project management service as well as best practice procurement and financial control with the objective of delivering on time, within budget and within client specification. tie’s staff has have been recruited from both the public and private sector and have increased to in excess of 75. The tie model has been promoted by the Scottish Executive as the way forward for transport project delivery and it is of interest to many public and private sector organisations.

2 EDINBURGH IN CONTEXT

Edinburgh is a world-famous city. To some it is known for culture: the major International Festival every August, the Fringe festival, or the more recent Hogmanay events. To others it is associated more with history: the Castle, the Royal Mile, pipers and tartan. It has a unique cityscape and urban heritage: the
medieval old town and the 18th century ‘new’ town have been designated by UNESCO as a World Heritage Site. It is a tourist city on a world scale with a unique setting.

But it is also a very modern city, with a vibrant and growing economy. The (re)establishment of the Scottish Parliament in 1999 has renewed its role as a capital city. The financial services sector is booming, and it has a world-wide reputation for research and innovation. Population and employment in Edinburgh and its surrounding region are increasing, in contrast to the rest of Scotland. Some economic indicators illustrating the success of the economy include:

- Average disposable income in Edinburgh is amongst the highest in the UK
- Edinburgh identified as the city with the fastest growing economy in the UK;
- Edinburgh is the UK’s second most important financial centre, after London;
- Edinburgh is the UK’s second overseas tourist destination after London.

Population within the Lothians – Edinburgh and its immediate hinterland – is forecast to grow by 50,000 over 15 years, while employment growth is focused very much on the city itself, with an extra 35,000 jobs over the same period (see Table 1). These substantial increases reflect the city’s success. The consequence is an expected shortfall in labour supply in and around Edinburgh, which will inevitably mean more in-commuting over longer distances. Travel in the city’s wider catchment area will increase, adding to the pressures already faced by the road network and rail services.

One of the contributory factors to Edinburgh’s success is undoubtedly the quality of life and environment it offers to its residents, workers and visitors. To attract key financial services staff, and tourists, these factors count and the city must maintain its competitive edge against global comparators. Transport is one area on which the city is benchmarked by investors and visitors.

Table 1: Population and Employment 2000-2015

<table>
<thead>
<tr>
<th>Indicator:</th>
<th>2000</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population - Edinburgh</td>
<td>453,400</td>
<td>469,500</td>
</tr>
<tr>
<td>- the Lothians</td>
<td>783,600</td>
<td>832,100</td>
</tr>
<tr>
<td>Employment - Edinburgh</td>
<td>287,100</td>
<td>321,900</td>
</tr>
<tr>
<td>- the Lothians</td>
<td>405,400</td>
<td>451,200</td>
</tr>
<tr>
<td>of which: % in financial &amp; business services</td>
<td>23.8%</td>
<td>23.3%</td>
</tr>
<tr>
<td>% in distribution, hotels, catering</td>
<td>19.1%</td>
<td>20.5%</td>
</tr>
</tbody>
</table>

Source: Edinburgh and the Lothians Structure Plan Joint Committee

Social concerns are also driving the need for action. An important objective for the city is to improve access to employment and other facilities for socially excluded groups. Despite a very low rate of unemployment overall, deprivation...
and social exclusion are still to be found in some areas and amongst certain groups.

3 THE CHALLENGES FOR EDINBURGH

In 1998 the then Director of City Development of the City of Edinburgh Council, in discussion with a number of city stakeholders on transport issues, identified common concerns about the effects of growing congestion and accessibility problems on the economic development of the city.

The Director reported that almost all agreed that ‘the status quo is not an option’. The message was that to move forward, there needed to be an exciting vision for transport in the future emerging from open, transparent and inclusive consultation and collaboration with all sectors of the city community. Finally, and in the context of government policy development at that time, many though not all agreed that road user charging should be considered, with certain caveats that had to be met if such a policy were to be adopted.

These views have been reinforced in the succeeding years. A survey of business leaders in 2002 to examine issues facing the key sectors of Edinburgh’s economy concluded:

“Transport clearly emerged as the single most important issue facing the city. In fact, the majority of consultees stated that finding a solution to the city’s transport problem was central to the continuing prosperity of Edinburgh’s economy.”

Public consultation and market research has confirmed a high degree of consensus on objectives for transport policy. In 2002, well over 50% of respondents to a consultation exercise carried out in Edinburgh and the surrounding region agreed that ‘congestion will get worse and needs to be reduced’ compared to 20% disagreeing; while over 70% agreed that ‘public transport needs to be substantially improved’ with less than 10% disagreeing.

In attempting to respond to these concerns, the Council faced a number of inter-related challenges. These can be summarised as:

- The translation of a widely supported vision into practical measures that can also achieve acceptance;
- Funding of the measures given the limited budgets available to local authorities;
- Successful delivery of the measures given past difficulties in delivering major projects; and
- The lack of an appropriate regional framework within which to facilitate and promote the necessary strategic vision – which has to be regional in nature.

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4 RESPONSE TO THE CHALLENGES

Based on the early consultation with stakeholders described above, the City of Edinburgh Council decided to start the development of a “New Transport Initiative” (NTI) in May 1999. Its aim was to take an imaginative approach to providing Edinburgh with a ‘world-class’ transport system that could sustain and facilitate the potential for economic growth, as well as being appropriate to its role as a major international city and Scotland’s capital. In so doing, the transport strategy would support Council aims of:

- Promoting a healthy and sustainable environment
- Developing the local economy
- Tackling poverty and disadvantage.

The NTI was initiated at a time when national government policy on transport was going through a significant stage of development. Legislation was introduced at this time which, amongst other matters, proposed powers allowing local authorities to introduce road user charges. In Scotland, this was enacted in the Transport (Scotland) Act 2001.

The NTI study examined the options for achieving a step change in transport quality. Funding issues were a key focus of the initial stage of the study, which included examination of road user (congestion) charging as well as a wide range of other potential funding sources. Alternatives ranged from tourist taxes to bus quality partnerships, from parking charges to the Private Finance Initiative.

At the same time, the Council started to develop an integrated and consistent set of transport policies, linked with an appropriate project portfolio. The biggest component was a proposal to develop a light rail network for Edinburgh. This would form the core of an upgraded public transport system, integrating with improved rail and bus services, as well as linking with Park and Ride sites around the edge of the city. The investment strategy also included significant enhancement of the city centre environment to maintain its attractiveness as a shopping and tourist destination.

Public views were always seen as a key issue in the development of the initiative. A major consultation was undertaken in 1999, including the distribution of a questionnaire throughout Edinburgh. The questionnaire sought views in relation to three strategic transport policy options, as well as testing key objectives and components of the transport strategy. Around 19,000 responses were received with high levels of support (62%) shown for the strategic option including the concept of congestion charging (Table 2). In addition to the public consultation, there was also extensive consultation with stakeholders.
Table 2: Consultation results 1999

<table>
<thead>
<tr>
<th></th>
<th>Option 1: Based on road user charging</th>
<th>Option 2: Based on workplace parking levy</th>
<th>Option 3: Status quo</th>
<th>None of these</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>62%</td>
<td>51%</td>
<td>28%</td>
<td>-</td>
</tr>
<tr>
<td>Don't know</td>
<td>6%</td>
<td>9%</td>
<td>8%</td>
<td>-</td>
</tr>
<tr>
<td>Oppose</td>
<td>32%</td>
<td>40%</td>
<td>64%</td>
<td>-</td>
</tr>
<tr>
<td>Preferred (all)</td>
<td>58%</td>
<td>22%</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>Preferred (business)</td>
<td>51%</td>
<td>18%</td>
<td>24%</td>
<td>6%</td>
</tr>
</tbody>
</table>

The conclusions drawn from the consultation and an initial technical appraisal were that congestion charging was feasible, would reduce traffic levels, could generate substantial revenue for transport investment and would have no or very limited adverse economic impact if the charge was set at an appropriate level. In addition, there was a high degree of acceptance provided that the overall package was right. This gave the Council confidence to develop the proposals in more detail. The Scottish Executive agreed to match fund the development studies, with some further funding provided by an EU research project “PRoGR€SS”.

The evolution of the scheme between this point and the referendum in February 2005 broadly followed the guidance on development of an Integrated Transport Initiative (ITI) issued in August 2001 by the Scottish Executive\(^6\). This included a two-stage decision-making process, with “in-principle” and “detailed” approvals required from Ministers for an ITI. As well as requiring technical appraisal (STAG\(^7\)), the guidance sets out four policy criteria that Ministers require a charging scheme to meet:

(i) the charging scheme must reduce congestion and/or noise and emissions;
(ii) the net revenues from charging will be additional;
(iii) there is fair treatment of those who pay the charge (and/or suffer the congestion or environmental problem) and those who benefit from the scheme;
(iv) a range of public transport improvements are in place before charging is introduced, with further improvements to follow.

Separately from this guidance, Ministers also indicated when giving approval in principle to the scheme in December 2002, that they would expect “clear public support” for a scheme to be demonstrated at the detailed stage.

To meet these requirements and ensure effective delivery if eventually approved, the development of the scheme from inception to the detailed, charging order, stage had to consider and balance technical, organisational and acceptance issues. Accordingly the main work streams were:

- public and stakeholder attitude research;
- design and technical appraisal of alternative scheme configurations;

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Consultation with the public and stakeholders was essential to assist scheme design and aimed to maximise the acceptability of the proposals. It also provided the opportunity for informing the public about the objectives of the scheme. A comprehensive programme of consultation and market research was developed for the Council by the University of Westminster\textsuperscript{8}. The programme built on the initial consultation undertaken in 1999 and was supplemented by direct discussions with key stakeholders. Neighbouring local authorities were particularly important in this respect, particularly in regard to their concerns about the impact that an outer cordon would have on their citizens. The most recent market research illustrated in Figure 3 was carried out in Autumn 2003\textsuperscript{9}.

**Figure 3: Opinion research 2003**

The technical assessment on which early decisions were based was supported by the central Scotland transport model developed for the Scottish Executive. To provide more robust estimates of the impacts of the scheme, a more appropriate strategic transport and land use modelling package was commissioned in December 2000. In addition, a methodology to forecast the impact of the initiative on the local economy – already highlighted as of key importance to city stakeholders – was required. An approach based on accessibility change linked to the transport and land use model described above was selected. The models were used to examine the impacts of the charging scheme and its associated transport investment package\textsuperscript{10}. 

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A ‘Preliminary Business Case’ linked charging revenues with estimated costs of collection and the implementation of a transport investment package. The objective was to identify the scale of investment that could be funded, and any further funding requirement. It also provided an indicative timetable for the implementation of the constituent projects. The capital and operating costs for the charging system itself were of crucial importance, especially given the relatively low congestion charge being proposed, and a detailed cost model was developed. The question of procurement strategy, and appropriate organisational and financial structures to deliver such a major project was also considered at this time.

5 THE CONGESTION CHARGING SCHEME

The final charging scheme consisted of two cordons at which a charge would be levied for vehicles travelling inbound, towards the city centre. There would be an outer cordon around the edge of the built-up area of Edinburgh, just inside the outer city bypass, and an inner cordon around the centre of the city, broadly encompassing the World Heritage Site (Fig 4). The outer cordon would operate between 7am and 10am only; the inner between 7am and 6.30pm, Mondays to Fridays in both cases. The finish time of 6.30pm was amended from 7pm following early stages of consultation, and proposed charges at the outer cordon in the evening peak period were also dropped following consultation.

The charge was to be £2, levied no more than once per day on any single vehicle. If a vehicle were to cross both cordons, or to cross either cordon a number of times during the day, the charge would still only be applied once that day. In this sense, the scheme resembles an entry permit scheme. Arrangements for payment of the charge and enforcement of the scheme would be similar to those in place for the London congestion charging scheme.

A number of exemptions were proposed: emergency service vehicles, buses, powered two-wheelers, licensed taxis, and vehicles belonging to an approved ‘city car club’ scheme. Approved recovery vehicles were also to be exempt.

An exemption added at a late stage by the Council was that residents of the administrative area of the City of Edinburgh who live outside the outer cordon would not be liable for the outer cordon charge. It was justified by the Council on the grounds of fairness for all Edinburgh residents. However, it gave rise to considerable concern from residents of neighbouring Council areas.
The scheme was intended to operate for 20 years. It could directly have funded around £35m-£40m of transport investment each year after deduction of collection and financing costs, providing a total package of £760m at 2002 prices.

A full STAG appraisal of these proposals was not completed, but interim assessment of the proposals compared to a reference case for 2011 and based on the modelling techniques described above showed that the scheme would achieve:

- Significant reduction in traffic levels and delays within the city centre.
- An increase of 5% in total journeys terminating in the city centre by all modes.
- A small reduction in overall traffic levels and delays between the inner and outer cordons, and only small changes outside the outer cordon.
- Slight increase in orbital traffic between the cordons, with some localised changes that would require mitigation measures.
- An increase in public transport use of around 10%.
- A very marginal impact on the Lothian economy – in terms of value added and jobs this is marginally negative.
- A redistribution effect within the area of both jobs and population: population will be slightly higher in the city centre and outside the city; there will be some movement of jobs out of the city into the surrounding areas\textsuperscript{11}.

The investment package would have further impacts on achievement of transport strategy objectives. These include environmental improvement (for example through grants for clean engines in buses and taxis, and city centre environmental enhancement); social inclusion, through the substantial improvement to public transport; and safety and residential amenity (more
funding for 20mph zones and safe routes to schools). It would provide the ability to maintain higher standards of safety and comfort for road, footway and cycleway users through increased maintenance funding.

6 SOME CRITICAL DECISIONS

Throughout the development of the initiative, it was always clear that the charging scheme in particular was risky, and might fail at one of the decision-making stages. The Council therefore put forward two alternative strategies in its Local Transport Strategy (LTS) documents produced in 2000 and 2004. Each LTS included a ‘Base Strategy’ comprising measures fundable from expected conventional funding sources, and a ‘Preferred Strategy’ adding in the congestion charging scheme and associated investment.

Two pivotal decisions have influenced the evolution of the scheme, and arguably affected the eventual view taken by the public. The first decision, in autumn 2002, was to hold a referendum prior to making any final commitment to the congestion charging scheme. This decision was made at the same time as agreeing to submit the scheme to Ministers for approval in principle. The Council view was that “the recent, independently analysed, public consultation showed very mixed opinion on the congestion charging proposals. There was not sufficient public support to reach a final conclusion on a single preferred scheme.” The Ministerial requirement for ‘clear public support’ to be demonstrated, although coming after the referendum decision, reinforced the Council in its view that this was the right approach to dealing with this controversial measure. However, Ministers gave no guidance (and still have not) as to how ‘clear public support’ should be demonstrated.

The second pivotal decision relates to the ‘package’ being put forward as the Preferred Strategy. Prior to approval in principle the Integrated Transport Initiative package being proposed to Ministers incorporated the congestion charging scheme, a package of transport improvements including a three-line tram network, and a request for an additional allocation of public funding amounting to £375m.

The additional central funding was considered to be a justifiable element of the package in recognition of the Council’s willingness to take a serious political risk by promoting congestion charging, an important policy tool for government to be able to achieve national transport objectives. A parallel was drawn with Norway, where income from the toll rings introduced in Oslo, Bergen and Trondheim was matched by additional government funding for the linked investments.
However, the approval in principle by Ministers in December 2002 was followed in March 2003 by a further announcement\textsuperscript{13} that the Scottish Executive would make £375m available to the City of Edinburgh Council to fund “at least the first tram line” regardless of any eventual introduction of congestion charging. In fact, £375m was the estimated requirement for the first two lines. Accordingly, the Council determined that it would pursue the development of these two lines independently of congestion charging. The effect of this decision was to move the two highest profile projects in the Preferred Strategy into the Base Strategy. This changed the scheme not only from a presentational point of view, but also in terms of its appraisal outcome.

In particular, this affected the definition of the scheme examined at public inquiry in Spring 2004. The decision to hold a public inquiry was taken at an early stage in the process: not only was the possibility of an inquiry built into the legislation, but it could be called by either the Council or the Scottish Executive. The Council decided to hold an inquiry itself both to demonstrate its willingness to submit the scheme to in-depth scrutiny, as well as to minimise the possibility of unplanned delays to the overall timetable if the Scottish Executive were to require an inquiry at an unknown future date.

In spite of the changed nature of the strategy being examined the report of the Inquiry\textsuperscript{14} generally supported the proposals, recommending that the Council should ‘proceed with caution’ in taking the scheme forward, but also recommending some changes. The Council accepted many of these proposals, but not the recommended abandonment of the ‘outer Edinburgh’ residents’ exemption referred to earlier. It agreed to proceed with the referendum preceded by an information campaign.

The effect of the referendum decision was clearly more decisive. Following a major information campaign, and political campaigning by ‘yes’ and ‘no’ groupings, 25.6% of voters voted ‘Yes’ and 74.4% voted ‘No’ when asked whether they supported the Council’s ‘preferred’ transport strategy including congestion charging. Turnout was over 61%, higher than in the 2003 Scottish Parliament elections. On 24 February, all further work on implementing congestion charging in Edinburgh was formally stopped by the Council. The total cost up to this point for development of the scheme amounted to about £9million.

The referendum outcome represents the final stage in a series of tests of public opinion in Edinburgh. Figure 5 illustrates how opinion has evolved, with a clear decline in support (even bearing in mind that the schemes on which views are being sought are not identical in each case). Similar shifts in opinion have been observed for other schemes, both London and some of the Norwegian toll ring schemes. In these places, opinion became more favourable once the scheme was in place and the benefits could be observed. With this in mind, Stockholm intends to introduce congestion charging on a trial basis in January 2006, with a referendum the following September.
7 THE REFERENDUM

Inevitably the focus now is on why there should be such an overwhelming rejection of a scheme that had been under development for over five years. A number of possible causes are suggested below, based on earlier consultation and views expressed in the media and elsewhere at the time of the vote. These are unlikely to be comprehensive, and the outcomes of current research on public attitudes to congestion charging in Edinburgh post-referendum will be required before the issues are fully understood.

A major area of uncertainty is the extent to which this was a vote against the principle of congestion charging, a vote against the particular scheme proposed, or a vote against the Council for wider reasons. All these factors seem likely to have been in play. For example, the Conservative opposition (13 out of the 58 Council members) opposed the principle of congestion charging in Edinburgh outright while the Liberal Democrats (15 Councillors) opposed the specifics of the scheme, in particular its timing. They took the view that more public transport alternatives should be in place first. The Labour administration, the only other party represented on the Council, were therefore left as the only supporters of the
scheme. The administration’s overall majority of just 2 seats will have had the
effect of politicising the issue, with opposition parties taking the opportunity to
seek potential future electoral advantage. No charismatic champion of the
scheme who would have the confidence of the public, emerged to build support.

Neighbouring authorities, also all Labour controlled, particularly opposed the
outer cordon and the exemption for Edinburgh citizens living outside it, while
indicating their support for the principle of congestion charging. Although only
residents of Edinburgh could vote in the referendum, the opposition from
surrounding areas affected the publicity about the scheme, and may well have
influenced opinion within the city.

A range of issues appear to have influenced voting behaviour, ranging from
serious errors of fact, to issues of fairness, to perceptions about taxation. Some
key points are suggested to be:

- Mistrust of Council motives (illustrated, for example, by a perception by some
  that the Council’s bus priority and traffic calming measures are designed to
  ‘generate congestion’);
- Some aspects of the proposals being seen as ‘unfair’, in particular the outer
  Edinburgh exemption;
- Errors of fact about the charging proposals, including by the media
- Insufficient connection between up-front investments and the charging
  scheme;
- Lack of understanding-definition of the associated long-term investment
  proposals;
- Lack of obvious benefits for motorists;
- A belief that improvement of public transport (agreed by most to be
  necessary) will on its own reduce car use;
- Belief that government would/should pay for transport investment – from the
  ‘excessive’ taxes already paid by motorists.

These issues might suggest that the Council and promoters of the transport
strategy were unsuccessful in their communications strategy, not only in the
referendum campaign but also more generally in their promotion of integrated
transport policies over a period of time. A major information campaign was
mounted prior to the referendum, which sought to present information about the
strategy in a balanced way. However, legal requirements about the use of public
money in the period leading up to the referendum meant that great care had to
be taken about how the issues were presented, limiting the creativity that could
be employed in attracting the attention of the public. The £600,000 available for
this campaign, while substantial by Council standards, is not a very large sum for
a major marketing campaign. No public funds were made available for ‘yes’ and
‘no’ campaigning groups, something that has been done in other referenda and is
recommended by the Initiatives and Referenda Institute (IRI), an international
referendum ‘think-tank’.

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This leads on to the issue of the referendum itself. The IRI report highlights a number of issues about the referendum, both positive and negative. A key point is that there is limited experience of such tests in the UK, and little in the way of a legal framework or good practice guidelines. Indeed the Edinburgh referendum had no legal status; in legal terms it was simply ‘a test of public opinion’. Nevertheless, a substantial effort was made to manage the process fairly and avoid the risk of legal challenge, limiting resources for dealing with the substantive issues. Many lessons remain to be learnt about the referendum process and the promotion of a major policy at a referendum.

8 LESSONS LEARNED

In spite of the referendum rejection, there are some positive aspects to the development of Edinburgh’s charging scheme. Many challenges were overcome, not least achieving a positive outcome from a public inquiry. The work undertaken demonstrated a clear public view that congestion is a problem and public transport needs improvement. The experience of Edinburgh in meeting the statutory requirements for introducing a congestion charging scheme should be of some comfort to other cities considering a similar scheme, as should Edinburgh’s success in developing cost-effective business systems for implementation.

But it has obviously not been possible to demonstrate ‘clear public support’ for the scheme, as required by Ministers. Such a hurdle is not applied to other policy initiatives prior to implementation, and there must be a question about whether it is a reasonable test. Evidence from London and elsewhere shows that levels of support are likely to be at their lowest soon before introduction of a scheme – the costs to the motorist’s wallet are known but the benefits still intangible. It is likely that even the London scheme, which now commands widespread support, would have failed if put to a referendum before introduction. It might be more realistic to require evidence of support for policy objectives, rather than the specific projects designed to bring these about.

While there are other ways of demonstrating public support than holding a referendum, there clearly is a substantial debate to be had about the role of referenda in the democratic process. A wide range of issues need to be considered if referenda are to become more widespread, including clear guidance on their management, timing and the extent of eligibility to participate. If there is a trend towards this approach to decisions on major policy initiatives, this will have significant implications for engineers and planners in promoting such policies. The result of the Stockholm scheme is awaited with much interest. As has been demonstrated in London a political champion in the form of the elected mayor has a clear role to play in the promotion of such a scheme. This can perhaps substitute for the requirement to demonstrate public support but it is not an option available to all cities.

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Could an alternative, perhaps more limited scheme, have succeeded in Edinburgh where the Council’s proposal failed? A city centre only scheme was more popular in the earlier consultation and market research work. It is possible that such a scheme would have been more easily understood by the public, would have avoided the vociferous opposition of neighbouring local authorities, and would have been perceived as fairer. This might have avoided the build-up of the momentum of opposition seen in February. But this is mere speculation: the City of Edinburgh Council will not be taking forward any congestion charging scheme in the foreseeable future, and is now focused on implementing its alternative ‘Base Strategy’.

Substantial effort was put into the development of a cost-effective business system to operate the congestion charging scheme. A major barrier to cities adopting charging is the cost of setting up and running the system. This was of particular concern in Edinburgh with the optimum charge proposed at £2. The London solution would have been too expensive, and the cost of ownership needed to be substantially reduced to maximise the opportunities for alternative transport investment. Alternative transport investment was a major objective of the Edinburgh scheme, to support and reinforce changing driver behaviour.

To minimise risk and demonstrate best value, tie adopted a dual design and prototype procurement process. Following the invitation to tender stage two suppliers, IBM and Capgemini were selected to carry out the detailed design, proof of concept through prototype and the development of a target cost for the delivery of the full system. The requirement for the design was to seek lowest cost of ownership using a single platform standard enterprise solution such as SAP or Oracle. It was also required to stand alone both technically and operationally. Although this was a more costly method of procurement in the early stages the competitive environment during the development phase was expected to lead to substantial savings in whole life costing. Had the referendum been successful one of the suppliers would have been selected to go forward to full implementation.

Another area of concern was controlling the cost of operation. It had been intended to begin the procurement of an operator following the selection of the preferred business system. tie retained ownership of the system and this arrangement would not only have provided operator independence but also allowed operational support services such a retail partners, bank clearing and the like to be exchanged. Contracts would have been renewed on a five year basis to ensure best value and the replacement of one element of the operation would not have impacted on the other parts.

The result of this procurement approach was that two fully developed and costed business systems were achieved which would have fully met the requirements for the operation of the congestion charging scheme. The indicative capital cost for
the Edinburgh scheme was £25 million with an annual operating cost of £9-14 million. The projected number of chargeable events was similar to London at 120,000 per day with the average transaction cost of 40 pence (20%). Tie retain ownership of both these systems and believe that they could be reused in any other congestion charging application. More importantly, we believe there are wider applications within the transport sector where substantial cost savings could be made using this business system approach. This is described further in the next section.

9 A Business Management Approach to Transport

Traditionally transport applications have focused on front end technology and paid little regard to wider business operational efficiency. As a result there are many bespoke front-end applications developed by small niche players. Looking at the available options it was clear Edinburgh could not afford to go down this route particularly at the level of charge being proposed. We therefore looked to the private sector for examples of best practice. In doing this we were in fact looking at the congestion charging from a viable business operations perspective and deriving and integrated back office solution. The business management approach adopted in the Edinburgh congestion charging scheme delivered successfully tested competitive business system designs that encompassed Financial Process Management, Operational Design and System Integration. These are described below.

Financial Process Management

The heart of the business system for the Edinburgh Congestion Charging was the financial processes that it supported. These processes needed to cover the immediate statutory obligations of the operation, and have the ability to cover future financial processing, accounting, and reporting needs. It was a requirement that there should be complete financial transparency throughout these processes which should be fully auditable, and provide a suite of financial reporting capabilities for both Management and Statutory requirements.

The issue of potential fraud goes hand-in-hand with perceived trust from users and stakeholders alike. As such the system design, the technology middleware, and the back office finance processes and operation needed to be designed with this as a key requirement. The supporting technology should be demonstrably secure with full capability for future security requirements to be incorporated as they develop.

It was considered that the best way to cover these requirements was to automate as much of the financial suite of processes as is practicable, and to sufficient levels of detail. Modern Enterprise solutions can provide full automated financial

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reconciliation down to individual transactions with full system audit capability. Such automation also reduces the possibility of fraud from within the operation.

The key element in the design and delivery of such solution that required no other structures and systems to fully function covered such business financial areas as:

- **Accounts Payable.** The ability to raise and authorise orders, and subsequently receive goods and services and authorise and settle payments for them, including refund capability. This can all be done through highly automated workflow constructs that can optimise operational structures and arrangements.
- **Accounts Receivable.** The ability to receive payments for goods and services. An example in this area could be possible payments for access rights and administration for operators to use the cards for consumer ticket payment, or direct offering of paid services to citizens and companies directly (information portal access, account management, etc)
- **General Ledger.** Consolidation of all financial transactions and movements that provides the basis for reporting and audit.

It also included optional functionality, namely;

- **Asset Management.** Full accounting control over assets that should be controlled through this scheme (back office equipment, offices, POST equipment, etc), including full support for a range of depreciation models.
- **Project Accounting.** The ability to cover the accounting requirements for future projects that aim to build on and develop the scheme. Projects such as further deployment to cover other transport areas, marketing campaigns, and business efficiency projects can all be covered using this functionality.

The financial construct, from its basis at the Chart of Accounts structure, will determine operational efficiency and the ability to report across and out with the organisation. The development of the solution for the Edinburgh Congestion Charging scheme is shown here.

Near real time reporting capabilities on financial metrics can form the basis of management reporting and allow the operation to be controlled and managed effectively.

Another facet that was considered in this development is the possible future introduction of the Euro. The
solution was designed to accommodate this migration. Also, depending on future use, the solution may also need to accept payments (and refunds) in other currencies where possible access may be open to tourists for example. All of this should be possible through the solution and we made sure that these requirements were correctly specified and delivered.

Other commercial possibilities were also considered, such as Merchant Acquirer services, Bank reconciliation, support for multiple commercial channels, eCommerce, etc, all of which was successfully prototyped and tested.

**Operational Design**

The remit of this project was to lay the foundation for Transport applications going forward. The initial project to provide a Congestion Charging scheme was ambitious and had to be delivered against a very aggressive timeline. Whilst the timeline for introduction of the scheme was fixed around the referendum, we believed that the implementation through a pragmatic and achievable plan could address the requirement for delivery programme. The ongoing efficiency of business operation was the key scheme cost driver and so required a comprehensive approach.

By understanding and further developing the Business operational model at a detailed level, the business processes that underpin the operation were accurately designed and optimised to deliver best practice processes that minimise ongoing costs.

The infrastructure to support congestion charging has been evolving with very different levels of attention over the last few years. The cameras and automatic number plate reading equipment are widely used and the technology is now mature. The key determining factors for successful delivery were strategic intent and organisational related

It was recognised that to manage the vast amount of information that the solution could capture, analyse and exploit and to allow the scheme to be effectively managed, provide stakeholders with valuable operational information, and possibly provide real value to citizens and other organisations was paramount. Information Management was a key design principle in all aspects of the scheme and the ability to consider the wider uses of the information available was to be fully explored.

>“Regardless of the state of your company and its immediate issues...you can only manage what you know. Moreover, you only know what the information tells you. Anything else is guessing.”
>Jim Davidson, President, iWheels Logistics
Offering users multiple channels to pay, register query, complain, and eventually buy additional services will increase take-up of services and the user's perception of the scheme. As such, design consideration of a wide range of channels for immediate and future use should offer such possibilities. eGovernment principles should be applied and the solution should be eBusiness ready.

By considering the operational model as a whole and developing a comprehensive approach to it, operational processes can be readily supported through the delivered solution which will enable the consolidated Information Management approach mentioned earlier. Some of the operational processes which we believed should be integrated are;

- Registration processes
- New, Lost, Changes, Replacements, etc
- Handle queries, challenges, or complaints, including the full escalation process
- Channel management
- Customer Relationship Management
- Information Management

Delivering a full set of integrated tools to manage the entire spectrum of citizen interaction in an intelligent way (full case history, easy access account information, routing and learning from enquiries and complaints, etc) will ensure that that a proactive approach is taken and that the operation dynamically learns from each interaction.

Information Management in the arena of channel management (future ability to access the system through various sources) is an essential requirement and should be built into the solution from the start, even if it will not be fully utilised at first. By understanding citizens use behaviours, areas requiring attention can be identified and addressed.

The delivery business solutions that meet these needs in a world class operation would cover;

- The provision of timely, accurate, and intelligent information to support decision making (including web based portals, management dashboards, balanced scorecard reporting, etc)
- Workflow based processes with escalation capabilities
- Optimised for e-Business
- Easy addition of channels
- Full support for multiple currencies and the potential introduction of the Euro

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• Intelligent Interactive Voice Recognition (IVR) solutions
• Predictive tools for determining trends, behaviours, etc
• A ‘paperless office’ design principle that could maximise document management techniques
• Statistical Process Control (SPC) techniques have could be integrated into the solution to directly support continuous improvement
• Process exception control
• Dynamic performance reporting covering all areas of operation and system performance
• Customer service metrics
• Consistent data gathering and storage also provides a solid base for forecasting
• Reporting through SLAs, KPIs, etc
• Standardise the user experience

Such an approach, coupled with the possibilities afforded through System Integration, open the potential to offer shared service arrangements for scheme development and service offerings to other local authorities.

**System Integration**

It is not uncommon on a project of this scale for elements of system design and build to be provided by different suppliers. This presents technical challenges and requires the use of an experienced systems integrator to oversee the system build and pilot to ensure that all elements are adequately integrated. In the case of this project this element was carried out by in house staff.

To fully realise its potential, the business system that was to be delivered through this project had Scalability and Flexibility as core design principles. The design principles, and business operations modelling that were delivered fundamentally underpin this requirement.

To make sure that information was transferred correctly and that subsequent financial reimbursements were correct, data validation was a key design feature at all levels of operation.

We encouraged independence of hardware architecture so that front end technologies were independent of back office technologies and the technology base is independent of the subsequent operation. Modular design avoids big bang replacement and allows future technological advances to be incorporated with ease. Modules can be added on demand, new workflows and processes can be included by the users.
be introduced without extensive redevelopment and open interfaces reduce dependency on single suppliers.

Properly integrated, this approach results in highly flexible and scalable systems which can rapidly be expanded to support future initiatives. Developing transaction level accounting systems with charging and disbursement, data warehouse and customer relationship management was all part of an integrated end-to-end solution.

Architecture is the most important factor in ensuring a quality integrated solution and ensuring that the solution meets the needs and requirements of the operation. Our approach to integrated architecture development is based upon best practices.

The first step in this approach is business process analysis where exhaustive scenarios are identified, prioritised and modelled. At this point the manner in which the integrated systems will support the business processes can be defined as can performance and capacity requirements.

The next step is to develop the architecture itself. The following design issues need to be considered:

- Identify each integration component
- Identify communications between components
- Identify user interaction with each component
- Propose a network topology and communications infrastructure
- Establish availability, fault tolerance, and load balancing requirements
- Incorporate security requirements
- Identify common services (e.g. process initialisation, audit, logging, error and exception handling etc.) so that these services can be consistent across the solution.
- Define operational monitoring and support
- Define test strategy and test cases to include volume and resilience testing

Selecting a highly reliable, flexible and scalable integration platform was key to achieving success on this project. Effective integration requires the formulation of an integration strategy and the establishment of an organisational and technical infrastructure to support that strategy.

The following diagram provides a general perspective on how the ECC central system was designed to integrate with other ECC project services as well as its external access channels:
Thorough end to end testing proved this architecture to be very reliable, flexible and resilient. High volume transaction stress testing was also carried out on this architecture with no issues.

**Conclusion**

The development of the business system for Edinburgh Congestion charging has demonstrated that a business management approach can deliver significant operational cost benefits. By considering the transport application as a business and by utilising industry standard packages and standard business practice, significant cost savings can be made and more importantly provide the ability to manage and understand how the business operates. We feel that there is merit in adopting this approach not just for future congestion charging schemes but for other transport applications, and indeed wider public sector operations. **tie** will be more than happy to share its experience and research on matters such as acceptance and business systems with other transport authorities considering taking forward congestion charging as a demand management tool.

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