SCANNING TOUR SUMMARY REPORT

PRICING EXPERIENCE IN NORTHERN EUROPE: LESSONS LEARNED AND APPLICABILITY TO MINNESOTA AND THE UNITED STATES

STATE AND LOCAL POLICY PROGRAM
HUBERT HUMPHREY INSTITUTE OF PUBLIC AFFAIRS
UNIVERSITY OF MINNESOTA

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1. BACKGROUND ON PRICING

Unpriced commodities, such as our current transportation system capacity, are viewed by users as being “free” and lead to excessive use. In the case of roads, this unconstrained demand results in high levels of congestion and delays and an associated reduction in safety and air quality. The concept of pricing as a means to limit peak period or seasonal demand is widely used by the airline industry, transit operators and utility companies, to name a few, and the public understands and accepts this.

Pricing of transportation facilities is seen as the most effective method for managing system capacity and for funding highway infrastructure and transit services. Pricing is used to manage demand on congested roads by charging for peak-period use, while charging less for off-peak period use. Pricing can be done dynamically—where the price charged varies with current, real-time level of demand or congestion—so as to maintain free-flow traffic conditions.

Pricing is also seen as an alternative to fuel taxes, which is currently the primary funding source for construction and improvement of the nation’s transportation infrastructure. There are three important concerns with continuing to use fuel taxes as the main source of transportation funding. The first is that fuel taxes, as a fixed cents-per-gallon charge, have not kept up with inflation. (In Minnesota, for example, the gas tax has not been increased since 1988.) Second, continued increase in vehicle fuel efficiency and growth in the number of alternative-fuel vehicles further and substantially diminishes fuel tax collections. The third concern is that fuel taxes are an indirect charge, not directly related in most people’s minds to the amount of travel they make nor to the congestion costs they impose.

The key to the success of pricing as a means of reducing demand while generating revenues is that pricing, as a direct charge, is clearly related to the time of travel as well as the amount of travel. Users can appreciate immediately that roadway capacity is not free, which causes many to adjust their travel patterns to avoid the charges. Road pricing ration scarce highway resources by discouraging demand and encouraging competition in use of facilities and services.

2. PURPOSE OF SCANNING TOUR

The Humphrey Institute for Public Affairs, State and Local Policy Program (SLPP), conducts an ongoing Pricing Outreach and Education program funded through the Federal Highway Administration’s Value Pricing Program. To increase the body of knowledge about pricing experiences outside the United States, SLPP organized an August 2006 Scanning Tour of pricing projects in northern Europe including the United Kingdom (London’s Congestion Charge), Germany (Toll Collect for Trucks), Sweden (Stockholm’s Congestion Charging Trial), and Norway (Oslo’s Toll Ring).
These pricing schemes offered a variety of important policy-in-action practices, including:

- Use of tolls primarily for traffic management versus revenue generations.
- Consideration of tolls as user fees versus taxes.
- Use of toll revenues for local versus non-local infrastructure improvements.
- Use of a portion of toll revenues for transit improvements.
- Use of a variety of pricing approaches including, trip-based cordon pricing, tunnel pricing, and distance-based pricing.
- Use of a broad range of technology and approaches for vehicle detection, identification, charging, billing and enforcement.

As indicated in the title of this report, the purpose of the Scanning Tour was to learn from northern European pricing projects and translate their experiences into lessons that could be applied to pricing efforts in Minnesota and the United States.
3. DESCRIPTION OF PRICING PROJECTS

London’s Congestion Charging

Background

The Central London congestion-charging scheme began operations in February 2003. Development started in 2000, but once construction started, it only took 12 months to implement. The project was championed by Ken Livingstone who ran for Mayor of London promising to implement congestion charging in Central London. He was elected Mayor in 2000.

Greater London has a population of 7.1 million persons spread out over 617 square miles. The congestion-charging zone has a population of 136,000 people, one million workers and occupies eight square miles (just over one percent of Greater London’s area).

Transport for London (TfL) is the body responsible for the planning and delivery of transport facilities across London and for implementing the Mayor of London’s Transport Strategy. As such, TfL was responsible for specifying the system, defining system parameters and system process, and bringing to the table its expertise in camera technology and complex technology.

For the most part, however, delivery of the project was outsourced, including the following aspects:

- Designing and building cameras and license plate readers, IT systems and system processes
- Integration of core operational processes and systems
- Setting up of customer contact and service centers, including retail aspects
- Setting up on-street enforcement services
- Scheme operations including registration/administration of discounts for residents and critically-ill NHS patients, fleet administration, charge collection and enforcement revenues
- Management of camera and communications systems and on-street enforcement services and bailiffs

Objectives

The London congestion charging system was designed as a traffic management scheme aimed at reducing congestion levels in Central London. In addition to congestion charges, the scheme was supported by substantial investments in buses and bus service, the London underground, and pedestrian/bicycle facilities. A second aim of the congestion-charging scheme was to generate revenues to continue to improve the transportation infrastructure. A third aim was to reduce emissions and improve the environment.
Approach to Pricing

The London Congestion Charges are considered user fees, not taxes, since travelers have many options available to avoid the fee (buses, LRT/trams, underground, taxis, walking, bicycling and river services, all of which are exempt).

The congestion charge scheme is set up as follows:
All vehicles, including foreign-registered vehicles, pay a single, all-day fee for entering the cordon zone between 7 a.m. and 6:30 p.m., Mondays through Fridays. There is also a charge for roaming inside the zone. Initially the single flat fee was 5 Pounds, but was raised to 8 Pounds in 2006 (about $15.70)\(^1\). Charges do not vary by time of day, level of congestion, vehicle type or frequency of use.

During the public outreach and consultation stage of the project, the following exemptions were negotiated:

- People with disabilities
- Motorbike and mopeds
- Emergency vehicles
- Military vehicles
- Certain alternative-fuel vehicles
- Breakdown and recovery vehicles
- Certain health service workers
- Buses, coaches and minibuses
- Taxis and licensed minicabs

In addition, the following exceptions were allowed:

- Residents of the area inside the cordon receive a 90 percent discount
- Fleets receive discounts

These exemptions and discounts currently account for over 25,000 vehicles per day, which is 23 percent of the total traffic using the system daily.

For reasons of equity, and to provide users with a wide array of options if they chose to avoid the congestion charge, a substantial investment was made in public transportation. An additional 14,500 peak-hour bus seats were provided to handle 14,000 additional passengers. Also, an extra 1,000 new buses were deployed across London, increasing the bus fleet to 7,500.

\(^1\) The mid-August exchange rate was $1.97 per pound.
Technology and Innovations

The London congestion charge relies, for the most part, on proven technology, including fixed signs at each of 688 cordon-crossing locations. This is combined with video cameras linked to automatic license plate recognition technology and comparison with a license plate database. On-board units or transponders are not utilized, and neither are readers nor car-to-roadside communications required. However, every license plate must be correctly read and matched to avoid incorrect billings and loss of revenues. Approximately one percent of license plate matches have to be verified manually (1,000 out of about 100,000 plates read daily).

The operations infrastructure uses wide area network communications to interface with the TfL Hub Site, the Data Center and the Call Center. The cameras transmit the license plate information to the TfL Hub Site.

Drivers’ privacy is ensured by limiting the camera’s picture-taking to the license plate, not the vehicle nor the passenger. In addition, once a match is made for a legal vehicle, the license plate picture is deleted from the system.

Billing and Payment Process

Charges are billed to the vehicle owner through the registration number. Payments can be made daily, weekly, monthly or annually, by post, telephone, Internet, SMS, self-service, or at retail outlets and gas stations. More than 100,000 payments are received daily. Payments can be made on or before the day of travel. However, charges paid after the day of travel rise to 10 Pounds ($19.70).

Enforcement

Vehicle identification and enforcement are carried out by means of 688 fixed cameras linked to automatic license plate recognition technology and compared to a database of license numbers. If there is no record of payment, a Penalty Charge Notice (PCN) of 100 Pounds ($197) is sent to the owner or keeper of the vehicle. Approximately 5,000 PCNs are issued daily (this number is down from 7,000 in 2004). For persistent evaders, the follow-up is towing or clamping (about 100 instances per month). If there is still no payment, vehicle can be auctioned or crushed. The 100-Pound fines are reduced to 50 Pounds ($98) if paid within 30 days, and increase to 150 Pounds ($295) if paid after 30 days.

Roaming vehicles with cameras are used within the zone to identify residents’ vehicle use as well as vehicles not detected when entering the zone. There is an independent appeals process against PCNs. Final appeals to independent adjudicator’s amounts to one percent of all PCNs issued. Of these, 78 percent are awarded in TfL’s favor.
Costs and Revenues

The initial investment costs were funded by issuing bonds. The initial as well as subsequent charge levels were set to show a solid financial plan.

In 2005, total annual revenues were 220 million Pounds ($432 million), while operating costs were approximately 120 million ($236 million), yielding annual net revenue of 100 million Pounds ($196 million). Net revenues are spent on the Mayor’s Transport Strategy, which include improvements to bus services, road safety, and cycling and pedestrian facilities. In addition, approximately 15 percent of annual operating costs are spent on additional bus service improvements.

Evaluation Results

A comprehensive five-year monitoring program is in place to track the congestion charge scheme and to evaluate its traffic management effects. Traffic changes (using 2005 data) indicate that the scheme has been successful in achieving its congestion reduction objective, as evidenced by the following results:

Traffic/Congestion

- It is reported that there are 50,000 to 60,000 fewer daily vehicle trips entering or passing through the zone.
- Total traffic entering the charging zone is down 22 percent; car traffic is down 37 percent.
- Traffic circulating within the zone is down 15 percent.
- Network speeds have increased from 13.6 kph (8.5 mph) before charges to 16.2 kph (10.1 mph) in 2005.
- Traffic delays inside the charging zone are down 22 percent (a decline from 30 percent initially).
- Congestion level during charging hours is down 26 percent.
- Traffic delays on main routes entering the charging zone are down 20 percent.
- Traffic on the boundary route (cordon) continues to be successfully managed: congestion reduction of one to five percent (there had been substantial concerns that the boundary route would become congested as drivers tried to avoid the charges).
- No significant adverse traffic impacts have been observed outside the charging zone.
Public Transportation

The effect on other modes has also been positive:

- Transit patronage has increased 30 percent since 2002.
- The modal shift to transit across London has increased by four percent.
- Public transport continues to cope well.
- Bus reliability is better: 60 percent less traffic disruption has resulted in improved bus speeds of six percent and 20 percent reduction in wait time at bus stops (33 percent within zone).
- Bicycle and power two-wheelers use has increased.

Traffic Diversion

- The majority of ex-car users have shifted to transit: 50 to 60 percent.
- 20-30 percent of the reduction in car trips have diverted around the zone.
- 15-25 percent of drivers have transferred to other forms of transport.

Other Impacts

- Number of crashes in charging zone is down, more so than across London.
- 13 percent reduction in NOx; 16 percent reduction in large particles (PM10), half of which is attributable to the zone charge; 15 percent reduction in CO2.
- 20 percent reduction in fuel consumption.
- Business impact analysis: overall sales up 5 to 6 percent; inside the zone down by 2 percent.
- A business survey conducted in 2003 indicated that only 12 percent of respondents attribute changes in sales to congestion charging. Most cited other reasons are economic factors (46 percent), seasonal factors (15 percent), and tourism factors (10 percent).

Lessons Learned and Challenges

Several features of the London Congestion Charging scheme have posed challenges to the system, which may have limited the overall system effectiveness. However, these factors do not diminish nor detract from the scheme’s clear success.

- The current pricing technology used was selected because it was proven technology, which was driven, in turn, by the desire to implement the system in only 12 months.
London's Congestion Charging

- The current technology limits the ability of the system to perform variable or dynamic pricing that varies charges according to level of demand or congestion.

- The system does not vary charges by time of day, by vehicle type, nor by frequency of access.

- There are suggestions that a substantial number of vehicle owners have gone "underground" by using various schemes to avoid paying the charges, thus affecting revenues collected.

- The system is costly to operate: more than 50 percent of system revenues are spent to operate the system. A large component of this cost is related to the use of camera and license-plate recognition technology.

- Approximately 23 percent of all vehicles entering the charge zone are exempt. This affects revenues, adds management complexity and cost, and may increase opportunities for fraud.

Despite substantial initial opposition, the project was implemented successfully because the following key elements were in place:

- Political champion: The Mayor of London pushed the pricing scheme despite great political opposition. Public support increased after the pricing scheme went into effect and reduced congestion in Central London, contributing to Mayor Livingstone's reelection in 2004.

- Clear policy and project objective: congestion reduction the context of overall traffic management

- Extensive public consultation and stakeholder engagement

- Strong public information campaign.

In addition, key factors in the success of the project, once implemented, included:

- Provision of adequate transportation alternatives, especially investment in public transport.

- Effective traffic management measures

- Ongoing customer support and stakeholder engagement

- Monitoring of impacts and willingness to make improvements

- Reliable technology

- Strong project management and effective contract management.
Next Steps/Future Plans

In an effort to improve traffic management, system cost-effectiveness and air quality, a number of steps are planned or are being considered:

- The congestion-charging zone will double in size as a result of a western extension that will begin operations in February 2007.
- The end-of-day charge period will be shortened from 6:30 p.m. to 6:00 p.m. to allow theater patrons to come to Central London and dine without paying a toll.
- Violators will be given an additional 24 hours to pay the charge before they are fined.
- Charges by vehicle type are being considered to reduce emissions further. Starting next year, SUVs will be charged 25 pounds.
- Exploring the use of technology that would allow for more flexible charging, including by direction and by time of day (expected availability: 2009).
- Looking at satellite and mobile phone location systems for “specific” link-based, distance-based charging (beyond 2010).

Non Pricing-Related Traffic Management Activities

The London Congestion charging scheme was conceived as a key element in the larger context of traffic management. In this context, a substantial number of other actions aimed at reducing traffic levels, improving flow and improving overall travel have continued to be implemented. Examples include:

- Expansion of public transportation systems (buses, LRT/trains, underground, river services)
- Implementation of roundabouts and traffic calming techniques.
- Construction of bicycle and pedestrian facilities including auto-free pedestrian zones.
- Implementation of parking restrictions and high costs.
- Posting of real-time arrival and other information at transit stations and stops.
- Remedial actions for road crashes.
The Cambridgeshire Guided Busway, Cambridge, United Kingdom

This innovative project combines traffic management and congestion reduction policies with growth and development policies, and quality of life principles.

A 25-mile, 116-million Pound ($229 million) transitway will connect the City of Cambridge with freestanding cities and villages to the north and northwest beyond the Greenway Ring. Eighty percent of the transitway is being funded by the government (91 million Pounds or $180 million) and 20 percent through development fees (25 million Pounds or $49 million), and will open to service in December 2008 (the initial concept was developed in 2001).

The guided busway is a 10-foot wide, primarily exclusive facility. When sharing local road right-of-way, new bus lanes with bus priority at traffic signals are provided. Buses will run on two-foot wheel-paths, slotted in guided troughs with guide-wheels, separated by grass; the troughs are 8-inches deep, with curbs. It is designed for 65-mph speeds, with 18 stops in the 25-mile route, and two-minute headways. The transitway will connect three major employment centers and will have bicycle, pedestrian and horse paths alongside it.

Buses from surrounding villages will be able to access the Guided Busway at a number of places so they too can avoid busy roads.

GPS monitoring will be used to provide real-time information at bus stops. The transitway will be operated by the private sector, and will use an “open access” approach that allows talking to competing service operators to set the fare.
Germany’s Toll Collect

Germany’s Toll Collect, which began commercial operations in January 2005, is the world’s first countrywide application of distance-based electronic toll collection. It is focused exclusively on trucks with a permissible total weight of 12 tons or more that use Germany’s 12,000-km (7,500-mile) federal motorway system.

The rationale for truck charges was based on three factors. First, was the substantial infrastructure costs imposed by heavy trucks on federal motorways, estimated at 3.4 billion Euros per year (internal costs), equivalent to 15 Euro cents per vehicle-km ($0.32 per vehicle-mile)\(^2\). The cost-allocation method used to estimate the impact of trucks on infrastructure damage was done under the direction of the European Commission. Second, the fact that 35 percent of truck-kilometers on Germany’s motorways were made by foreign-registered vehicles that impose infrastructure costs without contributing directly to system construction, maintenance and reconstruction. And third, many foreign trucks did not comply with European Union emission standards and therefore had a competitive advantage over German-registered trucks. The imposition of tolls on domestic and foreign trucks by the German government had to be authorized by the European Commission before implementation could occur. The Commission ensures that the scheme does not discriminate nor place foreign trucks at a competitive disadvantage. For example, an attempt to rebate fuel tax payments worth 600 million Euros ($787 million) to the German trucking industry was rejected by the European Commission as being de facto discrimination. Alternative legislative procedures being considered are lowering motor-vehicle taxes to the minimum under EU law, or subsidizing purchase of low-emission heavy trucks, which is not yet mandatory (Euro V and higher emission levels).

Toll Collect, which is part of a public-private partnership (PPP), was commissioned by the Federal Republic of Germany to develop the toll system. Toll Collect also operates the toll system. Partners include the German Federal Ministry of Transport, Deutsche Telecom, Daimler-Chrysler Financial Services, and Cofiroute. A governmental agency is responsible for enforcement, with assistance from Toll Collect.

The idea of a distance-based toll was conceived in 1989. Studies were conducted and in 1995 the federal government decided to introduce distance-based tolls. Initial opposition has turned into acceptance because it is considered fairer vis-à-vis foreign trucks; environmental interests like it, and more revenues are available for transportation infrastructure improvements. The decision to implement tolls was strongly supported by a coalition of the ruling Christian Democratic Party and the Green Party.

Objectives

The main objective of Toll Collect was to generate additional revenues for funding needed infrastructure, applying the “user-pays” principle. In addition, the scheme seeks to achieve more efficient use of transportation capacity, protect the environment by imposing emission-related tolls, and promote fairer competition between road transportation and railways/waterways.

\(^2\) The mid-August 2006 exchange rate was $1.30 per Euro.
Approach to Pricing

German Tolls are considered fees, not taxes, and are imposed based on the “user-pays” principle. They are applied, currently, to heavy commercial vehicles 12-ton gross vehicle weight (GVW) and above, that use the German federal motorway system (12,000 kilometers). Empty trucks are also tolled.

The toll system is set up as follows: All foreign and domestic trucks, 12-ton GVW and over, using the federal motorway system are tracked using GPS technology. Trucks are tolled at an average rate of 12.4 Euro-cents per kilometer (about $0.26 per mile). This 12.4 toll rate is lower than the 15 Euro-cents per kilometer infrastructure damage estimate, but was lowered to reduce the burden on the trucking industry. Toll rates vary from 9 to 14 Euro-cents per kilometer ($0.19 to $0.30 per mile), as shown below, based on number of axles and emission category.

<table>
<thead>
<tr>
<th>Three or Fewer Axles</th>
<th>Until 9/06</th>
<th>From 9/06-6/09</th>
</tr>
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<tbody>
<tr>
<td>0.09 E</td>
<td>Euro IV or higher (EEV)</td>
<td>Euro V or higher (EEV)</td>
</tr>
<tr>
<td>0.11 E</td>
<td>Euro III, Euro II</td>
<td>Euro IV, Euro III</td>
</tr>
<tr>
<td>0.13 E</td>
<td>Euro I or lower</td>
<td>Euro II, Euro I or lower</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Four of more Axles</th>
<th>Until 9/06</th>
<th>From 9/06-6/09</th>
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<tbody>
<tr>
<td>0.10 E</td>
<td>Euro IV or higher (EEV)</td>
<td>Euro V or higher (EEV)</td>
</tr>
<tr>
<td>0.12 E</td>
<td>Euro III, Euro II</td>
<td>Euro IV, Euro III</td>
</tr>
<tr>
<td>0.14 E</td>
<td>Euro I or lower</td>
<td>Euro II, Euro I or lower</td>
</tr>
</tbody>
</table>

Eligible trucks must furnish proof regarding emission category (self-declaration), and other suitable papers including vehicle documents, current motor vehicle tax statements, vehicle and engine manufacturer certificates, and engine certificate by independent experts.

Technology and Innovations

Toll Collect utilizes an innovative combination of satellite-supported positioning (GPS) and mobile communications network (Global Standard for Mobile Communications–GMS) to perform automatic tolling using the vehicle’s on-board unit (OBU). Manual tolling is done by means of the Internet and terminals. The OBU determines the vehicle position, recognizes the toll route segment, calculates the toll, and transmits the toll amount by GSM radio signal to the Toll Collect collection center. The OBU is equipped with a Dedicated Short Range Communications (DSRC) module (5.8 GHz).
The system fulfills technical preconditions for inter-operability with other road-charging systems. The OBU is used for system management purposes (90 percent of code lines are for this purpose, while five percent is for enforcement and five percent for toll calculation. The system management component allows for:

- Data update management (map, road network changes, toll rates, trigger updates, distribution function, delivery and update security).
- Software update management (trigger update, distribution function, delivery and security update).
- Check-up and monitoring (system errors, component breakdown, installation faults, fraud).
- Communication with service PC.
- Communications with computing center.
- Customer services.

The current system is capable of implementing toll pricing by road and link, by time of day and by area. However, the system cannot implement dynamic pricing because the OBU calculates the toll for each vehicle based on applicable rate (by axle group and emission category) and distance traveled. In addition, vehicle position is not exactly known (except in case of accidents), unless user gives permission to maintain this information (such as On-Star, which is voluntary).

More than 520,000 OBUs have been installed to date. Maintenance cost is 300 Euros ($394) but there are no charges for the unit itself. Maintenance costs are expected to drop to about 150 Euros ($197) in the near future. OBUs are installed by 1,900 service partners (1,500 in Germany and 400 abroad). This number is expected to drop to 1,400 to 1,500.

There are 3,600 touch-screen terminals located at Germany’s borders and in certain areas within Germany. However, because of low use (five percent) and high maintenance cost, this number is likely to be reduced.

Toll Collect also uses 300 multi-lane gantries for automatic enforcement control. Gantries are equipped with license plate cameras (with infrared flash) and Optical Character Recognition (OCR), vehicle location cameras that take three-dimensional pictures of the trucks, classification laser units for axle count, detection-tracking units, and DSRC transaction, if any.

Enforcement is also conducted by means of mobile units operated by the Heavy Transports Authority—BAG. These 278 mobile enforcement units are equipped with OBUs to control the accuracy of the automatic tolling system (using DSRC/IR communications). Vehicles have connections to the reservation and enforcement central system (GSM/GPRS), and location information (GPS). The Mobile enforcement, which is not dependent on gantries and can operate anywhere, controls five percent of the traffic. Mobile enforcement is easy to implement because it does not require any infrastructure except the GSM network.
Billing and Payment Process

Payments are primarily being made using the on-board unit (90 percent) and manually, using Internet or terminals (10 percent). However, the system is designed to allow 100 percent manual logon, in case of problems with the US GPS system being used. The OBU determines the truck’s position and toll route segment (using GPS), calculates the toll and transmits the amount by Global Standard Mobile Communications (GMS) to Toll Collect collection center, who deducts the toll from the road haulage company the truck is associated with. As of July 2006, there were over 115,000 registered users and 800,000 registered trucks. Toll Collect issued more than 1,625,000 toll statements between January 2005 and July 2006. Any failures or mistakes in toll calculation or billing are paid by Toll Collect.

Enforcement

Toll Collect is allowed to collect and store the following information: pictures of the trucks, number of axles, name of driver, when and where vehicle is used on the motorway, vehicle license plate, and classification information about the vehicle (for toll calculation). Toll Collect also has access to the German license plate database.

The Enforcement Department of Toll Collect coordinates all enforcement actions with the public agency (Heavy Transports Authority—BAG), to minimize toll violation and fraud. Enforcement is conducted primarily by means of four types of spot checks:

- Automatic checks backed by video pictures (at gantries)
- Stationary checks following automatic checks
- Mobile checks (278 BAG vehicles)
- Checks on the premises of German hauling companies

Enforcement resources include 95 people in the Toll Collect enforcement department and 800 in BAG, 300 multi-lane enforcement gantries for automatic control, and 278 mobile control vehicles operated by BAG.

Ten percent of trips are subjected to spot checks, which accounted for 17.6 million vehicles in 2005. The violation rate found was two percent, well below the five percent anticipated.

Fines levied are up to 20,000 Euros ($26,200). The fine for a first-time intentional offense by a hauler is 400 Euros ($524). If the offense is due to negligence, the fine is 200 Euros ($262). Drivers are assessed half the company fine.

Costs and Revenues

The cost to build and operate the German toll collect system is not available at this time. However, it is estimated that German tolls have resulted in a 0.15 percent higher cost for consumer products.
Revenues between January 2005 and July 2006 have been 4.6 billion Euros ($6.0 billion), or about 10 to 11 million Euros ($13.0 to $14.5 million) per day. Revenues in the first six months of 2006 are slightly ahead of the equivalent period in 2005.

Revenues are earmarked for freight transportation infrastructure as follows:

- 50 percent for roads
- 38 percent for rail
- 12 percent for waterways

Currently, only 10 percent of taxes is allocated to roadways (about 50 billion Euros [$65 billion]). However, 2.8 billion Euros ($3.7 billion) per year in toll revenues have been deducted from the tax allocation for roadways. Rail carriers also pay by distance traveled, but they get 100 percent of the revenue. They also get a subsidy of 18 billion Euros ($23.6 billion) per year. Road authorities would like toll revenues to go back to where they were collected, instead of 50 percent of the revenue being diverted to rail and waterways.

**Evaluation Results**

Monitoring of Toll Collect operations indicates that truck tolling in Germany has yielded positive impacts related to toll logistics:

- Loaded runs have increased by 2.1 percent to a total of 82.1 percent.
- There was a 15 percent reduction in empty runs.
- The number of containers carried by rail increased 7 percent.

Other findings:

- Violation rate is low: under 2 percent instead of the expected 5 percent.
- The reliability of toll assessment is 99.7 percent (the requirement was 99.0 percent).
- Have only had to refund 142,174 Euros ($186) of the 4.6 billion Euros ($6.0 billion) charged to date.

**Lessons Learned and Challenges**

The Toll Collect system is considered a success and seems to enjoy the support of all parties. This despite project delays due to technology implementation setbacks. Many participants blame unreasonable schedule pressures for the initial problems: the original expectation was that the project should be implemented in 11 months. It took 18, and many consider that given system complexity and extent of coverage, a more reasonable timeline would have been 24 to 30 months.
Germany's Toll Collect

Germany, under the direction of the European Commission, was able to demonstrate that heavy trucks, including a substantial number of foreign ones, cause substantial damage to motorway system. Armed with this information, truck-related cost estimates were used to assess truck tolls. It is interesting to note that truck haulers successfully passed on the cost to customers. This factor, combined with the fact that German trucks became more competitive vis-a-vis foreign trucks, contributed to truck haulers acceptance of the scheme. Environmental groups also support the system because it promotes cleaner air.

From the Federal Ministry of Transport perspective, the project revealed several prospects and opportunities, including:

- A key component of Germany's transport policy was implemented successfully.
- Toll Collect is efficient and has become a world leader in tolling technology.
- Opportunities have opened for marketing the technology abroad.
- Toll Collect has set the stage for future development of transport management technology.

**Next Steps/Future Plans**

- The government is considering expanding the system to trucks over 3.5 tons GVV.
- By 2010 will start using the Galileo satellite positioning system.
- The next generation will include a dual chip to allow the use of both GPS and Galileo in on-board units. Expected to improve reliability but probably not accuracy.
- Ready for interoperability with other future European systems.
- Expecting to sell platform services to third party providers in the future.
- Over the next few years, trucks on three roads (BundeStrassen) parallel to the federal motorway will be tolled to reduce diversion.
- Because cars also cause infrastructure damage, tolling autos—including foreign ones—is being considered.

**Non Pricing-Related Traffic Management Activities**

In addition to pricing, Germany is promoting other active traffic management schemes including setting up variable speed limits to let drivers know how fast they can drive based on real-time traffic and weather conditions. At present, they are considering expanding this application.

Germany has been able to reduce fatalities from 12,000 to 5,000 per year in less than a decade.
Stockholm’s Congestion Charging Trial

Background

In June 2003, the Stockholm City Council made the decision to conduct a trial implementation of environmental charges in the Stockholm inner-city area. The commission of inquiry set up by the government to study how congestion charges could be charged and used, presented its finding that a congestion charge had to be collected as a state tax.3

A Congestion Tax Bill and Congestion Tax Act were approved by the Swedish Parliament in June 2004. The letter stated that the Swedish Road Administration (SRA) should conduct a trial implementation of a congestion tax in Stockholm that would last until July 31, 2006 (Appendix to the Act).

SRA collects the tax on behalf of the National Tax Board, which is under the Swedish Department of Finance. SRA was permitted to publicly procure a third party to handle elements of the tax collection not pertaining to the exercise of public authority. IBM Svenska AB was contracted by SRA to develop, construct and operate the technical system. This decision by SRA, as well as SRA’s authority to conduct the procurement, was brought to trial by the City of Stockholm. Several months passed (Summer 2005—Spring 2006) during which the project was at a standstill. Finally, in April 2005, the Administrative Court of Appeals passed the verdict and SRA was judged to have acted correctly. At this point the Appendix to the Congestion Tax Act came into effect and the decision was made to begin operations on January 3, 2006.

The unanticipated delays had the effect of reducing system development and construction time, thus creating a difficult schedule, since, by law, the trial had to conclude on July 31, 2006. This delay also meant that the trial would last only seven months.

A significant feature of the Stockholm Congestion Charging Trial was that, once the trial ended in July 2006, the system would be turned off and a referendum would take place in the municipality of Stockholm on September 17, 2006. Residents would be given the opportunity to vote on whether to reactivate or dismantle the charging system. The trial was terminated, as scheduled, on July 31. The referendum took place, as scheduled (after the Scanning Tour had terminated).4

3 “In legal terms, a charge is what people pay in order to acquire something in return from the community, while a tax is a compulsory contribution to the community at large, without any direct recompense to the person paying. As no such recompense could be ascertained, the congestion charge had to be considered a tax. Due to the fact that a municipal authority is not permitted to tax people other than those living within the municipality, the congestion tax had then to be collected in the form of a state tax.” (Trial Implementation of Congestion Charging in Stockholm, January 3 to July 31, 2006, Swedish Road Administration, Department of Congestion Charges.)

4 As this report was being written, the news arrived that the referendum approved the reactivation of the Stockholm Congestion Charge by a vote of 53 percent. (Prior to the trial, survey results indicated that support was only 20 percent.) At the same time, however, the party who opposed the charges was elected and since Parliament has to ratify the decision, it may take several months before Parliament acts.
Purpose

The purpose of the trial was to determine if charging drivers for coming in and out of the inner city area would reduce the number of vehicles as well as congestion and vehicle emissions. The trial was conceived as an implementation of “environmental charges” as part of a larger full-scale trial whose objectives were to reduce congestion, improve access and mobility, and contribute to a more sustainable environment.

Approach to Pricing

Congestion charge is one aspect of what is referred to as the “Full Scale Trial in Stockholm.” This process began in August 2005, when Stockholm Transport expanded its public transport system by approximately 10 percent (200 additional articulated buses or 10,000 seats); built 2,400 new park-and-ride spaces near city access roads; provided bus-priority at traffic signals; created new bus lanes; and created eight new express bus routes (rush hours only). Only after these changes were made, were congestion charges implemented.

Owners of vehicles registered in Sweden are required to pay the congestion tax if their vehicle passes through one of 18 control points on their way in or out of the Stockholm inner area on weekends between 6:30 a.m. and 6:29 p.m. (no evening, night or weekend charges). Several vehicle categories are exempted, including:

- Public transit
- Taxis
- Certain alternative fuel vehicles (ECO-cars, LPG, electric)
- Ambulances and other emergency vehicles
- Motorcycles
- Disabled owners of vehicles
- Foreign-registered vehicles

Another notable exception to payment of the toll tax applies to vehicles driving between the island of Lidingö past the bridge control point, provided they subsequently pass another control point to exit the inner city zone within 30 minutes (through trips). However, if they remain in the inner zone or exceed the 30-minute threshold, charges apply. (The reason for this exception is that the one and only island-to-city connection runs through the City of Stockholm.) Another exception is traffic on the E4/E20 Essingeleden highway going past Stockholm (through trips).

The cost for passing a control point is 10, 15 or 20 Swedish Kronor (SEK) ($1.40, $2.20 or $2.90)\(^5\), depending on the time of day. A maximum of SEK 20 is charged during peak hours (7:30 a.m. to 8:30 a.m., and 4:00 p.m. to 5:30 p.m.). Vehicles are charged each time they cross a control point, up to a maximum of SEK 60 ($8.60). Charges are calculated every day and posted (for each vehicle) by 7:00 a.m. the day after.

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\(^5\) In mid-August 2006, the exchange rate was approximately $0.14 per SEK.
Technology and Innovation

Toll equipment is mounted on three gantries located at each of 18 control points as well as in a control box at the side of the road. The first gantry is equipped with a “Control Point” sign and a digital sign indicating the tax at that specific time. Cameras installed on this gantry photograph the rear number plates. The cameras take a high-resolution photo with an infrared flash when the cameras receive a signal from the laser detectors that a vehicle is driving past the control point. Only the plate number and part of the vehicle around the plate is shown (because of privacy issues). Cameras installed on the third gantry are used to photograph the front plate numbers. The plate number is identified directly in the camera using Optical Character Recognition (OCR) software. The plates are forwarded in digital format to the Multi-Lane Controller where they are packaged with other passage information.

Laser detectors and transceiver antennas, two per traffic lane, are mounted on the middle gantry and register signals from vehicle on-board units (OBU). These laser detectors sense when all vehicles drive through a control point as well as their location on the road. When a vehicle breaks the laser beam, the cameras are activated and the license plate is photographed, first from the front and then from the back.

Transceivers mounted on the middle gantry consist of a central transmitter aerial and a set of receiver aerials. The transmitter is activated when the laser detectors sense that a vehicle is driving past the control point. If the vehicle has an on-board unit, this is activated by the transmitter causing it to send its unique ID number to the receiver aerials.

The information from the cameras, laser detectors and OBU’s is sent to a Multi-Lane Controller (MLC) computer in the control box at the side of the road. The MLC computer packages vehicle passage information from the individual units to a file that is forwarded to a pre-processor. The file contains the following information:

- At least two license plate photos
- The license plate number interpreted via OCR
- The OBU ID number
- Passage time, date and location

A pre-processor processes the files from the control points and generates the tax charge for each vehicle using the license plate picture. All photos are examined to ensure reliable identification. Only seven to eight percent of cases have to be reviewed manually by Customer Services. The pre-processor contains daily updated reports from the Traffic Registry of exempted vehicles.

It is important to note that the information collected at the time of passage (i.e., license plate, personal data, congestion tax) is only kept as long as needed for tax collection purposes. After that, the information is deleted from the system.
Billing and Payment Process

No invoice or payment slips are sent to customers, and there are no pre-payments. The tax has to be posted in the SRA congestion tax account no later than 14 days after the date of passage. The vehicle owner is responsible for paying the tax on time. Information about the amount due can be obtained through Customer Services, via the web or when paying at kiosks or 7-Eleven stores all over Sweden.

Payments can also be made using the OBU direct debit method. More than 420,000 OBUs have been distributed to owners free of charge. OBUs are used as an alternative payment method, and are not used for vehicle ID. (This is done via license plate photos, which are considered legal documents.) Tax amounts are withdrawn from the debit account associated with the OBU 10 to 12 days after passage. Since an OBU is connected to a specific vehicle, it must be returned if there is a change in vehicle ownership.

Enforcement

If the congestion tax is not paid within 14 days, the vehicle owner receives a reminder by mail, including a SEK 70 ($10) service charge. The vehicle owner has four weeks from the day of passage to pay the congestion tax and service charge. If this is not received on time, the owner is sent a second reminder with a SEK 500 ($72) surcharge, which must be paid within a month from the date the surcharge was applied. If unpaid, the congestion tax and charges are then forwarded to the Enforcement Service, which charges an additional SEK 500 ($72) handling fee.

Costs and Revenues

The total cost of the system, including investment in transit improvements, was SEK 3.8 billion ($548 million), including an investment of SEK 1.9 billion ($294 million) in the congestion tax system and equipment. Operating costs are SEK 350 million ($50 million) per year.

OBUs are used as an alternative congestion tax collection method to the license plate ID. Since the latter has been used successfully to ID vehicles and to calculate the tax, elimination of OBUs and payments at 7-Eleven stores is being considered. It is estimated that this decision would result in savings of SEK 150 to 200 million ($21.6 to $28.8 million) per year.

Revenues collected between January 1 and July 31 were SEK 477 million ($68.7 million). It is estimated that if the system is implemented permanently, it will take four years to pay off the investment costs in the form of social and economic benefits. Approximately SEK 50 billion ($7.2 billion) are planned for future investments (rail, ring road segments, bridges and tunnels).

Evaluation Results

Evaluation of the Stockholm Trial was based on a large number of monitoring and study reports from three periods: two prior to the trials and one after. The first one was in August 2005, prior to the trial but after expansion of public transportation; the second was conducted in the fall of 2005, and the third was done for several months after the congestion tax was introduced in
January 2006. The post-trial evaluation was made difficult because of the shortness of the trial period (seven months). Longitudinal panel surveys were conducted using the same participants throughout to reduce the effect of external factors on trial results. Furthermore, the evaluation studies had to be completed halfway through the trial in order to be able to report results once the system was turned off on July 31, 2006, and before the planned September 17, 2006 referendum.

- The trial results show that the number of vehicles crossing the cordon during peak hours was reduced by 20 to 25 percent, more than the goal of 10 to 15 percent reduction expected. More surprisingly, traffic volumes declined at locations far from the cordon. This means that concerns about traffic shifting to roads outside the cordon did not materialize, particularly concerns about route E4/E20 (Essingeleden), an exempted freeway that passes through the west end of the inner city.

Over the full day, traffic crossing the cordon declined by 22 percent (equivalent to 115,000 trips out of total of 530,000 trips). The decrease in car traffic was 30 percent, light trucks 21 percent and heavy trucks 13 percent.

Epilogue: Once the trial ended on July 31, 2006, traffic crossing the cordon increased overnight by 20 percent to pre-trial levels of 406,000 trips (August-level traffic). Because of seasonal variation, it is estimated that traffic will grow to 450,000 trips for the September-to-April period.

- Improvement in accessibility has also been achieved as evidenced by improved travel time reliability and queue length reductions of one-third on approach roads during morning peak periods, and one-half during afternoon peak periods.

- The decline in traffic has resulted in less damage to the environment and better health. This conclusion has been reached because the decline in vehicle-kilometers traveled results in a drop in exhaust emissions of 2 to 3 percent in Stockholm County and 14 percent in the inner city. (Carbon dioxide emissions are generally proportional to vehicle-kilometers of travel.) It is estimated that the reduction in traffic has led to a 5 percent decline of particulate emissions in Stockholm County and a 10 percent in the inner city.

- Public transit use increased by 6 percent during the trial. It should be noted that public transit improvements were implemented five months before the congestion trial was initiated. However, these improvements did not yield any discernible increase in transit usage following the improvements and before the congestion charges were implemented. The shift to transit only began to occur after the congestion charge was in place. It is estimated that 4.5 percent (of the 6 percent increase in transit use) is attributable to the congestion charge. External factors such as gasoline price increases are responsible for the remaining 1.5 percent.

Transit accessibility and on-time performance have improved; however, the number of standing passengers on the underground has increased while decreasing on commuter trains.
Stockholm's Congestion Charging Trial

- Before the trial, the percent of county citizens who thought that the congestion tax trial was a "rather/very bad decision" was 55 percent (fall of 2005). This percentage fell continuously during the trial and by April-May 2006, this percent had fallen to 41 percent, while those who thought that the trial was a "rather/very good decision" increased to 53 percent.

- The technical system works. For example, on an average day in May 2006, 371,300 trips passed through the control points, resulting in 115,100 charges, and revenues of more than SEK 3 million. Of the 115,100 charges, 100 were investigated by the Swedish Tax Agency and only five were appealed. The SRA Customer Service unit received 2,200 calls on an average day in May, compared to an expected 30,000 calls.

Lessons Learned and Challenges

One of the biggest challenges in managing the congestion charge system has been to accurately keep track of exempted vehicles and toll exceptions. These represent about 30 percent of all vehicles crossing the control points. Of particular difficulty is keeping track of vehicles traveling between Lidingö to the inner city and beyond. Since these vehicles are exempted from paying the tax if they go through the city within a period of 30 minutes, the system must keep track of them from the moment they cross the Lidingö control point to when they cross (or do not cross) another control point, and must keep track of clock-time when this occurs. The political sensitivity to incorrectly billing Lidingö residents, workers and visitors is high, and requires costly processes for avoiding these occurrences.

A complementary issue related to the large number of exempted vehicles is the impact on revenues, particularly when, for example, the fastest growing segment of vehicles is exempted alternative fuel vehicles (20 percent of new cars).

The lesson learned from the Swedish Trial is that public opinion can shift from negative to positive once the public experiences the positive effects of pricing.

An interesting aspect of the Stockholm Trial was that public transit improvements alone did not result in an increase in transit usage. However, once the congestion charge was put in place, transit use increased by a sizable amount (40,000 more trips per day). This would seem to point to the "carrot-and-stick" synergy between transit improvements and pricing.

Next Steps/Future Plans

Now that the County of Stockholm has voted to permanently extend the congestion tax system, a request goes to the national legislature for a final decision. If the legislature approves the extension, the system will be reactivated, but probably not until the beginning of 2007, given the complexity associated with restarting the system.
Oslo Toll Ring

Background

Norway has been a pioneer in the development of road tolling (70 years) to finance expensive infrastructure. During the last 20 years, urban road tolls have become an increasingly important way of financing road projects. In 2003, for example, 2.3 billion NOK ($381 million), or almost 34 percent of the total annual state road construction budget came from user toll fees collected countrywide. Bergen became the first toll ring (1986), followed by Ålesund (1987), which became the first toll plaza in the world with electronic toll collection. These were followed by the Oslo Toll Ring (1990) and by the Trondheim Toll Ring (1991).

The motivation behind the toll ring projects was that something had to be done to improve road capacity, traffic safety and environmental conditions, and that an efficient solution had to be found. The toll ring solution, while basically unpopular, satisfied these requirements and became even more acceptable because the fee was low and because, by law, the tolls had to be eliminated after 15 years. All toll projects must be local initiatives, but they must be approved by Parliament.

The Norwegian Public Roads Administration (NPRA) is responsible for planning, building and operating road projects financed by toll revenues, and for planning and building the toll collection systems. For each toll project, a dedicated toll company with limited responsibility is established by the local authorities. Its function is to operate the road toll system and to handle the associated financial tasks.

The construction of a new road normally takes place before the collection of tolls starts. The toll company obtains loans from banks to finance the portion of the investment that is covered by road tolls, and is responsible for these loans if conditions make it difficult to generate sufficient toll revenues to repay the loan.

Despite heated public debate and negative response to the concept for the Oslo Toll Ring, the political parties in the City Council, as well as central governmental authorities, agreed that implementation of the toll ring should not become a political issue. In addition, central government authorities agreed to supplement toll revenues with national funding to make the project viable.

The Oslo Toll Ring is a joint venture between the City of Oslo and the surrounding County of Akershus, and toll revenues are divided equally between the two. Oslo has a population of 512,000 people and it is the center of a region with a population of one million.

Purpose

The main objective of the Oslo Toll Ring was to finance transportation infrastructure, with the expectation that the addition of infrastructure capacity would reduce congestion, improve traffic safety and improve environmental conditions.
Approach to Pricing

The Oslo Toll Ring consists of 19 toll plazas placed around central Oslo, cutting across the three major federal motorways leading to central Oslo. All inbound and outbound traffic, including foreign-registered vehicles, is tolled. Through trips have to pay twice. Tolls, which are in force 24/7 with no time-of-day differential, are considered user fees, not taxes.

Single-ticket tolls for cars/light vehicles are NOK 20 ($3.30) and NOK 40 ($6.60) for heavy vehicles. Motorcycles/mopeds are free. Users can purchase discount passes for unlimited use (monthly, six months and yearly) or for a limited number of trips (25, 100, 175 and 350). Vehicle owners can acquire AutoPASS electronic chips with a deposit of NOK 200 ($33).

Vehicles with toll passes or with AutoPASS are assigned use of the left lanes at toll plazas. The right “Manual” and “Coin” lanes are used for cash payment (exact amount). Foreign currency can be changed into NOKs in the “Manual” lane. Trucks over 7,700 GVW or vehicles without passes must drive through the “Manual” lane. Vehicles equipped with AutoPASS are assigned the left lane.

Even though the main objective of the Oslo Toll Ring was to generate revenues to finance roadway infrastructure, the central government decided that 20 percent of the revenues should be used for public transit infrastructure.

Technology and Innovation

The Toll Ring ETC lanes are instrumented with automatic vehicle identification (AVI) that reads the AutoPASS chip as the vehicle passes through the reading zone. Digital cameras equipped with infrared flash read the license plate and vehicle make once pavement loop detectors sense the vehicle in the imaging zone. A traffic signal indicates whether the vehicle passing through the zone is invalid (yellow minus-sign light), of if it only has a few trips left (white plus-sign light), or if it is valid (green plus-sign light).

Most users on the E6 motorway use the AutoPASS three lanes. Currently there are more than 500,000 AutoPASS on-board unit mounted in vehicles.

Multiple pictures of the license plate and vehicle make are taken of the front end of the car. Pictures of the whole car or driver are not permitted to protect privacy. If the plates are covered or too dirty, or if cars moving at high speeds (60 mph) are too close to each other, license plates cannot be identified.

The NPRA has developed a communications specification for electronic toll collection (AutoPASS) that is in conformance with European Standards for Dedicated Short Range Communications (DSRC). Between 2001 and 2003, approximately one million AutoPASS onboard units have been distributed to replace the first-generation OBU's and to supply new toll projects.

6 In mid-August the exchange rate was $0.165 per NOK.
Billing and Payment Process

Use is generally prepaid: (a) by purchasing a single trip ticket for cash; (b) by purchasing discount passes for a predetermined time period (monthly, bi-annual, annual); (c) by purchasing multiple-trip discount passes (25, 100, 175 and 350 trips); or (d) by having an electronic AutoPASS on-board unit with a pre-paid account (debit).

Enforcement

Cameras register the license plate and make of vehicles using the system, and are the main enforcement tool. One of the clauses in the Norwegian Act gives drivers the right to pay cash within two days of passage. If a vehicle is found to be in violation, the owner is sent a notice with a fine of NOK 300 ($50). These are not considered traffic offenses. In 2005, 125,000 fines were issued and 25,000 complaints were received (out of a total of more than 60 million users of the system).

Costs and Revenues

The Oslo Toll Ring project was financed with a 50 percent contribution from the central government, and 50 percent was financed through revenue bonds. Tolls were supposed to be eliminated after 15 years (2007), but this requirement has been extended to the year 2014, with reconstruction of the toll plazas to act as fully-automated plazas. Roadway maintenance and operation costs are allocated by the central government. Toll revenues can only be spent for debt repayment and roadway infrastructure construction and improvements, including bridges. However, in the case of the Oslo Toll Ring, parliament passed a law that allows 20 percent of revenues to be used for public transportation.

Tolls increases are limited to the rate of inflation, unless approved by Parliament.

The toll ring construction cost was NOK 250 million ($41 million) and revenues are approximately NOK 1.4 billion per year ($232 million). Operating expenses are less than 10 percent of annual revenues. Most of the operating costs go to manning tollbooths (50 percent of costs) and administration.

Evaluation Results

The primary purpose of the Oslo Toll Ring was to generate revenues to pay for roadway and bridge construction and improvement (80 percent), and for improving public transportation (20 percent). This objective has been achieved. Since the 1987 Oslo Package 1 (roadway infrastructure, including the Oslo tunnel and public transit improvements), 37 projects have been completed. In Package 2, monies were used to continue to build road projects and transit improvements aimed at improving traffic safety, capacity and the environment.

The effects of the Toll Ring on traffic have been less dramatic. Initially, traffic declined 3 to 5 percent after opening, but after 10 weeks, traffic was back to previous levels. It has been found that off-peak drivers are not sensitive to pricing. Public transit use, on the other hand, grew by 6 to 9 percent. The current mode split is 35 percent daily for transit, and 70 percent in the peak hour. Growth forecasts indicate that, in 10 years, the City of Oslo will grow by 80,000 people.
Lessons Learned and Challenges

The Oslo pricing scheme has been successful on many fronts, namely: generating revenues to pay for road infrastructure and transit improvements, and promoting transit ridership. Oslo has also shown that system-operating costs can be held at a reasonable level, less than 10 percent of revenues on an annual basis. However, compared to other pricing schemes in northern Europe, the Oslo system is only able to achieve a small and short-lived reduction in traffic entering the City. One of the reasons may have been that traffic a management/congestion reductions was not a top priority of the pricing scheme. A system that set tolls based on levels of demand by time of day (i.e., variable or dynamic pricing), could help achieve greater traffic management outcomes.

Next Steps/Future Plans

A key question is whether Norway will introduce congestion charging with time differentiation fees for managing traffic during peak periods. One of the main principles of the legal platform for road pricing that Parliament has enacted is that there has to be local support before an implementation occurs, and revenues must be allocated to local transportation projects. The debate over the extension of the Oslo Toll Ring beyond 2007 to allow for fully automatic toll plazas continues.

Non Pricing-Related Traffic Management Activities

Norway has made a decision that tunnel construction is an important element in its objectives to improve the environment, reduce congestion and reclaim surface space for green space, redevelopment and local streets. As an example, a major arterial running east-west through the Oslo central city was relocated under the city and priced. The tunnel was designed to carry a maximum of 90,000 to 100,000 vehicles per day, and pricing is used to limit demand. The cost of this one-mile tunnel (NOK 1.6 billion or $265 million) was paid back in eight years. Air from the tunnel is captured in a processing building adjacent to the tunnel and cleaned of polluting gases and particulates.

At the present time, a new Bjorvikata tunnel extension is being constructed across the Bjorvikata Bay, and will run between the new Opera House and the medieval part of the city. The decision has been made that this tunnel will be paid for through road-user tolls.

Norway has one of the safest road systems in the world, together with the United Kingdom and Sweden. The number of people killed in traffic-related crashes had steadily increased from about 150 per year in the late 1940s to 560 in 1970. Since then, fatalities have steadily decreased to the point that in 2004 the number was 258, similar to level of fatalities last seen in 1958.

A combination of mandatory seat belt use, low tolerance for driving under the influence of alcohol (0.02 level), automatic speed enforcement using cameras, and stiff consequences for teenage drivers involved in crashes, has been responsible for this dramatic decrease in the number of people killed in traffic-related crashes. Mandatory seat belt use was first required in 1975, with a fine of NOK 200 ($33). By 1979, seat belt use had increased in urban areas from 32 percent (1975) to 75 percent. Today, use is over 85 percent and the fine has been increased to NOK 750 ($124).
4. LESSONS LEARNED AND APPLICABILITY TO MINNESOTA AND THE UNITED STATES

Public Acceptance

One of the most striking common characteristics of the four pricing systems visited was that each was implemented despite majority public and political opposition. More importantly, once in place, and benefits became evident, public opinion shifted to majority approval, and political opposition has diminished. Nowhere is this more evident than in the most recent pricing experiment that took place in Stockholm. In a matter of six months, public opinion went from 55 percent opposed, prior to the Congestion Charging Trial, to 53 percent approval (during and after the trial). In addition, the Mayor of Stockholm who ran, initially, on an anti-charging trial platform, became a champion. A key ingredient in overcoming political opposition was the formation of a coalition between the major party and small minority parties, especially the Green Party, who sees pricing as an effective method for reducing traffic and improving safety and environmental quality. While the Stockholm referendum in September 2006 shows that residents favor making congestion charges permanent, the defeat of the SPD/Green coalition in Parliamentary elections has introduced a level of uncertainty for the future of Stockholm’s congestion charges scheme.

Primary Purpose of Pricing Scheme

The main objective of the pricing project was varied. In London and Stockholm the main purpose was traffic management: to reduce traffic in the central area and improve safety and air quality. In both cases, net revenues were used for roadway and transit improvements.

In Oslo, the primary purpose of the charging tax was to generate revenues for local highway and transit improvements, with traffic management being secondary.

In Germany, the purpose of the mileage-based charge was to generate revenues by charging trucks for the damage they impose on the roadway infrastructure. Two factors made it possible to gain support for this unique pricing application. The first was that foreign-registered trucks accounted for 40 percent of total vehicle-miles on German roads, but did not contribute taxes to pay for infrastructure construction and maintenance costs. Secondly, many foreign trucks came from countries that did not comply with the strict European emission control requirements that Germany’s trucks comply with. By imposing tolls based on levels of emission, Germany helped promote use of cleaner trucks, which was a direct benefit to the environment in Germany.

Tolls as User Fees versus Taxes

All pricing schemes, except for Stockholm, consider toll charges to be user fees. It is generally clear that the London, Stockholm and Oslo system provide many travelers with the option to avoid the toll by shifting their auto travel to public transit, walking or bicycling, all of which are popular modes of travel in these countries. In Stockholm and Oslo, travelers can also shift their time of travel to reduce the amount of toll they pay. Despite these options, the Swedish
Parliament decided that the Stockholm toll would be considered a tax on the basis that “...a tax is a compulsory contribution to the community at large, without any direct recompense to the person paying.” Furthermore, since municipalities cannot, by law, impose taxes, the Congestion Charge Tax in Stockholm is collected by the State through the Department of Finance.

It should be noted, that, in all countries visited, fuel taxes—which are a significant proportion of fuel costs (in the order of 40 to 50 percent)—tax revenues go directly to the general fund, not to a Highway Trust Fund as in the United States. On the other hand, toll user fees collected in London, Oslo and Germany are allocated to transportation funding.

Technology and Privacy

It is evident that technology has not been an impediment to pricing implementation. A wide variety of technology is being used to detect, identify, calculate charges, bill and enforce the system. The reliability and accuracy of system components are very high.

From the perspective of future United States implementation, the most innovative technologies being used are the German system satellite location (GPS) and communications approach (GSM). In addition, the widespread use of license plate identification using cameras with infrared flashes and optical character-recognition technology for both billing and enforcement has certainly contributed to the success of the European systems.

It does not appear that the use of cameras for vehicle license plate identification for billing and enforcement have resulted in a loss of or threat to privacy. Even in Germany, where a picture of the entire truck—not just the license plate and vehicle make—is taken, there does not seem to be a substantial privacy concern.

Project Complexity

As indicated above, technology has been used effectively to achieve project performance requirements. Possibly, the factor that has contributed the most to added system and technological complexity has been the introduction of exemptions and exceptions to toll charges. For example, 23 percent of London’s daily vehicle traffic entering the cordon are exempt or are offered discounts, while in Stockholm, exemptions account for 30 percent of vehicles crossing the cordon. While dealing with exempt vehicles such as buses and motorcycles is straightforward, dealing with exempt autos and other light vehicles (e.g., alternative fuel autos, health service workers, taxis and licensed minicabs in London, or alternative fuel vehicles and residents of the island of Lidingö in Stockholm) poses a significant challenge. The challenge is that the greater the number of exemptions and exceptions granted, the greater the number of rules that have to be written into software code, hardware and post-processing steps, all of which add technical complexity and cost. At the same time, exemptions and exceptions increase the potential for fraud, and certainly reduce revenue collection.
In the final analysis, however, it must be remembered that the granting of exemptions and exceptions is a result of in-place public policies, and are the outcomes of negotiations with stakeholders that lead to compromises and accommodations.

Cost, Funding and Revenues

Without exception, the cost to implement the pricing projects examined was substantial and, in all cases, the government either fully funded the project or contributed a significant level of funds. Even in the case of the Stockholm Trial, which was to last seven months, and depended on a later public referendum to determine whether to continue or dismantle the system, the implementation cost, including investment in public transportation, was SEK 3.8 billion ($548 million).

Revenues generated are also substantial. Annualized revenues range from $3.9 billion for Germany, $432 million for London, $232 million for Oslo, and $118 million for Stockholm.

Annual system operating costs range from a high of approximately 50 percent of annual revenues in London (with 688 toll stations) to 10 percent in Oslo (with 19 stations).

Use of Revenues

In all project visited, tolls charges are applied to road users, but by no means all, because of the many exemptions and exceptions allowed. In all cases, however, revenues collected are not earmarked exclusively for roadway improvements. A substantial portion of revenues goes to transit improvements in London, Stockholm and Oslo. The reason for this decision is that pricing is seen as only one element of congestion management, transit being another key element. In addition, transit is seen as providing choices for avoiding or reducing toll charges for those who wish to do so.

In Germany, only 50 percent of tolls collected is returned to roadway improvements. The remaining 50 percent go to rail and waterways. This decision was made to ensure continued competition among freight modes.

In Britain and Germany, there are significant differences between political leaders on the left, who prefer to use revenues to pay transit or rail/water improvements, respectively, and political leaders on the right, who believe that toll revenues should only be used for road improvements.
APPENDICES
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SCANNING TOUR HOSTS

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SCANNING TOUR HOSTS

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London
- Dave Wetzel, Vice Chair, Transport for London
- Peter Vine, Head of Technical & Commercial Congestion Charging, Transport for London
- Owen Paterson, Member of Parliament, House of Commons
- Anthony D. May, Institute for Transport Studies, University of Leeds
- Robert Tuckwell, Cambridgeshire County Council

Germany—Berlin
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