

has been slow. Firm offers from Indian parties were received for only two projects. It appears that some gaps between official and industry viewpoints have come to light. For example, prospective entrepreneurs would like their road construction projects to be treated on a par with other industrial projects that qualify for financial assistance from the state-owned financial institutions, whereas the government would like financing of road projects to be done by private entrepreneurs from their own resources or from open market borrowings and equity flotations. Other subjects under discussion include governmental participation in these projects, foreign collaborations, import of equipment, and tax concessions including accelerated depreciation. It is hoped that differences

will be eventually ironed out and that this unique experiment will be a success.

ACKNOWLEDGMENT

The author acknowledges with sincere thanks the support received from the Center for Privatization, Washington, D.C., for his participation in the International Conference on the Role of the Private Sector and Marketing Processes in the Financing and Provision of Roads. The views expressed are strictly those of the author.

The Toll Ring in Bergen, Norway

ODD I. LARSEN

This paper is about the recently opened toll ring around Bergen, Norway. The physical characteristics of the toll ring—toll stations, methods of payment, reserved lanes, and control system—are described. The toll ring is successful because it was introduced to raise funds for badly needed major improvements to the road system not to restrain traffic.

On January 2, 1986, the city of Bergen implemented a toll ring around the central business district (CBD). The Bergen toll ring and the Area License Scheme in Singapore are the only examples known to this author of vehicles being charged a toll for entering the CBD. Similar schemes have previously been proposed and considered in several cities as a measure of traffic restraint. Implementation, however, has usually been found unfeasible, mainly because of lack of public and political support.

Using some kind of road-pricing scheme to restrain traffic in the presence of severe congestion has been advocated on the grounds that it may be a better alternative than heavy investments in road capacity or continued congestion. Economists have also pointed out that this may bring the private cost of using scarce road space more in line with the social cost. The toll ring in Bergen, however, was introduced to help finance a major program of road construction, and traffic diversion is not considered an objective.

BACKGROUND

Bergen is situated on the western coast of Norway (Figure 1). It is the second largest town in Norway with a population of 200,000. Including the surrounding municipalities, the Bergen area has a population of 250,000.

Bergen has for centuries been a center of coastal trade, but its role as a trade center has been diminishing, in part because of better land-based communications and the declining importance of the Norwegian fishing industries. In recent years the economy of the Bergen area has gained from the northward movement of oil explorations on the Norwegian continental shelf.

The city of Bergen, a separate municipality within the county of Hordaland, is situated on a mountainous peninsula and is often called the city between the seven mountains. The topography concentrates the built-up area in certain corridors. Compared with many other cities of similar size, a large share of the population has been living in the central area, but in the last 10 to 20 years there has been a marked outward movement of population. Another consequence of the topography is that the cost of road construction is high and that vacant land that can be used for new roads is scarce in the central parts of the city.

Car ownership is below the national average, but in recent years the gap has been closing. At present car ownership in Bergen is about 320 cars per 1,000 population compared with a national average of 360.

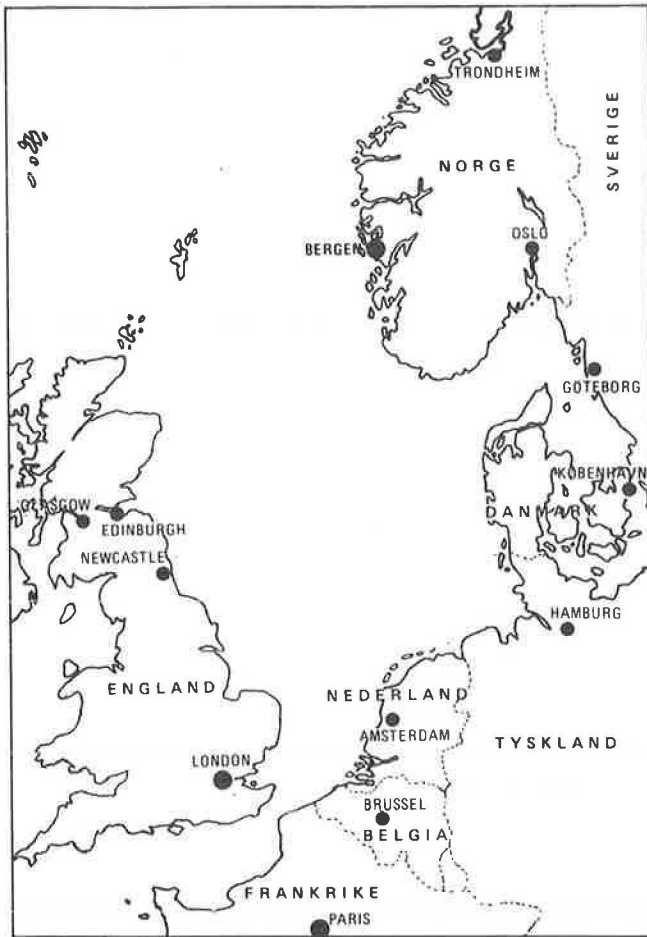


FIGURE 1 Bergen in the context of northern Europe.

THE TOLL RING

Because of the topography and the present road system, the CBD in Bergen is covered by only six toll stations, the locations of which are shown in Figure 2, on the main access roads to the CBD.

The exact location of the toll stations was dictated mainly by

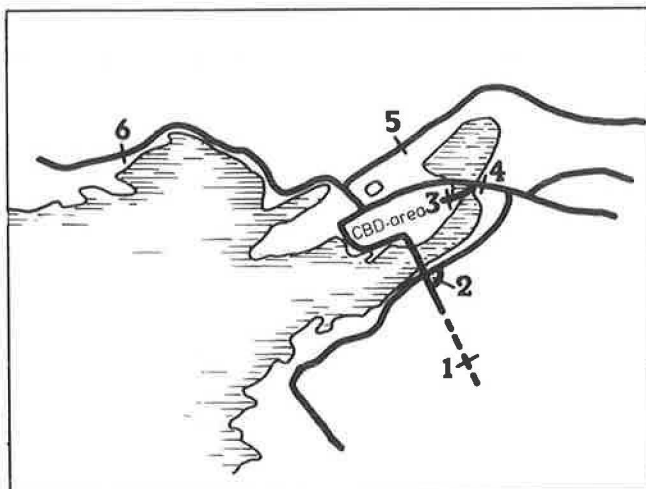


FIGURE 2 Location of toll stations.

practical considerations. Three bridges lead to the CBD and these are natural points for toll collection. In two cases the toll station is actually located on the bridge (3 and 4 in Figure 2). On the third bridge there is one station on each of the two accesses. The reason for this is that the bridge is too narrow for the construction of a toll station.

One of the access roads is from a tunnel that was financed and built by a private company, the Bridge and Tunnel Company. The company has until now operated a toll station at this tunnel and collected tolls in both directions. This station (1 in Figure 2) has now become part of the toll ring. The ownership and the remaining outstanding debt were transferred to the government when the toll ring came into operation.

One consequence of using the existing toll station is that the toll ring is not strictly speaking a "ring." The drivers of a daily traffic flow of approximately 2,500 vehicles have to pay the toll on entering the tunnel although they are not going over the bridge to the CBD on the other side of the tunnel. If these drivers want to avoid paying the toll, they can detour by way of a steep, narrow, and badly paved road.

The two remaining toll stations (5 and 6) are on land-based access roads. These stations are located at points where there are no suitable alternative roads that vehicles going to the CBD can use. An additional toll station will become operational when the construction of a new western road link is completed. Less than 10 percent of the population in Bergen lives inside the toll ring.

Tolls are collected from all motor vehicles, except buses in regular service and light motorcycles, going toward the CBD. Tolls are collected from 6 a.m. to 10 p.m., Monday through Friday, except on public holidays.

Methods of Payment

The level of toll rates was set to satisfy a goal of 35 million NoK in net revenue for 1986 based on an estimated average daily traffic volume of 54,000 paying vehicles. The payment scheme includes

- Single tickets that are bought at the manned toll booths,
- Prepaid tickets that are bought in booklets of 20 tickets and delivered at the manned toll booths, and
- Monthly, semiannual, and annual passes that are placed on the windscreen.

The toll rates, in Norwegian Kroner (NoK 1 \approx U.S. \$0.13), for 1986 are as follows.

	Light Vehicles	Heavy Vehicles
Single tickets	5	10
Booklet of 20 tickets	90	180
Monthly pass	100	200
Semiannual	575	1,150
Yearly	1,100	2,200

Heavy vehicles are defined as vehicles allowed to carry a payload of 3.5 metric tonnes or more.

Reserved Lanes

There are reserved lanes for vehicles with passes and such vehicles can pass through the toll stations without stopping. As a rule, the toll booths that serve the reserved lanes are unmanned part of the day.

The two toll stations with the highest traffic load have four lanes of which two are reserved for pass users. In the morning peak hour the traffic at these stations is from 1,500 to 1,600 vehicles. The remaining four stations have two lanes with one lane reserved for pass users and peak-hour traffic ranges from 1,200 to about 600.

Control System

The use of passes necessitates some kind of control system to avoid extensive cheating. In Bergen the system is based on videotape recordings of licence plates.

The licence numbers on the videotape are punched and compared with a file containing the licence numbers of vehicles that have a valid pass for the month. The licence numbers of vehicles without a valid pass can thus be sorted out and the owner found. The procedure followed to collect the fine of NoK 200 is the same as that used for parking fines.

The initial plan was to randomly select a toll station and a 4-hr period for a daily taping session. So far, however, the taping sessions have been more selective.

From this description it should be clear that the toll ring in Bergen is a rather simple construct. It is easy to imagine more sophisticated schemes for toll collection, but the system works and the time and manpower available for preparations made it impossible to explore more sophisticated systems. At present it appears that the cost of toll collection (including engineering work, equipment, and consultant fees) will amount to from 18 to 20 percent of net revenue.

WHY A TOLL RING IN BERGEN?

One of the interesting aspects of the toll ring in Bergen is that it was indeed implemented instead of remaining only a proposal. Several factors were important in this regard.

Insufficient Funds

The main roads in Bergen and in the other major cities in Norway are classified as national roads. The construction and maintenance of national roads are funded by the national treasury. Toll financing is used on a small scale and has until now been used mainly for a few bridges and tunnels outside the major cities.

Motor vehicles and road traffic are subject to heavy taxation in Norway. Taxes on import, ownership, and fuel are, however, considered part of the government's general tax base and are not earmarked for the construction and maintenance of roads. Government income from these taxes has in recent years exceeded government spending on roads by a substantial amount. More important is the strong emphasis on regional

policies in allocating government funds for road construction. Less developed regions with substandard roads or missing road links are given priority even if the returns on investments are lower than in the larger cities.

A result of this policy is that problems caused by insufficient capacity on the main roads are steadily increasing in the larger cities. At present the situation is worst in Bergen and Oslo.

Toll-Financing Proposal

In each county there is a local branch of the National Roads Authority that has the administrative responsibility for planning, constructing, and maintaining national and county roads in the county.

The toll ring was first proposed in a Master Plan for National and County Roads in the Bergen area, dated October 1983. The plan was prepared by the local branch of the National Roads Authority and was to serve a twofold purpose:

- It was to be an input in the preparation of a general plan for the transport sector in the Bergen area and
- It was to be an input to a National Roads Plan for the period 1986–1989.

For the preparation of the National Roads Plan the government had issued guidelines that contained an assessment of the government funds to be allocated to each county in the planning period. The Master Plan for Roads in the Bergen area documented severe problems of congestion, traffic safety, noise, and air pollution on the existing road system. The plan also outlined projects that could provide Bergen with a satisfactory road system. The combined investment cost of these projects was calculated at NoK 2,000 million.

It would have been technically feasible to complete all of the projects in 12 years starting in 1986. However, given the government funds that could be allocated for road projects in Bergen, the construction period would have been at least 30 years.

To speed up construction, supplementary financing from the revenues from a toll ring and additional grants from the government were proposed. Before inclusion of this proposal in the plan, an informal meeting was held with representatives of the major political parties.

Collecting tolls on existing roads and using the proceeds to build new road was considered the best and possibly the only feasible solution. Several possible schemes of toll collection were considered. The recommended solution was toll collection on all weekdays from 6 a.m. to 12 p.m.

Good Marketing and Clear-Cut Alternatives

The presentation of the plan was followed by public hearings and dissemination of information. A special newspaper that described the plan was distributed to all households in the Bergen area. The emphasis in the information campaign was on the choice to be made between having good roads in 12 or 30 years, and the toll ring as the only realistic way to shorten the period of construction.

The first decision in the Bergen City Council about the Master Plan for Roads in Bergen took the form of a proposal to the central government. The municipality of Bergen would provide extra funds for roadbuilding of NoK 30 million (in 1983 Knones) per year if the government would provide the same amount as a special grant to national roads in Bergen. This proposal was made in April 1984 before any decision had been made about how Bergen's share would be financed.

Different methods of financing Bergen's own share were then discussed in a report that was presented in November 1984. The conclusion was that the only realistic solution was a toll ring as proposed in the Master Plan for Roads.

Toll Ring Not a Major Political Issue

Finally, in January 1985, the Bergen City Council decided on a toll ring with a period of collection from 6 a.m. to 10 p.m., Monday through Friday. Deciding on further details was delegated to the executive body of the city council. The decision was supported by a great majority, and all of the major parties voted for the toll ring.

Eleven months were left for preparations, engineering work, and so forth. Additional delay was caused because a decision on what agency would be responsible for toll collection was not reached until May. The outcome was that the Bridge and Tunnel Company should be responsible. The main reason for this choice was that the company had experience in toll collection.

In June 1985 the Norwegian Parliament formally approved the toll ring scheme and agreed to the proposal set forth by the Bergen City Council. Although the proposal of a toll ring scheme had political backing from the start, it was a controversial issue. If one of the major parties in Bergen had opposed the scheme, it could probably have gained many supporters.

One of the main reasons for the success of the scheme is that the proposal for a road toll was linked to the completion of specific projects. It was evident that major improvements to the road system were badly needed, and this made the benefits easy to understand. If a toll ring had been proposed as a measure of traffic restraint, it would certainly not have gained the necessary support in Bergen.

SOME REFLECTIONS ON THE TOLL RING AND TOLL FINANCING IN GENERAL

In comparison with traditional toll financing schemes, the toll ring in Bergen has several advantages:

- There is no attractive alternative route open to motorists who want to avoid paying the toll. The impacts on route choice are therefore of minor importance.
- The unfavorable impact on traffic that would occur if motorists were charged only for the use of new high-capacity roads is avoided.
- Distributional issues will not cause the same concern as they would if toll financing were used and tolls were collected on only a few road links.
- Extensive use of passes reduces the delays inflicted on motorists.

On the other hand, from an economic point of view, the solution chosen in Bergen could still be improved. The period of toll collection is 16 hr a day, which makes the cost of toll collection unnecessarily high. In the rush hours Bergen experiences rather severe congestion on the main roads, but the toll rates are probably too low to cause a significant shift in modal split and thereby relief of the congestion.

On economic grounds a strong case can therefore be made for toll collection only in the rush hours and for charging higher toll rates to meet the goal for net revenue. This could reduce the costs of both traffic congestion and toll collection.

Although several alternative periods of toll collection (including a 6 a.m. to 10 a.m. alternative) were considered, a thorough cost-benefit analysis was not carried out. The argument put forth in favor of a long period of toll collection was that all motorists would benefit from an improved road system and should accordingly share the cost equally. It was also pointed out that a shift in modal split in the rush hours would have the unwanted effect of increasing the subsidies paid to public transport.

A cost-benefit analysis of different periods of toll collection might not have changed the final decision, but it would at least have presented the Bergen City Council with an assessment of the economic trade-offs involved.

Is Toll Financing Inefficient?

Although toll financing of road construction is used in many countries, it is often regarded as a costly and rather clumsy way of financing road projects.

Taking account of the marginal cost of public funds may change this conclusion. Recent estimates by Ballard et al. (1) and Hansson (2) of the marginal cost of public funds indicate that the cost of tax financing may well exceed the cost of toll financing for many projects.

It should be pointed out that the choice between tolls and taxes can be treated as a problem of minimizing the cost of financing a project or a collection of projects. This procedure involves two steps. The first is to design toll schemes that minimize the "social cost" of collecting a given net revenue. The next step is to compare average and marginal costs of collecting different amounts of net revenue with the marginal cost of public funds.

Depending on the parameters involved, the optimal solution may be full financing by taxes, full financing by tolls, or the financing split between tolls and taxes. In the last case an optimal share will, in principle, exist.

IMPACTS AND EXPERIENCES TO DATE

It is too early for a comprehensive evaluation of the toll ring, but some conclusions are evident.

The opinion was widespread among the general public that the toll ring would lead to increased congestion. On the first day of operation this was true. On the second day, however, delays were back to normal levels during the rush hours.

In February and March there was increased congestion on the first day of the month due to motorists stopping at the toll stations to renew their monthly passes. In April this was

avoided, mainly because an advertising campaign urging renewal of passes before the first of the month was run in the newspapers. In May and June the same problem emerged.

Passes are for sale in bank offices as well as at the toll booths. Continued problems on the first day of each month indicate that additional sales outlets are needed or that some other action should be taken.

A major concern in deciding the prices for passes and tickets was to foster the use of passes. The Institute of Transport Economics acted as a consultant on this matter and their recommendations were followed. It was estimated that the recommended price structure would lead to about 18,000 pass users. The share of pass users in the total traffic stream was estimated to be approximately 60 percent on a daily basis and around 80 percent in the morning rush hour.

The estimate of the number of pass users proved to be correct. The exact share of pass users in the traffic stream has not been established so far because the vehicle detectors on the toll stations have not functioned properly. The available evidence indicates that about 55 percent of the daily traffic stream is pass users. This corresponds to higher than estimated revenue from the sale of single and prepaid tickets. The sales of tickets and passes so far indicate that gross revenue in 1986 may reach or slightly exceed NoK 50 million; estimated revenue was NoK 44 million.

The Institute of Transport Economics also recommended the control scheme used. Several alternatives were considered, but the chosen alternative appeared to be the only one that could catch both motorists without passes and motorists using forged or borrowed passes. A government agency had to approve the control scheme, and this delayed implementation until April. The results from the first taping sessions indicated that approximately 5 percent of the motorists have been cheating. This is somewhat more than expected. The percentage will certainly decrease when it becomes known that cheating is not as riskless as it had been before April.

The impacts on traffic volumes are of major interest. It was expected that the toll ring would decrease the number of passing vehicles in the period of operation by 3 percent. Due to the malfunctioning of the detectors, there has not been a continuous traffic count at the toll stations. The comparisons that have been made so far are based on ordinary traffic counts in October and November 1985 and January and February 1986. The traffic counts show a decrease of about 10 percent in the period of operation.

The results from these traffic counts, however, do not warrant any firm conclusions. First, account must be taken of the

seasonal variations in traffic flows. This factor alone may account for a decrease of this magnitude. Second, that the price of gasoline decreased by nearly 20 percent between October 1985 and February 1986 must be considered. Third, in 1985 the Bergen area experienced the highest sales figures for new cars in years and these figures have also been high in the first quarter of this year. Public transport fares were increased by 7 percent on January 1.

A proper assessment of the impacts on traffic will therefore have to wait until more data are available and a thorough analysis has been carried out. The latest traffic figures, however, indicate a slightly higher diversion of traffic than expected. The greatest impact can be expected among motorists who use single or prepaid tickets. Pass users will face a marginal price of zero and can be expected to be unaffected by the toll ring.

FUTURE TOLL FINANCING IN NORWAY

As was mentioned previously, the financing of major road construction schemes is a general problem in the larger cities in Norway. At present discussions are going on in the Oslo region and in the city of Trondheim about whether to use toll financing on a major scale. In Trondheim a toll ring will certainly be considered. The Oslo City Council voted against a toll ring scheme a number of years ago and decided to use a traditional toll financing scheme for a major road project in the CBD. However, to obtain funds for additional projects and to avoid diverting traffic to other roads in the CBD, the use of a toll ring (or an area licence scheme) might be reconsidered.

The agreement reached between Bergen and the government, which guarantees Bergen a special grant of the same amount as the proceeds from the toll ring, will certainly create a precedent for similar agreements with Oslo and Trondheim. This will also make it more tempting for the local authorities to consider toll financing.

REFERENCES

1. C. L. Ballard, J. B. Shoven, and J. Whalley. General Equilibrium Computations of the Marginal Welfare Costs of Taxes in the United States. *American Economic Review*, 1985, pp. 128-138.
2. I. Hansson. Marginal Cost of Public Funds for Different Tax Instruments and Government Expenditures. *Scandinavian Journal of Economics*, 1984, pp. 115-130.