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When might we see congestion charging in British cities outside London?

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Abstract

Underlying this question is really a much deeper issue of public acceptability intertwined with political reality and decisiveness. Although it is not possible to predict exactly where, nor when the next congestion charging scheme outside London will come to light, it is however feasible to list some important factors based on previous schemes which have been successful. In order to illustrate these factors, case study examples will be utilised from Norway, Italy and Britain. A hypothetical British city will be presented, a city which might be about to introduce charging, and some of the potential issues and factors that work in favour and against it becoming a reality will be discussed. Finally, a critique on the course of recent transport policy in Britain and the effect it has had on road pricing measures, among others, suggests that government strategy has had as yet an inconclusive effect on the future of urban schemes.

Contents

1. Introduction

Economic growth has put a tremendous strain on existing transport networks in recent years. Consequently, and also for broader environmental and financial reasons, transport issues have risen sharply on the political agenda of most countries, especially in areas where population density is the highest. Congestion is widely acknowledged as becoming the critical issue regarding surface transport especially in urban areas (DfT, 2004; EU, 2003). The UK and other western European countries are gradually learning that economic growth and traffic congestion cannot be reconciled by simply building new road infrastructure, as car traffic expands to fill up new road capacity. In the context of rising car ownership, pricing instruments as part of an integrated package of measures are increasingly seen as an effective strategy to reduce traffic and raise revenue (€UROPRICE 1, 1998). The introduction in 2003 of a congestion charging scheme in London was part of a growing interest in the subject of road pricing both by practitioners and academics in the UK and Europe. In Europe, a number of urban road pricing trials have been underway since the late 1990s (CUPID, 2004; €UROPRICE 2, 1998; PRoGRESS, 2003, Armelius and Hultkrantz, 2005). But, despite gaining attention and enjoying the support of economists and transport professionals, there remain few implemented road pricing schemes.

It appears that it is not the technical design or the economic justification that is problematic with road pricing projects, but the decision making and planning processes leading to implementation, where difficulties of winning acceptance and support are involved. The overall implementation process of traditional transport policies of road expansion entail a relatively simple system of actors and processes around which expertise, knowledge, and skills have built up over many decades. Some of the more controversial demand management measures, including urban road pricing policies, involve a complicated set of institutions, processes, people and procedures.

This paper looks at the conditions necessary for urban road pricing schemes in Britain to become a reality. It presents the road pricing experiences of three countries: toll rings in Norway, access control in Italy and congestion charging in Britain. It seeks to draw lessons from the three countries and identify critical factors in the implementation of the road pricing measures. In the paper, section two introduces road pricing as a generic term and gives examples of the different terminologies used. The third section gives a brief overview on the schemes of the three countries. More information on the cases is given in the appendices in the form of tables and individual case descriptions. The fourth section details the critical factors identified as central to the implementation of the aforementioned schemes and discusses the importance they could have in a new road pricing initiative in the hypothetical British city of Stoneford. The final section discusses a number of conclusions.

2. Road Pricing

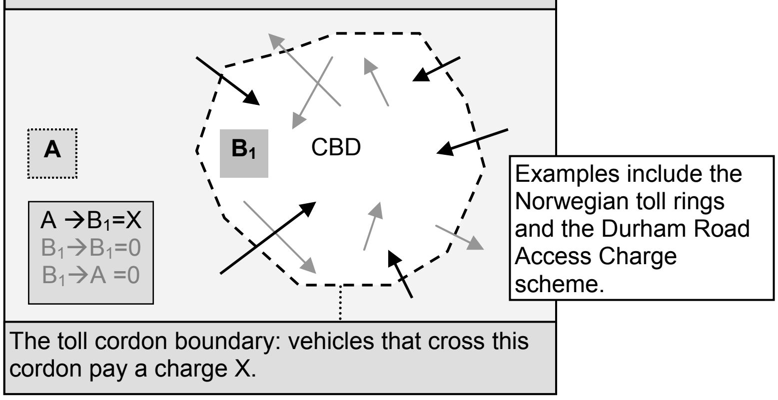
It was as early as the 1920's, when economists (Knight, 1924; Pigou, 1920) recognised road pricing as a simple way for taxing the external costs of transportation – congestion, accident risks, noise and emissions of pollutants (Maddison *et al*., 1996). In the UK, the road pricing debate started in the Ministry of Transport Smeed report (1964), which identified the policy as a means of obtaining better value from roads. But a long time passed until the suggestions started to become a gradual reality.

With the exception of the Singapore scheme (1975), it was not until two decades later that politicians started to recognise road pricing as a potential funding source and travel demand management measure. Examples include the Norwegian urban toll schemes of the mid-eighties and early nineties, the Italian city centre pricing trials that evolved from zone access control and the two road user charging schemes that came into operation more recently in Britain.

There are a variety of urban road pricing methods and sometimes a confusing variety of names are given to the schemes. It is therefore useful first to define the types of road pricing presented in this paper. The following two figures provide an explanation of terms used in this paper. A further list identifies other possible ways of charging.

Cordon charging (Fig. 1) involves charging drivers crossing a cordon to enter a specific area – usually the city's central business district (CBD). Drivers pay a charge dependent on how many times the boundary is crossed. The fee can be levied using manual methods – either by manned toll booths or coin operated machines, as well as electronic tags – relatively simple read/write tags or smart card technology.

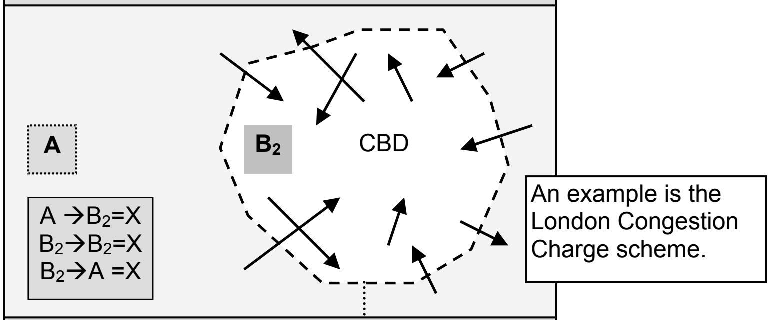
Figure 1: Cordon Charging



Successful examples of cordon charging (toll rings) are found mainly in Norway where the policy has developed into a niche after most major cities adopted the measure (Ieromonachou et al., 2006a). With one point controlling access to the Peninsula, the Durham scheme also operates as a cordon scheme. Had it been implemented, the Edinburgh scheme would have operated a dual cordon scheme.

Area charging (Fig. 2) applies to vehicles for accessing and travelling within a specified area by providing a license (paper permit) or charging (cameras, smart cards) to enter a certain defined area. It does not restrict how many journeys a license holder can make within the area and could be more refined as a congestion tackling tool. The London Congestion Charging scheme (2003) operates as area charging.

Figure 2: Area Charging



The area boundary: vehicles that cross this cordon or move within its area pay a charge X.

Another Norwegian scheme in Trondheim, which ceased operation at the end of 2005, started off as a cordon charging system. Seven years later, in 1998, it advanced to a 'proxy' area-based charging by dividing the initial area into several zones and introducing a charge for trips within zones (Ieromonachou et al., 2006a).

Road Pricing Technology

A recent report by the Green Light Group (2006) lists three main technologies used in road pricing:

- DSRC (Direct Short Range Communications): where roadside beacons are used to detect electronic tags on the windscreens of passing vehicles and charge the owner. This is the most common technology employed in the Norwegian toll-rings;

- ANPR (Automatic Number Plate Recognition): using cameras to visually identify vehicles and read number plates as is the case in London; and,

- REP (Remote Electronic Positioning): by using either satellites (GPS) or mobile phone systems (GSM) the system can track vehicles continuously and make distance based charging work. The German HGV charging system 'Toll Collect' is based on this technology. GPS systems permit charges to be varied by area, road type, congestion etc. There are some drawbacks such as a drop in reliability in densely built areas but technological solutions continue to develop solutions to problems. A REP system would need to have a back-up system in place and the Green Light Group (p.4) suggests that the best solution would be to combine technologies: "general distance charging using REP, supported by a DSRC system for charging in those central urban areas where tall buildings make REP less reliable".

Another option could be *Distance-based charging*: A fee is charged according to the distance travelled. The Netherlands and Oregon have conducted trials on this system. Distance-based charging does not require GPS, but uses an on-board odometer charging unit.

3. Road Pricing in three Countries

The following three sub-sections summarise briefly the situation in Norway, Italy and Britain. A more detailed description of the nine cases can be found in Appendix 2 at the back of the report. Also, Table 1 in Appendix 1 contains information about each of the cities and aids in assessing several of their physical characteristics.

3.1 Toll Rings in Norway

Funding road construction from toll revenue has been in practice for over 70 years (Wærsted, 2005) but the use of tolls has increased considerably in the last two decades. There are around 48 road toll projects in existence today (Amdal and Welde, 2005), with seven of them operating as urban toll rings. Funds from these projects form the main source of road, and to a certain extent, public transport investment programmes (Odeck and Bråthen, 2002). Toll revenues are supplemented by additional governmental funds (Norwegian White Paper on Transport, 1996). On average, about 30% of the total annual state budget for road construction comes from toll revenue from both urban and motorway tolls (Langmyhr, 2003). The first Norwegian urban toll ring was established in Bergen in 1986 to raise funds to accelerate the implementation of a wide-ranging programme of transport investments. Since then, a number of other Norwegian cities have adopted urban toll charging including: Oslo, Trondheim, Stavanger and Kristiansand (Ramjerdi et al, 2004) as well as the smaller settlements of Tønsberg and Namsos (Wærsted, 2005).

In Norway, it is possible to say that road pricing is on the way to forming a new transport regime. It is becoming normal to pay a road charge in a growing number of situations. This includes not only urban toll rings but tolled motorways, bridges and tunnels. More urban toll ring schemes have come into operation in recent years but the initial objective of raising revenue as opposed to removing traffic is still the primary function behind the schemes. In terms of design the three cases discussed in this chapter were initially similar but differences developed in time, including size, hours of operation and the way that funds were used. One main difference came from Trondheim where they experimented with inter-zone tolling, a rather unsuccessful idea (see Appendix 2). All schemes were upgraded to electronic at some stage and use a national tag system. This is similar to Italy where a similar national system is under operation. Regarding overall implementation, the schemes were introduced using similar networks of organisations. These scheme implementation networks were dominated by local authorities – councils and road administrations - with users and other actors having little or no influence. This authoritative way of implementation in Norway, combined with political consensus on the use of charging, was probably the reason for the quick and trouble free introduction of the schemes. The authoritative approach also helps explain for the fact that, until now, public acceptability has failed to improve, as shown in research by Odeck and Bråthen (1997; 2002)[1]. The next step for the Norwegian schemes, which have been in operation for quite a few years, is to make the transition from raising revenue to demand management.

3.2 Access Control in Italy

Italy has a long tradition of toll roads (motorways, tunnels and bridges) even though this did not extent to the urban road network. Among growing efforts to reduce the serious pollution caused by congested traffic, some Italian municipalities explored access control in Limited Traffic Zones (LTZ)[2]. These controlled zones usually cover the historic city centres. Only residents of the area and a limited number of permit holders are allowed to access the zones. The city of Bologna pioneered the policy in the mid/late 1980's, and despite initial difficulties, this prompted a widespread adoption of the measure. In other towns and cities, the policy is gradually evolving to a hybrid form of road pricing by requesting LTZ permit holders to pay an annual fee. To achieve this, a directive (known as "D.L. 285/92" in Italy) was introduced, that allows Municipalities to charge motor vehicles a fee when entering or circulating inside the LTZ. A presidential decree (250/99) approved the installation and operation of automatic access control systems in historic centres and LTZs. The cases of Rome, Genoa and Bologna (explained in more detail in Appendix 2) record the experiments carried out in these two cities in order to establish the political and public acceptability required to implement a full-scale scheme and the technological advances from the early manual access control to the modern electronic on-board transponders (Ieromonachou *et al.*, 2006b).

The Italian cases dealt with two policies, Zone Access Control (ZAC) through permits and through pricing. Essentially both policies were addressing the same problem, the introduction of the pricing factor in the ZAC schemes renewed opposition to the car restrictions. Bologna did not manage to make the transition towards changing to a price based ZAC and the Genoa scheme is struggling with public acceptability and political indecisiveness (see Appendix 2). Only Rome managed to successfully perform the transition. In terms of design, the Italian schemes were largely similar. A distinctive aspect was the importance given to the environmental protection of the historic centres of the cities and their inhabitants through the removal of traffic congestion. Regarding implementation, the Italian schemes had similarities to London in the sense that they tried to collect power under one public agency (i.e. TfL in London and STA[3] in Rome), and distance themselves from politics. In many cases in Italy, politics shift rapidly and along with them the people who control the public bodies leading to instability in the support for the schemes.

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[1] There was an initial improvement in public acceptability but this fluctuated during the years and stabilised somewhere above 50% in most cases. In Trondheim, the introduction of inter-zone charging increased opposition (Langmyhr, 2001).

[2] In Italian*: ZTL (Zona a Traffico Limitato)*

[3] Societá Trasporti Automobilistici – Rome's Mobility Agency

3.3 Road User Charging in the UK

Road user charging had been proposed in the UK several times since the Smeed report (1964), but there were no serious attempts to practically introduce the policy, with exception a trial in the city of Cambridge in the early 1990s. For a number of reasons, most notably the lack of political support and not least because of the proposed "congestion" technology, the Cambridge scheme failed to progress beyond the field trial (Ison, 2004). Legislation for road pricing measures in the UK has been encouraged in recent years through the Transport White paper 'A New Deal for Transport: Better for Everyone' (DETR, 1998a) and the following daughter document – 'Breaking the Logjam' (DETR, 1998b). The 2000 Transport Act (HMG, 2000) contains powers for English and Welsh local authorities to introduce 'road user charging' schemes provided they form part of an integrated transport plan. The legislation allowing for the implementation of congestion charging in Central London was made available earlier under the Greater London Authority Act (HMG, 1999).

The three British road pricing schemes referred to in this paper (see Appendix 2) are very contrasting in size and process of implementation. London is a vast city but the charging area is comparatively small and contains only 2% of the population. Durham is a small city but few reside in the small access controlled area. Edinburgh is a medium-sized city but the authorities had envisaged to include all of it in the double cordoned area. The other contrast is in legislation. Implementation of the schemes was initiated from three different sets of legislation: In London the Greater London Authority Act of 1999, in Durham the Transport Act 2000 and Edinburgh from the 2001 Scottish Transport Act.

In terms of design they were three entirely different schemes. London, despite being called a congestion charging scheme in fact operates as an area based charging scheme. The London scheme "*does not charge motorists according to the distance traveled, nor is the charge varied with differing levels of congestion. Nevertheless, the London scheme does appear to have achieved its objectives*" (Glaister and Graham, 2004). Durham operates as a single road restriction resembling an urban road toll and perhaps should rightfully be called a road access charge. Edinburgh's congestion charging scheme would have operated as a double cordon, similar to a Norwegian urban toll scheme. In terms of implementation there were also differences that had a direct effect on the schemes' outcome. In London, charging powers are vested in the Mayor who exercises these powers through the Greater London Authority and Transport for London (TfL). The whole management process of the congestion charging scheme is coordinated from within the TfL organisation, under Mayor Ken Livingstone. In Durham the situation was different. There was no single named person leading the scheme or anything like London's concentration of power. Instead, a group was formed that went beyond the council level to include local stakeholders. Edinburgh did not succeed in creating the necessary alliances between the adjoining authorities in the public sector and failed to secure a consensus among the political parties before any decisions were made. Whereas the management of the scheme indicated that consultations were carried out and these had an effect upon the scheme design, they were proved wrong by the results of the referendum. A range of issues was responsible for the way Edinburgh's residents voted in the referendum, but most importantly people's perceptions on issues of fairness and taxation (Saunders, 2005).

4. Key implementation factors from Norway, Italy and Britain

Road pricing is a complex market based instrument and its implementation does not depend on a single issue. This section details a number of these critical factors relating to the implementation of road pricing. The factors cannot be considered complete as each scheme can bring in its own complexity, but they represent areas of concern identified in previous research by the author (Ieromonachou, 2005). Other studies have also identified important issues concerning the implementation of road pricing based on scenarios (Glaister and Graham, 2005) and game theory (Levinson, 2005) or implementation steps (Ison and Rye, 2005). Some relate to the factors presented in this paper, but do not concentrate on a network based analysis. Table 2 in Appendix 1 lists lessons derived from each city referred to in the paper and based on the critical factors. Below, a brief analysis explains each of the six factors.

4.1 Partner-Actor Networks

Around any policy measure are networks of affected groups – businesses, interest groups, neighbouring local authorities and local residents. These seek to influence or be part of the policy development process. The active involvement of such groups in policy development and implementation is seen as essential (Gillingwater and Ison, 2003). Glaister et al., (1998, p10) emphasised that:

> "…anyone with an interest in transport policy who wants to exercise an effective influence in that process needs to understand who the actors are, how they relate to one another, what powers they exercise and what constraints they face".

In this paper, a categorisation of such 'stakeholders'[4] has been adopted, developed in earlier work by the author (Ieromonachou, 2005) and based on innovation management studies (Hoogma *et al.*, 2002; Geels, 2002; Potter, 1999; Rothwell, 1992; Schot and Rip, 1996). A distinction has been made between two groups: (a) the partners, those actively involved in the planning, implementation and operation of a scheme, and (b) the actors, users and other groups that were affected by the measure and may have been indirectly involved in the decision-making process. In almost all cases, the leading Partner (or project manager) has been the Local Authorities, represented either by a strong champion or group. The first stage of the analysis is to identify the Partner-Actor network for developing and implementing a policy initiative. A network of partners and actors was apparent in all the investigated cases,

[4] The term 'stakeholder' is used here to mean any affected group. More restricted meanings are sometimes used (e.g. by TfL to mean only "corporate" interested bodies.)

but the level of involvement of each group differed in each project. All cases required a wide partner network to implement their respective schemes and this involved a complex project planning system. Even in the case of London where the key partner appears to be TfL headed by the Mayor, there were a large number of groups working for this and they were all grouped under the aegis of TfL.[5] The importance of particular relationships in each Partner-Actor network varied with the institutional context in which they were placed. It cannot be generically said that a certain set of links were more important than others. An important aspect of the analysis is that this context (regional context) is mapped and from this an understanding of key relationships emerges.

The initial purpose of the Norwegian schemes was to finance additional roads and road users were familiar with tolling schemes. This helps to explain why the Norwegian networks concentrated on political and technical authorities. There was no initial perceived need for user learning. This situation means that the Norwegian network relationships cannot simply be replicated in another country. In each city/case the implementation network was different but the core structure did not vary considerably. All three projects began operation within a five-year period. The planning and decision making stages followed the 'Norwegian' framework. Oslo and Trondheim followed Bergen's example in most procedures with the only exception being the electronic toll collection systems they introduced. Trondheim went on to produce zones within the tolled area with time-differentiated toll fees and thus the system came to more closely resemble a road-pricing scheme. Inter zone charging increased opposition but was not the main factor that led to the end of the Trondheim scheme. This modification to the scheme remained in place until December 2005 when the scheme officially ended. Politicians insisted to end the scheme, keeping in line with the promise made that any toll project would not run for more than 15 years. In this way they enhanced public trust in future political promises.

The Italian schemes had initial networks of partners in place. The networks were partly established through the introduction of the earlier Access Control schemes. In the rather politically volatile Italian context, the important relationships centred on the creation of a powerful bureaucratic institution (e.g. Rome's STA) that could promote mobility solutions despite shifting political support. This resulted in a complicated set of connections between the various stakeholders and beneficiaries.

The UK schemes started with no user familiarity with road user charges and also sought to cut traffic flows. This combination required a wider partner/actor network and thus the project planning system and network had to be largely created anew. Durham did try initially to introduce Access Control using a very restricted partner network but that failed. Later, Durham identified and empowered a wide range of community stakeholders, developing relationships with them and drawing them in to become partners to the scheme. The way in which the County Council also promoted actors in the scheme into partners was

[5] Boroughs are not part if TfL but are highway authority for much of the London road network; furthermore, the Underground remained under Government control until the PPP was finalised.

probably one of the most interesting and important factors. The scheme therefore was protected by a network of partners and actors that wanted a solution of the problem that existed in the area. As it would be expected, the London Congestion Charging scheme required a great number of stakeholders to be involved in its planning, implementation and management operations. It appears that not many seemed involved due to the fact that the Mayor and Transport for London (TfL) combined the majority of the most essential partners that invested in the scheme. London had all vital partners grouped under the aegis of one 'lead player', TfL although the London Boroughs remained independent and some have been the focus of opposition. Despite a niche being created in urban road pricing policies by the London and Durham schemes, the Edinburgh project failed to get past the design stage. The majority of the voters in Edinburgh failed to accept the importance of the policy in reducing the use of private vehicles in the city and the potential benefits it would have brought to their overall mobility. The politicians were not close to the population to understand their needs.

4.2 Project champion

Where projects involve complex systems of partners and actors, the management process needs a mechanism to provide focus and drive. This is particularly so for innovative projects involving the creation of new networks. This role is one that can be filled by project champions - charismatic individuals that spearhead projects. Support of politicians is vital to the introduction of any road-pricing scheme whether a charismatic project champion exists or not. The project champion emerges as a critical part of the process of getting the charging system into place.

All schemes examined had some type of champion figure or change agent but this varied, with the role being an individual (London, Bergen) or a coalition (Rome, Genoa) or community group (Durham). In some places (like London) the champions held special places (such as a government office) and their personal motivation could have linked to motives beyond the scope of transport policy. By contrast, in Edinburgh "no independent champion of the scheme, political or not political, emerged to build support" (Saunders, 2005).

4.3 Expectations – Motivations

It is interesting to find how the expectations of different partners and actors gradually become aligned and, for this to happen, a shift in expectations would have occurred. The next stage in the analysis is to explore the motivations and the extent to which the different expectations of partners and actors come together. Many of the parties taking part bring their own notions, values and beliefs with them, which may be summarised as their motivations. When examined, motivations help explain why each group became involved in a road pricing scheme in the first place and the amount of commitment they have towards it. Sometimes motivations are very obvious and in some cases they develop or evolve during the various scheme phases. Motivations are intrinsically linked to the expected outcome of the scheme. These expectations of partners and actors are useful to analyse for many reasons. A real danger sign is where a scheme involves partner and actors who have very different expectations and conflicting motivations.

It is of note that behind the transport reasons for the road pricing schemes referred to in this paper there were deeper motivations than simply transport policy. For example, protection of historical buildings was of great importance in Rome, and Genoa as well as Durham and Edinburgh. Historical heritage is a sensitive issue for many cities in Italy, more so in Rome where the LTZ covers most of the ancient city and therefore protection from pollution becomes necessary. In London the main motivation was the economic cost of congestion and the direct transport benefits. Tapping into the core motivation of key actor groups is therefore important.

In Durham, groups that would otherwise be seen as actors in the scheme were brought in the network as partners. They were given responsibilities and thus were able to voice their concerns and have more control over working through their motivations and exploring expectations.

4.4 Protection measures

These are complementary actions benefiting users to support road pricing policies. The author in a previous project (Ieromonachou, 2005) has categorised protection measures into two forms: (a) *Enhancement Protection*, which are actions that enhance the effect of road pricing (like the provision of extra public transport capacity to facilitate modal shift from car, subsidies to reduce public transport ticket prices, reallocating road space for pedestrians and bicycles etc.); (b) *Compensation Protection*, where there are full or part exemptions from charges for certain groups of users, for social or transport policy reasons. Typically the latter include buses, taxis, disabled drivers and local residents.

Both types of protection measures are particularly needed for innovative or unfamiliar policy measures and are closely related to the level of acceptance achieved (considered below). Enhancement Protection measures featured strongly in the London and Durham schemes. These were therefore an inherent part of both schemes. A major part of enhancement protection in London was enhancing public transport services and the London experience shows how much can be accomplished in a relatively short amount of time and with relatively low capital (i.e. extra 300 buses). Durham also introduced the Cathedral bus service to provide alternative access to the charging area.

One contrast with the Italian road pricing schemes is a lesser need for Enhancement Protection measures. This seems to be because they did not have to further improve their public transport system as it was already highly developed and under heavy subsidy. They did, however, introduce electric scooter hire. For Compensation Protection, actions were more similar. In both Italy and the UK there were exemptions for buses, taxis, residents, accessibility groups and some other public services.

Protection measures only emerged in Norway as the policy focus shifted from funding road building to funding alternative modes. Some protection measures for particular key groups (like retail) could also be crucial in winning widespread support, rather than reluctant acceptance. In one Norwegian city (Trondheim) retail protection was provided by development control, whereby retail developments outside the city centre were not permitted, and also by using some funds from the charge to enhance the retail environment of the city centre (Ieromonachou et al., 2005). In London, there has been some concern about the impacts of the congestion charge in retailing, yet early indications show very little retail displacement beyond the charge zone.

4.5 Network Learning

Successful development of a specific policy niche depends on the local level of innovation processes and stakeholders behaviour. If the innovations (in this case road pricing policies) are successful, then the niche they create will become known and may be adopted more widely. Niche development can be evaluated by the level of learning and the level of institutional embedding. Hoogma et al. (2002, p.28) appreciate the learning that occurs through a range of processes of articulating “relevant technology, market and other properties” but enhance this notion by suggesting that a second-order learning is required for niche development to result in a regime shift. This form of learning will involve a co-evolutionary learning (Wynne, 1995) that will draw in the partners and actors involved in the scheme but also third parties like governments that can help in the institutional and societal embedding. Learning processes need to extend beyond the immediate local network of stakeholders. This is where the wider issue arises of what contributes to acceptance of a policy measure.

Each of the cities referred to in the paper used incremental processes but in different ways. All the successful schemes have used an incremental approach with flexibility to experiment and adapt. As the process unfolds, many of the barriers would be (or in effect be seen) as less dramatic. Radical policies require a relatively un-complicated start and a pre-defined ‘test’ phase that would allow for problems like political and public acceptability to gradually normalise. Even London, a case praised for its “courage and rapid execution” (Grush, 2005), used incremental processes. This refers firstly to the initial choice of ANPR (automated number plate recognition) as enforcement technology which was expensive but it constituted tested technology that could easily and quickly be put in place in time for the proposed start date. After the scheme was established, experiments started with GPS (global positioning system). An incremental evolution in the technology path could easily follow a successful scheme, a similar situation like the one observed in Norway, with the substitution of manual toll booths with the electronic AutoPass system. Secondly, a relatively small area was chosen for the initial charging zone for reasons of cost and technical feasibility. An incremental approach has emerged with the expansions of the zone – expected in 2008 – which builds on existing experience and network learning.

An important part of learning by the network of partners and actors involves understanding user needs and attitudes towards policy measures such as road pricing. The actor/partner network's assessment of user attitudes has, of course, already influenced them through the factors of expectations/motivations and has been reflected in the design of protection measures. However, this is indirect and therefore a separate category is viewed as necessary taking the user perspective of the policy.

4.6 User Learning/Acceptance

A number of studies took place in order to establish the social aspects and acceptability of transport pricing policies in the UK (Jones, 1998; Preston et al, 2000; Rajé, 2003). In the UK, Ison (2000) found that approximately 80% of surveyed people viewed urban road pricing as being publicly unacceptable. This point was supported by findings from an RAC study (2002) that 83% of motorists would find it very difficult to adjust to a lifestyle without the car. The same report argues that most would find road tolls acceptable if there were equivalent reductions in fuel duty or as part of a package for better roads, public transport and traffic management. The TransPrice project (TransPrice, 1999) concluded that the lack of political willingness to implement charging measures stems from the electorate's perceived low acceptability for such measures. Other studies showed the acceptability of road pricing depends upon perceived benefits and the justification given for the development of such a programme in the selected area (Jones, 1998; Schade & Schlag 2003). This links in to the motivation/expectation and protection measures. It is clearly important to take into consideration both in the design and implementation of the scheme the views that arise within the general public. Acceptability needs to be considered seriously by implementers and government officials. The public still has little knowledge of the possibilities of pricing policies as solutions to traffic congestion over other policies.

Incremental approaches permit learning and enhance understanding and acceptance. The UK and Italian schemes started from different user experiences. In Italy, road pricing existed in the form of tolled motorways and urban road pricing is an extension of an accepted practice, city centre access control. In the UK there was little experience of road charges or even city centre access control zones, which meant that the London and Durham schemes involved something entirely new. In all cases, acceptance of road pricing required a widespread acceptance that it was needed to address an accepted problem. In London and Durham it was congestion; in Norway, this was initially road financing, and later financing public transport and other environmental improvements. It is essential that the charging scheme is seen as a solution to an accepted problem. In Edinburgh, people that voted against the proposed scheme considered that congestion was not a big problem.

In the Norwegian context, Odeck and Bråthen (2002) noted that other key acceptability points should include higher levels of information and marketing to the public, a strong link between the revenue use and transport upgrade (while making sure that the public perceives things happening as soon as charges are collected), and ensuring that the information is transformed into stronger public confidence. A road pricing policy needs to be introduced incrementally to facilitate learning, with complementary protection measures that support the learning process. The policy needs to be flexible, so that it can then be adapted and, if failing, rejected.

There are many difficulties when introducing a radical transport scheme like road user charging. There are always a number of technical difficulties but however complex such issues may be, they rarely compare with the social barriers linked with such a process (Langmyhr, 1997). Dealing with all the diverse opinions of the different stakeholders, users or affected groups and most importantly finding the way to win the support of the majority of the public can be made easier if the project is explained and the benefits of such a venture are clearly identified. Improvements to transport (private and public) prior to the charging would benefit the image of the scheme as performing well.

The success of both the London scheme and Ken Livingstone's re-election revived the Government's interest in road pricing. This led to the rapid development of proposals for a national congestion charging scheme, preceded by local trials financed under the Transport Innovation Fund (TIF). Yet in practice, many politicians see the London experience as exceptional and identify more closely with the politically damaging outcomes in Edinburgh. The issue of user learning and acceptance, and the need for implementation processes that facilitate this, is therefore as important as ever.

5. The 'Stoneford' Congestion Charging scheme

To avoid association with a real place, this paper uses a hypothetical city, namely Stoneford, to discuss some issues relating to the possible implementation of the next congestion charging scheme in Britain. For a road pricing scheme to be implemented there needs to be an understanding of the transport situation in the local environment. Particularly in the case of a congestion charging scheme, whereas the price will depend on the severity of the traffic congestion, there needs to be an acceptance in Stoneford that traffic levels are severe. Elliot (1986, p. 153) states that proposals can fail because congestion has not yet become unbearable. This is a sensitive issue as the severity also depends on local perceptions of congestion. Such issues are dealt better if there is political decisiveness and stability. The cases of Cambridge (Ison, 1998) and Edinburgh more recently (Saunders, 2005) show that schemes may fail to advance because of changes in the local political character. In Edinburgh, although Labour retained control, the loss of Labour seats on the Council and in the Parliament was attributed to the charging proposals, at least in part but not necessarily correctly, and was thought to have caused the Council to opt for the referendum, which the law did not require.

Road pricing in its various forms is a very difficult policy to implement. The factors presented in this paper highlight critical issues in a scheme but at the same time do not provide solutions. The factors were identified in a retrospective analysis of cases in three European countries, including Britain. By using the factors to extract useful lessons for potential road pricing schemes it does not mean they can be used as a mechanical process to promise success. But, using the factor analysis could be useful when exploring what a scheme needs to cover.

Partner – Actor Networks:

Partner networks with wide and complex interrelationships are a necessity when implementing radical policies that require a complex project planning system.

The network of Partners in Stoneford would need to include the Local Authorities and the major stakeholders of the area. They, in turn, would need to cooperate with the group of actors in the area: users, environmental, motoring and accessibility groups as well as major land owners and businesses. The last two groups in particular could be empowered to take up the role of Partners, strengthening the network. In terms of implementation, there is a need for a clear strategy and objectives. The network responsible for the implementation in Stoneford need to be clear about the reasons for implementation of the congestion charging scheme, keep a clear communication with all interested parties and state clear objectives about the operation and the use of revenue. The use of the revenue to improve public transport generally improves acceptance when introduced simultaneously. Stoneford's implementation and management network would need to deliver what they promise. A final note that Stoneford must keep in mind is that networks involved in demand management schemes, such as congestion charging, need to be sustained throughout the operation of the project – this is a big difference with other more conventional transport policies.

Project champion:

A project champion can stimulate the learning and acceptance process.

The project implementation in Stoneford should be spearheaded by a champion or 'policy entrepreneur' (Fauth *et al.*, 1978), to advance the concept and seek support. The champion will be a vital part of the network for implementation of Stoneford's congestion charging scheme. Whether it will be a charismatic individual, such as it was the case in London, or community group (Durham) or a powerful agency (Rome), will be decided on local contextual grounds although the presence of a clear figurehead is advantageous in all cases. The role of the champion however would still be the same, which is to bridge differences within the complex and diversely motivated group of partners as well as seen as a leading factor and as a guarantee for promises made to the various actors in Stoneford affected by the policy.

Expectations - Motivations:

Motivations of stakeholders are intrinsically linked to the expected outcome of the scheme.

The role of the partner/actor network in the implementation of the Stoneford scheme is undoubtedly of paramount importance, but this role cannot be fulfilled if the partners do not work in alliance. In order to do so it will be necessary to align the expectations of each partner with the scheme's goal. It is understandable that when joining the scheme the partners will have different motivations from the root motivation but for improving the efficiency of the network and the acceptance by the actors they will have to work with a common vision. There is a need to promote the Stoneford scheme, to make the influential partners buy in – it's important to firstly get them on board because this will show to other partners as well as actors that important organisations support congestion charging. To maintain momentum, it is also important to deliver on promises that match the expectations of the various network groups.

Protection Measures:

Protection measures to support the road pricing policies were needed most where demand management was involved.

A key point emerging from the analysis of the case studies is the distinction between enhancement protection (complementary measures to make a RP scheme work better) and compensation protection (exemptions or reductions in the charge based on user need). A congestion charging scheme inevitably raises concerns about inequity between users and Stoneford's local media will not treat this point lightly. The media have concentrated upon this during the planning and implementation of schemes in Britain (LTT, 2005; Ryley, 2005). This relates to compensation protection. The provision of exemptions could be seen as counteracting the notion of road pricing but in fact acts as a balance for users with social needs, residents and emergency services.

Enhancement protection is often viewed separately, in terms of providing adequate public transport to allow modal shift from private vehicles. However, public transport improvements are also part of the solution to equity issues. The cases also show that Stoneford should not fall into the trap of proving or promising an expensive or inflexible enhancement to public transport. In practice, people respond to road pricing in a variety of ways and a flexible provision of additional public transport capacity is needed. London's pragmatic approach of additional bus capacity was really more appropriate than Oslo's tram. Stoneford should therefore provide a mix of alternative transport that provides flexibility. However, that does not exclude innovation, and schemes such as bike, scooter and car share could feature as well as enhancing bus services. Stoneford's local public transport providers would form an inherent part of the network as they will not only be responsible for the introduction of the scheme but also it's maintenance.

Network Learning:

Incremental processes permit learning and enhance understanding and acceptance.

The network of partners in Stoneford would need to learn many things. Firstly they should learn to build confidence in the charging measure they are implementing. Congestion charging is not a technical exercise, it is a political process; the network needs to learn their role. Incremental processes help in allowing time for learning – learning between partners and learning from partners to actors. Flexibility allows space for adaptation. Rigid boundaries in either network relations or expectations/motivations do not work well. Networks also need to learn how to 'behave' politically. This involves sensitive issues such as revenue spending and learning how to deal with the media. Stoneford's scheme choice, e.g. congestion charging, cordon charging, would need to be enforced with the appropriate technology. Experience from most schemes, including the one in London, suggests that the technology is not an issue for concern as most technical problems are more or less sorted. However, the type of technology used could affect acceptance in various ways. Firstly it could raise concerns regarding user privacy. Secondly, highly advanced systems are usually more expensive and this could be used as a negative factor. Thirdly, the complexity of the system could create unexpected problems. The case of Norway, where control and payment progressed from a manual to an electronic system over a number of years and trials could help the Stoneford authorities reach a decision.

User Learning/Acceptance:

The social and political acceptance of road pricing by users, plays a central role in the feasibility of implementing a road-pricing programme.

By empowering the users in Stoneford learning can be enhanced both ways – within the network and between partners. This can be achieved in many ways. One way is through experimentation and feedback. Experimentation improves acceptance because it helps understanding. Not all cases referred to in the paper used this but in those cases it was not necessary because of the presence of a strong central figure (i.e. Ken Livingstone in London), or the authoritative approach of the Norwegian Public Roads Administration. Stoneford should not look for optimal levels of acceptance as there do not seem to be any. Instead they should aim for an 'appropriate' level of acceptance, one that enables a smooth implementation process which at the same time allows for improvement.

6. Recent UK Transport Policy

The list of factors affecting the introduction of controversial and difficult to implement schemes can never become exhaustive. To further understand the reasons responsible for the introduction of road pricing schemes in Britain and the subsequent 'stalemate' that has been reached, a brief overview of recent transport policy issues is necessary.

The current Government, after the success in the 1997 general election, published the consultation document '*Developing an Integrated Transport Policy*' that had little impact as it basically reiterated the goals set by the previous administration. This was followed by the 1998 White Paper (DETR, 1998) which was the first transport White Paper in 20 years (Goodwin, 2003). This document "*influenced policy and research and geared them towards the idea of an integrated transport system*" (Hine and Preston, 2003). Policy moved towards reducing car use and increasing alternatives, including public transport, cycling and walking.

New powers were proposed for local authorities to improve public transport services and encourage more sustainable modes of travel. The Greater London Authority Act and Transport Act (HMG, 1999; 2000) enacted the White Paper proposals, including provision for road user charging (RUC) and work-place parking levy (WPPL) schemes to be introduced by local authorities. Road user charging could have a role to play in reducing overall demand and the Royal Commission on Environmental Pollution (RCEP) concluded since 1994 (and also in 1997) that RUC could help reduce the dominance of motor traffic if local authorities were given powers to introduce RUC in their own areas.

Right after the publication of the Transport Act 2000, the fuel protests in September caused the removal of the fuel duty escalator, an important part of the transport policy until then. "All attempts to rebalance the cost of car use and public transport - a policy of successive Conservative and Labour governments for ten years - ceased from that point on" (Potter, 2004). The first instalment of *'Transport 2010: The 10-Year Plan for Transport'*, started the shift of the policy back to road construction, with around £60 billion allocated to roads over 10 years. The 'second' 10-Year Plan came in 2002 when the government published a progress report on the 10 Year Transport Plan. In this report it was admitted that congestion-cutting targets set out in the first plan were not going to be reached. Unforeseen economic growth and an unwillingness of local governments to implement congestion charging schemes were blamed for the failure to stay on target.

The 2004 White Paper on Transport, 'The Future of Transport: A Network for 2030', appeared as supporting a national road pricing scheme but did not set any firm time limits or reassurances about the technological feasibility of such a scheme. A national scheme was 'reassuringly' set aside for the next 15 years, therefore removing it from a current political focus. However, at the same time as the White Paper was being published, another document emerged which constituted a comprehensive study on road pricing and how it could help make better use of the road capacity. The Road Pricing Feasibility Study (DfT, 2004c) explained the reason for the time scale of the national road pricing scheme as being the need to develop the appropriate technology which was not expected to be available until at least 2014. Moreover, in its chapter six the report suggests that undertaking forms of road pricing on a more limited scale would improve knowledge on the effects and benefits of pricing. Support for these local schemes could come from the Transport Innovation Fund (TIF) which a following year report outlined (DfT, 2005). The TIF offered support for packages which combine demand management (including radical schemes like road pricing) with measures to promote modal shift and better bus services but, the first TIF money would be made available from 2008/9.

A need for change

The car has evolved from an expensive luxury for a few to become an important tool for the everyday lives and employment of the majority of people, a status symbol and a hobby. Increased use of private vehicles has not only brought benefits. For many years congestion was little more than a localised problem. Today it has become endemic, not just for major cities but even in many rural regions. Associated with traffic congestion, are the related problems of air pollution, emissions of CO_2 and other greenhouse gases, together with more subtle lifestyle effects, such as contributing to less healthy lifestyles and transport poverty (Ieromonachou et al., 2006b). Other academics have reported thoroughly the unsustainability of current transport practices (Bannister, 2004; Whitelegg, 1993).

The current government has made many steps in "*rejecting the myth of the great car economy*" (Docherty and Shaw, 2003) but the performance of their policies has been viewed as somewhat disappointing. Car use continues to grow, car-reducing policies such as road pricing as well as alternative travel modes are not promoted adequately, and large-scale road building projects are slowly appearing again. With the large parliamentary majorities (for their first two terms of office) the current administration could have taken some bold decisions and promoted some promising but controversial car-reduction policies. With their performance, they will appear not too substantially different from the previous government.

It has been said often, but apparently not often enough, that "*in transport things cannot go on as they have before*" (Glaister, 2001; Docherty and Shaw, 2003). A move from the 'predict and provide' transport policy to a demand-management, multi-modal, environmentally and socially sustainable approach was never expected to be easy. A fundamental shift in transport policy was pledged in the pre-election campaign of 1997. But the problem is that the Government backed out too easily from its original promises, as many academics agree (Docherty, 2003; Goodwin, 2003; Potter, 2001), and that it has fallen well short of the integrated transport aspirations expressed in the 1998 White Paper even by the time the 10 year Plan was issued in 2000.

7. Moving forward

When might we see congestion charging in British cities outside London? This review of UK and international experience indicates that the key to this is the decision making and planning part of the overall implementation process. The role of transport professionals is not just implementation in the old sense – i.e. building roads – but implementation in a new sense of being fully involved in decision making and planning. Most professionals know this, but perhaps do not appreciate the different nature of the tasks involved and the skills needed. Part of this new role is for them to become more involved in the upstream process, the process prior to the implementation of measures.

From the road pricing cases referred to in this paper, and from which the guidelines for Stoneford have been derived, some key issues seem recurring. These key issues concern: the importance of consensus in the level of congestion or perception of congestion; the choice of scheme; the need for transparency in the project implementation and management as well as the use of revenue; the importance of local politics and network alliances in attaining acceptance for the scheme. The brief presentation of these issues cannot be considered a recipe for success as it cannot form an exhaustive discussion on the subject. To aid understanding, the issues have been grouped under six factors that appear to capture the basic structure of a road pricing implementation process. The list of factors is only a partial list but which includes the most important areas emerging from the analysis of the cases. Each factor when analysed separately would expand to a new list of key points crucial to the upstream process.

Overall, the use of the factors to analyse the European road pricing schemes has helped to go beyond simply identifying basic similarities and contrasts. The discussion has highlighted a number of key issues in the process leading up to and implementing this radical traffic control measure. Where there have been differences, the factors have helped to identify why these key issues occurred and how they have contributed to the success (or not) of each city's scheme. In summary, possible key factors to consider are:

- Managing the partner network for implementing a road pricing scheme can be a complex task. This can involve new skills and tasks than are normally involved in more traditional local transport measures;
- Radical policies need a champion to spearhead their implementation, but champions can take many forms;
- Identifying and understanding core motivations of actors that the measure could support - these may only be indirectly related to transport (e.g. cultural image, economic impacts, prestige, well being etc.);
- Extending beyond the partner network to the actor network that provides support for a road pricing scheme. Understanding, informing and empowering actor groups is important for winning widespread acceptability;
- Learning occurs at many levels and in many ways. However, it is important for a new scheme to build on existing processes and measures to promote learning. If possible, build on what is already known, in terms of understanding, motivations and experience, rather than trying to get people and organisations to do something totally new. Incremental advances can be made in many different ways.

What this paper has shown is that solutions are very much contextual issues. Most places in the UK and especially rural areas do not experience London's levels of traffic. Findings from the cases show that recognition of the problem is vital as well as incremental implementation. Avoiding this incremental implementation and jumping straight to a national scheme in 10 to 15 years does not register as good practice. The paper also suggests it would be better to continue to provide a back-up to local schemes first, so there is a spread of the urban road pricing niche and gradual acceptance of the policy at the local level so that combined with tolled roads and charging in urban centres the transition would become easier.

It requires work from system builders and project champions. The overall process involves the change of users' attitudes and institutional structures and requires, apart from time, planning. As seen from the cases analysed in this paper, users' response to proposed measures plays an important role in the final outcome of the project. In many cases, management (partners) were the main driving force for introducing a measure but users and other groups (actors) had an active role in the shaping of a measure. However, despite the efforts of local authorities and their networks, it remains crucial for the central government to remain active on the measure. Glaister *et al*. (1998) judge that: "*Transport policy is not a technical issue which can be debated and decided between experts. It has been and remains a political decision*".

The announcement in June 2005 for a National Road Pricing Scheme combined with the 2004 White Paper on transport (DfT, 2004), marks a shift in the approach to local road pricing measures. The previous policy was to provide enabling powers for local authorities to introduce RUC (DETR 1998a, 1998b). The new policy is for a radical, nationwide scheme. There is a danger that this will not permit a gradual adaptation, learning and user understanding that this paper has shown to be so crucial for the successful implementation of local schemes. The paper suggests that phased measures (in the form of local urban schemes) would be crucial as 'stepping stones' towards the countrywide solution, a view supported in the announcement by the Government of the Transport Innovation Fund to support such ventures. The TIF schemes, made known a year after the plans for an eventual national congestion charge, could possibly provide stepping stones to such learning. The formation of local policy niches would help in building up people's (both partners and actors) knowledge, experience and understanding of road pricing. But it is also important to contain all the important elements for learning that have been vital in previous successful schemes.

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Appendix 1

Table 1: Some key characteristics of the 9 cities

	Bergen	Oslo	Trondheim	Durham	London	Edinburgh[6]	Bologna	Rome	Genoa
City population	227 000	456 000	147 000	85 000	7 500 000	445 000	400 000	2 800 000	622 000
Percentage living inside charged area	10	50	40	< 0.1	2	~ 100	15 (estimate)	1.5	-
Starting date	Jan 1986	Feb 1990	Oct 1991	Oct 2002	Feb 2003	2006 (planned)	1989 on-off and on from spring 2005	Oct 2001	March-August 2003
Charging Area (km2)	18 (estimate)	64	35 (estimate)	0.35 (estimate)	21	Inner: - Outer: -	4.5	5.5	1 (test area)
Number of toll stations/ control points	7	19	23	1	174	-	9	23	6
Entry charge for a small vehicle	10 NOK (£0.9 GBP)	20 NOK (£1.8 GBP)	15 NOK (£0.14 GBP)	£2 GBP	£5 GBP	£2 GBP (planned)	Permit based	~ €1.2 (daily) €340 (£233) (Annual permit)	€1.5 (£1.03)
Charging period	Mon - Fri 6am – 10pm	All days, all hours	Mon – Fri 6am – 5pm	Mon - Sat 10am – 4pm	Mon - Fri 7am – 6.30pm	Mon - Fri, 7am – 6.30pm Outer: 7 - 10am & 4 - 6.30pm	Sun - Fri 7 am - 8 pm	Mon – Fri 6.30 am – 6 pm Sat 2 pm – 6 pm	Mon – Fri 6.30 am – 6 pm
Average daily crossings during charging hours	73 000	244 000	71 000	239	205 000	-	46 000	70 000	47 000
Annual gross revenue (millions)	70 NOK (£6 GBP)	880 NOK (£75 GBP)	126 NOK (£10.7 GBP)	£0.05 GBP	£80 GBP (2004 estimate)	-	n/a	€8.5 (£5.8 GBP)	€1.72 (£1.18 GBP) (predicted)

[6] Data for Edinburgh were the ones proposed in case of implementation.

Table 2: The analytical framework showing key points for each case referred to in the paper

	Bergen	Oslo	Trondheim	Bologna	Rome	Genoa	Durham	London	Edinburgh
Partner-Actor Network	-Authoritative, Institutional -Partner emphasis – Actors not consulted			-Political differences split the network	-Strength of STA Roma	-Conflicting interests	-Actors empowered and made Partners	-TfL was the main Partner headed by the Mayor	-Good network building -Actors not consulted
Project champion	Arild Egen – good networker, acted as a catalyst for quick implementation	-After success in Bergen was not important	-Following the other schemes	-Champion avoidance	-Lack of apparent/ named champion	-Political indecisiven ess	Transport Steering Group -Institutional/group champion	Ken Livingstone -power? Strong claims by the champion	Anti-champions -Did not inspire users or gain their confidence
Expectations-Motivations	-Consistent policy (due to power concentration) -Parties reached agreement due to the scheme's importance in funding infrastructure -Aim was to raise revenue, not reduce traffic -Actors expected better new roads			-Less consensus -Dispersed power: need for larger networks to work less stable support larger implementation periods			-Reduce traffic congestion and pedestrian/ vehicle conflict -less radical than pedestrianisation -better environment	-Reduce congestion -Save money/time -Raise money for Public Transport enhancement	-Promise of Trams -Reduce congestion and pollution
Protection measures: (a) Enhancement, (b) Compensation	-Political support both nationally and locally	-Delivered the 'castle tunnel' before toll ring to gain support	(a) Planning regulations against out of town shops	-Architectural protection -New parking systems -Introduction of clean buses and electric cars/scooters and recharging infrastructure -Bundled packages: permits – cheaper P.T.			-exemptions for church and university -community solution -no restriction on access	-Enhanced P.T. and especially buses -Raised fee	-Would have enhanced P.T. and improved environmental conditions
Network learning	-Geo-spatial factors are very strong -If a promise was made for a toll ring duration it should be kept, boosts political credibility			-Political friction and disagreements caused a loss of momentum (and benefits) in the Bologna scheme	-Incremental implementati on was thought necessary and it paid off in the case of Rome	-Too slow implementati on on the other hand and political indecision could cost Genoa the success	-Bigger drop in traffic than expected -Restricted areas work ok -Retail sales have been sustained	-Income too low - cost of scheme too high -Eco-efficiency gains -Buses work -No loss to economy -transport evaporation can happen	-Be cautious with referendums -Don't implement a scheme that is too complex
User learning - Acceptance	-Cost of scheme is acceptable -Payoff for more urban regeneration, P.T. -Opposition is reduced but not considerably – seems to fluctuate -Toll rings still not accepted, main philosophy is revenue raising, seen as yet another tax			-There is no general rule for gaining acceptance but good networking, strong reasons for implementation and obvious benefits do help -Political power can be a help but can also hinder the process			-Solution was provided to a widely accepted problem -Networking helped build trust	-Buses can work but other modes necessary -Tube is still a mess	-What will be the next proposed solution?

Appendix 2

Individual case description

1. Norway

Bergen

Bergen's charging system was unique not only because it was the first Norwegian urban toll scheme but it also involves the smallest in area, lowest number of toll booths and traditionally had the lowest gross revenue of the three biggest Norwegian urban toll schemes. It was the director of the local branch of the National Public Roads Administration (NPRA) that pioneered the initial idea for the urban toll ring in Bergen. Permission from the central government for the operation of the toll ring scheme was given in June 1985 and seven months later, the system was completed. Toll stations were placed on all the main access roads leading to the centre of the city; initially there were six, with another one added later. All vehicles entering the tolled area between 6am to 10pm Monday to Friday, apart from buses, paid the fee. The fee was 5 NOK (€ 0.62)[7] for cars and 10 NOK (€ 1.24) for trucks until 1999 when they were doubled. In 2004 the fee was increased to 15 NOK (€ 1.86) for cars, and 30 NOK (€ 3.72) for trucks, per crossing. Prepaid tickets and monthly, bi-annual and annual permits were also available, at a slightly discounted rate.

The toll fees were designed to raise 35 million NOK (€ 4.34 million) for 1986 traffic levels based on approximately 70,000 vehicles accessing the tolled area per day. Annual revenue proved to be far higher than expected and in 2000 it amounted to almost twice as much, around 70 million NOK (€ 8.68 million). Almost 70% of the income went towards road construction costs, 20% for operating costs and the remaining 10% was put aside in a fund, the use of which was regularly under heated political discussion (Herdlevær and Arnesen, 2003). Operating costs in Bergen were higher than in other Norwegian cities due to the manned tollbooths. Enforcement was through digital video control, with offenders fined 300 NOK (€ 37.2). This manual system remained in place until 1st of February 2004, when a new electronic toll collection (EFC) system was introduced; EFC is carried out by using an on-board unit (OBU) which identifies each vehicle during movement into the charging area at a defined boundary. The OBU system – called AutoPass– was already in place in Trondheim and Oslo since 1991 (Ieromonachou, 2005).

The toll scheme was intended to cease in 2001 but Bergen developed a new programme for transport and city development. To raise the money for the plan, the toll ring was retained. The new transport programme reflected a shift in transport planning. Of the 4 billion NOK (€ 0.5 billion) budget; only 45% would be used for road infrastructure investment and the remaining 55% for city centre 'environmental' improvements. Funding public transport operations was one of the original intentions but there were legal restrictions on what tolls could fund. However, new legislation that promoted the use of congestion pricing measures allowed the revenue to be used for wider purposes, such as building public transport projects (i.e. light rail) and subsidising tickets. The toll scheme was not intended to affect traffic levels, and although there was a small initial drop in traffic (≈ 6-7% overall), the infrastructure built with toll revenue facilitated traffic growth. Motorisation rates also grew rapidly during this time period. Traffic management was carried out not through the tolls, but by controlling the amount and cost of parking spaces in the city centre. Parking charges were 10-20 times as much as the toll fee. This helped lessen traffic within city boundaries over time, whilst overall traffic in the region was increasing 3-5% per year.

Oslo

In February 1990, Oslo followed Bergen's example and implemented a toll ring scheme. Again, the initial objective was mainly to provide funds to enlarge road capacity. Discussions

[7] Exchange rate at time of writing 1 NOK ≈ € 0.124 Euros

for the introduction of the toll ring in Oslo started about 10 years before its implementation. During this time many issues were debated concerning the planning phase, in particular the balance between revenue generation and traffic reduction. Traffic reduction was forfeited, and this was ultimately reflected in the low toll price. Four years before implementation, Oslo City Council and Akershus County Council finally agreed and sought approval from parliament for some type of toll to provide finance for road construction projects, whilst having as little traffic consequences as possible. The toll fee started at 11 NOK (€ 1.36) and currently is at 15 NOK (€ 1.86) per cordon pass, with an AutoPass season ticket being available. At the beginning it was operated manually but this lasted only a few months; since 1991 tolls have been collected electronically. Today over a quarter of a million vehicles drive through the toll cordon every day. Of these, more than 60% pay the tolls electronically through AutoPass tags. During rush hours, 85% of the traffic is recorded using the AutoPass system.

Currently there are 19 operating toll booths located in a ring around the city. Toll stations vary in size according to the corridor that they serve. The toll stations were geo-strategically placed between 3 and 8 km from the city centre solely to maximise revenue. In the first year of operation of the Oslo toll ring scheme, the initial investment of 250million NOK (€ 31 million) was covered by revenue of 750million NOK (€ 93 million). Revenue reached 1,192 million NOK (€ 147.7 million) in 2004, with operational costs being only 10% of the total revenue. Both transport packages for Oslo (OsloPakke 1 & 2, 1990; 2002) dictated that toll funds must be used for investment in road construction or public transport infrastructure and not towards operating costs (e.g. bus subsidies, etc.). The difference with the second transport package (for 2001-2011) was that it dedicated almost all toll revenues to public transport investment.

Trondheim

In 1991, just one year after the introduction of the scheme in Oslo, the third urban toll ring of Norway was implemented in Trondheim - the third largest city of Norway. The project in Trondheim was again primarily a road financing venture but with a different ring design, utilising constant scheme upgrades and the use of more advanced technology, it had a different character. A development plan was discussed for the city's future infrastructure that included not only roads but also pedestrian and cyclist networks and improved public transport. Toll collection was based on a new electronic system and the toll fees were designed to vary for different times of the day with higher fees during rush hours and free entries during the evenings (after 5pm) and at weekends. From 1998, the charging period was extended to 6 pm.

The system came in to operation in October 1991 when Trondheim installed the world's first fully automated toll ring using the AutoPASS system. The variable fees for cars and other light vehicles were collected electronically from 12 toll gates around the city centre. A signal, sent by radar equipment placed in these 'gates' detects the AutoPASS electronic tag mounted on the windshield of passing cars and deducts the appropriate fee from a pre paid account. During rush hours, especially during the morning and afternoon, as the demand for road space increases, so does the price. In Trondheim it was also possible to pay in advance, not in time periods as in the other cities, but as 'lump-sum' payment groups (i.e., 500, 2500, 5000 NOK) which provide a discount when compared to the normal gate price. For non-users of the electronic system there were also options for credit card or coin payment at machines located in a side road near the toll stations. A 'between-zones' charge was introduced in 1998 and in November 2003 more changes took place as 10 new toll stations divided the city centre for fairer charging of the city centre population (who had always paid reduced fees) as well as to increase income. At the time of the interviews for this research, there were only two years left for the toll ring to run (to 2005) but the 16 million NOK invested in the six new stations was justified by an expected return of 60 million revenue (Langmyhr, 2003).

When the project was first announced, 70% of the general public opposed the scheme but this subsequently dropped to around 50% (Odeck and Bråthen, 2002). A substantial share of opposition came from local retailers in the city centre claiming that the toll ring would drive customers away (a not dissimilar response to that of retailers in London prior to the introduction of the Congestion Charge). The environment of the city centre was rejuvenated, making it more pleasant and thus attracting visitors and improving sales. When the public sees where and how the money is used, it helps winning acceptance for a project. Similar user acceptance has been reported for other toll projects. It also makes drivers understand the real cost of environmental and social expenses of heavy traffic. The City council in

Trondheim also followed the policy of improving existing retail and commercial centres instead of building new areas at the edge of the town; this also helped preserve the character and economic vitality of the old town.

It can be said that the Trondheim toll ring acted as a demand management scheme for some time as there were different charges for different hours of the day. It ranged from high charges during peak hours and low charges during low traffic hours to free access during evenings and weekends. One option under consideration was to remove some outlying toll booths and use only the inner city ones for demand management charging. But, despite considering a 'life extension' to the scheme similar to that in Bergen, a decision has been reached to stop the operation of the Trondheim toll ring. The final day of operation was set to be the 31st of December 2005. Politicians insisted to end the scheme, keeping in line with the promise made that any toll project would not run for more than 15 years and at the same time enhancing public trust in future political promises. Despite an ongoing debate regarding the introduction of a congestion charging scheme the most likely outcome will be a new type of toll ring in order to further finance essential road projects. The decision on what may happen also depends on who controls the city council. The left-wing party has traditionally opposed more road building, but they understood the need for income for roads, whilst the right-wing party has objected to tolling altogether. It is expected that whatever the outcome, tolling schemes will evolve towards some form of congestion pricing and that revenues should also be earmarked for transport investment and public transport operating costs.

Trondheim was radical in the way its toll ring was managed; by being the first to introduce electronic toll collection[8] utilising the AutoPASS and inter-zone charging. It had all the elements necessary to make the transition from a funding mechanism into a demand management scheme, like congestion charging. However, this process came to an end in 2005. At the end of December 2005 the local and road authorities decided to end the Trondheim toll ring, keeping in line with their initial promise about the duration of the scheme. Plans are under discussion about the future of road pricing in Trondheim. Despite an ongoing debate regarding the introduction of a congestion charging scheme the most likely outcome will be a new type of toll ring in order to further finance essential road projects (Amdal, 2005).

2. Italy

Rome

High car growth rates and unbearable levels of atmospheric pollution that endangered not only residents but also the cultural heritage of historic buildings in the city centre, has forced Rome to revise its transport strategy. For years, development was centred on accommodating the private car but in the mid 1980s, the municipality decided on a series of measures to reduce the negative externalities of car use (Comune di Roma, 2000). The measures focused on increasing the sustainable modes of transport and on raising awareness of the negative impacts of the car among citizens. Among the most important measures were:

- Access restrictions and integrated pricing strategies,
- Collective passenger transport, new forms of vehicle use,
- New concepts for the distribution of goods,
- Innovative soft measures, and
- Integration of transport management systems and clean technology public and private fleets.

The most radical and difficult to implement were the first two, which concerned the implementation of an Access Control system followed by experiments for a Road Pricing scheme. To address acceptability issues and provide a fall back, the municipality proceeded to implement the scheme in incremental steps. The historic centre of Rome was classified as an LTZ in 1989. A manual system was implemented at that time that would only allow residents and permit holders to enter. The measures were not enforced very strictly for a number of years, and there were many violations with no action taken against offenders (Forestieri and Tomassini, 1999). In some way, both users and the police knew that the restrictions were not followed in a systematic way. This dramatically changed in 1994 when concrete blocks were used to prevent entry into the LTZ, physically and visually reinforcing

[8] The first single Toll Plaza using ETC (Electronic Toll Collection) came into operation in Ålesund in 1987.

the policy of access control. Permission for entry was given to residents and a few other exceptions such as emergency services.

Evolution from access control to road pricing was seen as a natural progression (€UROPRICE, 2001). The introduction of automated enforcement in 1998, paved the way for a road pricing scheme. After some years of planning and consultations, an experiment began in 2001 in the LTZ (Musso and Corazza, 2003). The period 1998 to 2001 also served to develop and install the electronic system of on-board charging units and gantries. The system in Rome, based on existing motorway tolling technology (Pasquali, 2001), became operational in August 2001 but enforcement started later, in October 2001. The system initially targeted specific categories (e.g. commercial vehicles) and gradually was applied to all road users. From Monday through Friday (6.30 am to 6 pm) and Saturday (2 pm to 6 pm) only permit holders are allowed to enter the restricted zone in Rome. There are a total of 135,000 permit holders that include residents, disabled people, taxi drivers and city services, which can access the zone free of charge. In addition to these are the 20,000 authorised individuals allowed to pay the fee to enter the zone (€UROPRICE, 2000). The price of an annual permit is the equivalent cost of a 12-month public transport card which costs €340[9] (£233). Electronic access detection equipment records illegal access of vehicles at 23 'gates' leading to the restricted zone. The electronic system 'reads' the vehicles number plates and reports offenders who are then fined. The total number of plates permitted to access the LTZ represents about 8.5% of the total vehicles in the city (€UROPRICE, 2002). Research is underway by STA into reading the small-sized number plates of motorcycles; this could lead to including them in future access restrictions.

Between 2003 and 2004, two other smaller restricted access experiments took place in areas adjacent to the central LTZ in Rome. The difference was that they operated at night. The first 'nocturnal' LTZ concerned San Lorenzo, an area nearby the University of Rome associated with student clubs and other youth oriented entertainment – activities that resulted in atmospheric and noise pollution from misuse and overcrowding of vehicles. The San Lorenzo experiment took place between 4 June and 31 October of 2003, excluding August[10], for five nights a week from Wednesday until Sunday, from 8 pm until 3 am (Comune di Roma, 2003). The other experiment concerned the 'gastronomic' area of Rome, Trastevere, a favourite area for dining, where from 7 May until 9 October 2004, for two nights of the week – Friday and Saturday, entrance to cars was forbidden from 9 pm until 3 am (Comune di Roma, 2004).

The main objectives of both experiments were to provide a more enjoyable and safer environment for pedestrians accessing the two areas and test if the traffic limiting measures had a positive effect on business. Access to the areas was complemented with extra night bus and tram services. In addition, Rome linked parking to the road pricing scheme. This involved parking charge zones; charges rising the closer the parking is to the city centre. The idea is to encourage parking at the periphery in order to reduce inner city congestion.

Genoa

The city of Genoa is situated in a narrow strip of land between the Apennine Mountains in the north and the Ligurian Sea. The city extends along 30km of coast and two valleys spreading northwards. Genoa's distinctive geographical characteristics resulted in the way in which the urban structure of the city developed. Average population density is 2,600/km2 but rises to 10,150/km2 within the city centre (Comune di Genova, 2003). Combined with a perception of inadequate road infrastructure, these factors can be greatly held responsible for the existing environmental problems caused from traffic congestion. One of the worst affected areas in Genoa is the centre of the city, which includes the main retail and historic areas. The municipality of Genoa responded to the growing traffic related environmental problems with proposals for various measures that included the introduction of road pricing measures in the centre (€UROPRICE, 2000).

A new Urban Traffic Plan (Comune di Genova, 2000) formed part of a civic regeneration that included plans to limit traffic related pollution and annoyance in the historic city centre and to revitalise the commercial centre of the city. Various measures proposed by the municipality of Genoa in their plan included:

[9] 2004 prices

[10] August is traditionally considered a month reserved for holidays and as such was not included. Traffic levels were expected to be lower.

- Optimising parking zones according to the surrounding land use,
- Constructing an elevated relief road ("supraelevata") that bypasses the centre to improve the main Traffic flow from the harbour,
- Favouring public transport,
- Improving the connections between different travel modes,
- Regulating and reducing traffic in the centre through the creation of a series of one-way roads, and
- Introducing an area-based pricing scheme.

The municipality of Genoa intended to implement a full scale road pricing scheme in the historic and retail areas in the centre mainly to reduce transit traffic. But difficulties relating to the general management of the project, the political and public acceptability as well as resistance from some stakeholders made it necessary to perform a demonstration beforehand (€UROPRICE, 2002). An experimental road pricing scheme was tested in 2003 in part of the existing LTZ (Limited Traffic Zone) that covers the historic centre of Genoa. The full cordon was planned to be 2.5 km^2 whereas the trial zone was about 1 km^2. This 'trial' scheme was designed to evaluate the effectiveness of a road pricing scheme in the area including traffic volume reduction, the use of alternative modes in accessing the area and the general environmental benefits. Another important aim was to test the technological equipment. Genoa, like Rome, favoured a system of gates based on plate recognition and central software data processing.

The six month road pricing trial, using 200 volunteer drivers, took place in two three-month phases (Mastretta, 2003). The first phase between March and May 2003 was conducted with a €2 charge and the second (June – August 2003) with a €1 (£0.7) charge. Genoa installed optical character recognition (OCR) equipment at seven entry gates. The gates were also equipped with video cameras that linked each gate with the traffic control centre. The volunteers were assigned a 'virtual budget' to use during the trial. From the initial sample of volunteers, 159 completed the demonstration. From the statistical analysis of the trial results and a modelling study, a 38% reduction of entrances to the zone was found to correspond to a €1.5 (£1.03) charge (Contursi, 2004). A lower charge resulted in more crossings and vice versa. Overall, the road pricing trials attempted to make the system easy to understand for all involved. It also addressed all the social, economical, environmental, technological and organisational issues for the stakeholders in the network.

Whether Genoa's Access Control scheme evolves to road pricing depends on a number of objectives and new work packages associated with achieving the overall aims. The following, constitute a brief summary of the objectives set by the Municipality of Genoa (Comune di Genova, 2004) in their projected activities towards a system of tariff-based access control. The report also includes a detailed list of complex and interrelated work packages (approximately 23) covering all aspects of the system. These issues are broken down into the major work themes which are to: encompass the public and political acceptability, allow for a good level of mobility, aim to reduce private traffic, address parking, account for the cost and structure of public transport, support integrated transport modes, explore innovative and alternative forms of transport, conduct a study of potential infrastructure work, analyse different charging scenarios and investigate user payment options. It was evident that the road pricing trials were more than just an 'experiment'. The depth of consideration shows that the municipality is earnest about advancing the policy to a full-scale implementation, although volatile politics in Italian cities always raise uncertainties.

Bologna

Bologna serves as the capital city of the prosperous *Emilia Romagna* region in the north of Italy. Bologna is a major industrial area and regularly hosts international commercial fairs and is the centre of a commuting hinterland. In addition Bologna has a large university and also a well preserved historic centre with various sites of interest. Bologna's historic city centre is based on medieval planning; most streets in the historic centre are narrow and incapable of dealing with heavy traffic or sustaining traffic flows. An important architectural characteristic of the city are the 'porticos' that line the streets – a series of inter-connected and covered pavements where the pedestrian traffic of the city is concentrated – that also trap many vehicle pollutants.

In the 1980s, in response to this situation, the Comune (Municipality) of Bologna proposed a new urban plan to protect the centre and the inhabitants from environmental hazards, improve public transport options and walking facilities and reduce through traffic. Among the measures proposed was the creation of an LTZ in the city centre. Creation of the LTZ was subject to a public referendum. The population approved a controlled zone that covered most of the historic area of the city (4% of the municipal territory). The zone was not implemented until 1989 when access to the LTZ between 7 a.m. and 8 p.m. was restricted to permit holders, emergency services and public transport. Around 82,000 permits were distributed to residents, taxis, governmental services and delivery or construction firms with business in the zone. There were also limits placed on delivery truck weight, entry times and delivery times (max. 30 minutes). For all vehicles circulating in the zone, a 30km/h speed limit was imposed. Residents could only park in the area they lived. Parking areas outside the zone were extended and a Park and Ride scheme was set up. Initially, enforcement of the restriction was by ‘gate-guard’ Policemen stationed at entry gates who checked that cars entering the zone had a permit sticker. Police presence at entry gates was random but parked vehicles inside the zone were also checked.

Alternative for access to the zone was enhanced at the same time. Bus lanes were constructed in areas adjacent to the historic centre and the municipal bus services were reorganised with the help of the local public transport operator, ATC. Some streets within the zone were reserved for buses and pedestrian zones extended. The daily number of cars entering the city centre in 1989 fell by 62%, compared to 1981. By the early 1990s, buses provided 78% of trips to the centre[11], cars 11% and motorcycles 8% (Antognazza and Chizzolini, 2003). Air quality improved considerably and safety for pedestrian and bicycle traffic increased. Bus services became faster and more punctual.

But the appointment in 1992 of a new traffic commissioner of Bologna who was less enthusiastic toward the ZAC, together with continuing opposition by traders groups, changed the situation. The traffic police were less motivated to enforce the rules and public officials were granting an increasing number of permits. The enforcement of access control became lax and the principles of the policy were effectively undermined. This fuelled a rise in the number of rule infringements by car drivers that in turn brought about increases in congestion and air pollution in the historic centre. The City Council of Bologna was looking for a solution to this problem of law enforcement.

Electronic ZAC

The solution came in 1994 with the development of an electronic ZAC system in Bologna’s LTZ. *SIRIO*[12] was a system developed by Elettronica Santerno, a small electro-technical firm located in the province of Bologna. An extended trial took place with 3000 transponders[13] handed out to users from all authorised user classes (Hoogma, 1998).

Even with extensive tests, the SIRIO system was not trouble free. It had trouble ‘reading’ older Italian number plates and the uneven surface at some entry gates caused problems with the operation of the transponders, especially if cars passed at high speed. Slow speeds and tailgating also produced problems because it only allowed the last car to be photographed. Even when the problems were solved, political problems remained. Many groups challenged the validity of the system again and again and some politicians used their powers to block SIRIO’s operation. The SIRIO system returned to operation after the spring 2005 municipal elections when the Berlusconi administration suffered electoral losses and the rightwing parties’ power in the council of Bologna was reduced.

Despite its controversial life, the pioneering scheme in Bologna set in motion a successful policy mechanism that gradually spread in many Italian city centres. A number of large cities (including Rome, Milan and Turin) as well as smaller cities and towns with important historic centres (such as Como, Sienna, and Perugia) implemented city centre limited traffic zones to combat congestion and environmental pollution.

[11] Modal share
[12] ‘*Sistema di Rilevamento Infrazioni Ottico*’ – system for optical sensing of violations
[13] On-board units (OBUs)

3. Britain

London

Central London had long established and serious traffic congestion. Over the years, a number of measures had been implemented to tackle the problem but none managed to do so effectively. The Congestion Charge scheme was introduced in February 2003, following an intense planning and advertising campaign led by Mayor Ken Livingstone. A fee of £5 GBP (€7.3)[14] was initially[15] charged to motorists entering a central zone of a 5km radius between the hours of 7 a.m. and 6.30 p.m. on weekdays (TfL, 2003). The £5 charge was expected to deter 10-15% of vehicles entering the zone and reduce journey times by 25% but in practice reduced cars by around 20% and congestion by 30% compared with the last few weeks before charging (TfL, 2004). This better than expected impact upon traffic reduced the revenue generated from an expected £130m (€190m) to around £90m (€131m) (Ison, 2004).

The charged area represents only 1.3% of the total Greater London area but around 200,000 vehicles drive into the charging zone every day. From these, the charge applies to about 110,000. The remaining are exempt vehicles: 100% reduction to taxis, emergency vehicles, disabled badge holders as well as other groups and 90% reduction to residents of the zone (TfL, 2004). A network of 700 video cameras in 230 positions throughout the charging zone, 174 of which are on the inner ring road, enforce the scheme (TfL, 2003). There are also a number of mobile units with cameras that patrol within the zone. Payment can be made to any of the 9,500 UK-wide Pay Points, at various petrol stations and shops throughout the UK. Payments can also be made by phone, SMS text, or the internet (TfL, 2003).

The traffic impact outside the congestion charging zone has, contrary to expectations, been minimal. To accommodate modal transfer, 300 additional buses, offering 11,000 places were added to the already extensive bus network of London increasing bus usage by more than 7%. Making radical improvements in bus services was one of the Mayor’s ten priorities for transport in London (TfL, 2004). The scheme also generated net revenues to generally improve transport in London. Plans for an extension of the charging zone westwards have been approved by the Mayor of London and are expected to become operational in February 2007 (TfL, 2005).

Durham

As with the majority of transport projects, the background to the Durham scheme was very important to the outcome of the implementation process. Durham is in the North East of England and here the council had being trying to restrict city centre traffic to the ‘Peninsula’ area since 1949. This area has been designated as a UNESCO World Heritage Site[16] because of its religious and architectural significance and protecting it from traffic pollution was important.

The area had particularly acute traffic problems. Of the 3000 vehicles that entered the area each day prior to the scheme being adopted, 50% used the road as a mobile parking area thus contributing short-term to congestion by slowing down traffic. Congestion was high because of the sheer number of vehicles and pedestrians concentrated in a small street – around 13,000 pedestrians accessed the area each weekday and 17,000 on Saturdays (DCC, 2000). The situation in the area was untenable, threatening the viability of local businesses and damaging the appeal of the Durham Peninsula as a World Heritage Site.

Various measures had been proposed and tried over some 20 years, but failed to solve the problem. With the ineffectiveness of the conventional parking and traffic management scheme, 1997 saw the creation of Durham’s Transport Steering Group. This consisted of members of the City and County Council members and various representatives of the major stakeholders on the Peninsula, businesses and other establishments as well as the police and the Chamber of Trade. The agreed aim for the Peninsula was to significantly reduce the pedestrian and vehicular conflict by removing a substantial proportion of the existing traffic through a road user charge.

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[14] Exchange rate at time of writing £1 GBP ≈ €1.46 Euro.
[15] The charge was increased to £8 (€11.7) in July 2005.
[16] There are 26 World Heritage Sites in the UK. For more details visit: *http://www.culture.gov.uk/ historic_ environment/World_ Heritage.htm*

A key part of introducing the congestion charge was the provision of alternative means of access to the Peninsula, and discussions with public transport users resulted in the launch of a new minibus service that began operating some two months before the congestion charge was introduced (DCC, 2002). Part-funded by the congestion charge, the 'Cathedral Bus' provides access to the Cathedral and Market Square with the Rail, Coach Stations and a Park and Ride car park. Overall, the cost of the project to implementation including the operating systems, buses and pedestrian improvements was £250,000 (€365,000), and was funded entirely through the Council's Local Transport Plan (LTP) settlement.

The Durham Road Access Charge Scheme began operating in October 2002, the first to take advantage of road user charging powers granted in the Transport Act 2000 (HMG, 2000). The charging zone included the Cathedral and Castle, the University of Durham, the Chorister school, the market place area, other trading and servicing establishments and a small number of private dwellings. Motorists pay a £2 (€2.95) charge to exit the area on Monday to Saturday between 10am and 4pm (the busiest time for both car and pedestrian traffic) via Saddler Street, the Peninsula's only access thoroughfare (DCC, 2003). The exit is controlled during the charging period by an automatic rising bollard that is dropped upon payment (the machine accepts coins and cards, while annual permit holders can lower the bollard by using a transponder). The exit charge allows free flow of vehicles into the area, preventing traffic queues back to a nearby major road.

It was estimated before the implementation that there would be a 50% reduction in vehicle access to the area. For the remaining traffic, a very generous 70% would have permits and 30% would be liable to pay. The first evaluation of the scheme (DCC, 2003) showed the reduction of vehicles to be around 85% so the permit allocation, despite the fact that it seemed generous, has not affected the scheme's traffic reduction impact.

Edinburgh

Edinburgh has been enjoying continued economic growth and success in recent years. The city is a major tourism destination and its centre provides a mix of residential, commercial, retail and tourist uses (PROGR€SS Project, 2002). Transport has been a high profile issue in Edinburgh for some years now because of the impact it has on the economy, society and the environment. Growth in car ownership and use has caused traffic levels in certain roads to increase by up to 60% in the last 20 years, which in turn has caused congestion, parking problems and air pollution at key city locations (Edinburgh Council, 1999).

July 1999 saw the establishment of the Scottish Parliament, which assumed many legislative and executive responsibilities for transport issues from the UK Government. The beginning of 2000 saw the launch of the Integrated Transport Bill by the Scottish Executive (TSO, 2000), which included proposals for congestion charging. In May 2004, the Council approved the decision to progress with a road user charging in the city centre but, for such a scheme to take place, winning the local and political support was required (LTT, 2004). A number of consultations and other development work were promoted as the Phase 2 of the New Transport Initiative that included research into the likely economical, social, accessibility and environmental impacts of the proposed road user charging scheme and subsequent investment. An initial consultation, conducted with residents and businesses in Edinburgh showed the majority of respondents in favour of a road user charging scheme (Arthur Andersen, 2000). The Scottish Transport Act was approved in 2001 (TSO, 2001).

Edinburgh Council, proposed to introduce a congestion charging scheme to directly reduce the number of vehicles using Edinburgh's road network whilst at the same time raising revenue for public transport improvements. The Scottish capital city, like Durham, is a World Heritage site, a major financial and commercial centre and a major generator of economic activity for the region as well as the country, has been facing for some time congestion and other environmental problems. Without the charging scheme, transport models (MVA, 2000a; 2000b) predicted traffic level increases of around 30% by 2021, as well as increased time lost due to congestion.

In brief, the proposed scheme would have charges levied at roads crossing two cordon lines: an inner cordon defined by the boundaries of the centre of Edinburgh and an outer cordon inside the city bypass. A daily, one-off charge of £2 (Edinburgh Council, 2003) would be collected from vehicles travelling inbound the cordons and only during the charging period. The two cordons would operate from Monday to Friday with slightly different schedules, with the inner one from 7 am until 6.30 pm, while the outer cordon would operate in peak times between 7 am until 10 am and between 4 pm until 6.30 pm. The scheme would operate with cameras so that no toll barriers or charge points would add to delays. Payment of the charge would be made available through a number of methods that would include: pay-points at shops, the Internet, a call centre and mobile phones. The Edinburgh scheme was designed as a cordon charge, closely representing the Norwegian toll rings, and unlike London's area charging scheme.

The Council had committed to spending all net revenue raised by the charging scheme on transport projects and services, in addition to the existing public sources of transport funding. Prior to any charging scheme being introduced, there would be a £100 million up-front investment to improve the city and regional public transport network. Over £100 million was already estimated as public sector funding for projects within Edinburgh and southeast Scotland (tie, 2003). In addition to this investment, the Scottish Executive was proposing to contribute substantial funding towards national projects (tie, 2003).

The Referendum

On the 22nd of February 2005, Edinburgh residents were asked to vote for or against the Council's transport proposals which included plans for the congestion charge and consequently a package of planned transport improvements for the area that would be funded from the charging revenue. From a turnout of around 62 per cent, 75 per cent (133,678 voters) were against the proposals for the charging scheme. Reports on the referendum cited reasons given that the scheme would have hurt the local economy as well as pushing traffic into the residential areas of the city (BBC, 2005). Other voters (Reuters, 2005) explained that the Council failed to convince them that the proposals for the charge were sufficiently equitable. The Council had claimed throughout its campaign that their first priority was to make the scheme fair and socially inclusive. Supporters of the road charging scheme accused the Council of "*an excess of democratic zeal*" and, that the referendum had condemned the plans beforehand. Derek Turner, one of the designers of the successful London charging scheme, pointed out that Edinburgh should have avoided the referendum and brought as an example the Stockholm compromise where the local authority agreed for the public to vote on a charging scheme after it operates for a year (BBC, 2005).

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