



EXECUTIVE BRIEF



TOLLING PRINCIPLES

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PPIAF is supporting a number of developing country clients who are looking to use public-private partnerships (PPPs) as a means of financing highway construction, rehabilitation and maintenance. However, before government decides on if and how to structure a PPP for a highway project, it needs to tackle the more rudimentary policy question of whether it is possible to charge tolls to highway users so as to create a more reliable and dedicated funding source for improving highways. This can be a challenging policy area and PPIAF is currently working in both Laos and Uganda with central government to help formulate policy and strategy towards tolling in advance of launching major highway PPP projects in both countries. PPIAF's technical assistance in this area has a key role in helping government understand the inherent policy trade-offs and risks associated with charging road-users.

INTRODUCTION

Most countries find it difficult or even impossible to provide sufficient resources for the optimal maintenance and rehabilitation of their highways. Highway infrastructure has a very long life if maintained properly. However, rapid growth of traffic, and goods vehicles in particular, which make the highest contribution to the 'wear and tear' of the highway, exert pressures on both the highway capacity and pavement performance. Highway deterioration is costly to existing highway users, whose vehicle operating costs increase and suffer from the negative effects of increasing congestion, and on social and environmental grounds as highway safety deteriorates and vehicle emissions rise.

Traditionally the public sector repairs deteriorating highways from its fiscal budgets. However, if fiscal budgets are constrained, highways will continue to deteriorate and economic, social and environmental costs will increase. Many countries have tried to combat this by levying tolls on users of highways. In fact, toll revenues already provide a much-needed source of revenue to expand and maintain highway networks in countries as diverse as Argentina, Australia, Austria, Brazil, Canada, Chile, China, France, Germany, Ghana, Greece, Hungary, India, Indonesia, Italy, Japan, Malaysia, Mexico, Mozambique, Nigeria, Peru, Philippines, Paraguay, Poland, Portugal, Russia, Senegal, Spain, South Africa, Sri Lanka, Switzerland, Thailand, United Kingdom and the United States of America.

WHY TOLL?

Charging highway users provides the following benefits to the public sector¹:

- **New, Stable and Dedicated Source of Funding and Finance.** Toll revenues represent a “new” source of revenue, where previously highways were supported out of general government revenues (and were free at the point of use). Tolls provide an incremental and ongoing revenue source, which is not tied to the annual government budgetary process; and importantly can be used as collateral to raise third-party finance (e.g. project finance/PPPs) that can fund further expansion of the road network. The funds from toll revenues are dedicated to support the construction and maintenance of a particular highway and therefore do not compete with the requirements of other highways in the network.
- **Applies the “User Pays” principle and the Internalization of External Costs.** Some governments have introduced tolls in pursuit of a general policy to increase the extent of “use related payment” or with the goal of reducing highway use and internalizing the negative effects of highway usage (e.g. congestion, air pollution and accidents). Charging for highway usage is central to a ‘sustainable’ transport policy. The “user-pay” principle is considered a fair and precise way of paying for transportation facilities.

- **Facilitates Private Sector Development.** Some governments have sought private sector participation in highway provision and to develop the private sector within their economy. The involvement of the private sector can allow the government to finance at least part of the highway development ‘off balance sheet’.

Toll revenues can also be used to promote regional equity through cross-subsidization of highway construction and maintenance. Some countries, including France and Japan, have introduced tolls on one highway in order to support the development of infrastructure networks in less developed regions.

It is crucial that a government considering highway tolling has established clear objectives in pursuing a highway tolling policy as these objectives will direct all activities undertaken, both in the early years and during the operation of the highway as regulatory questions arise. The objectives of tolling directly influence the final toll tariffs charged to highway users.

POTENTIAL CONSEQUENCES OF TOLLING

The introduction of a toll charge on new or upgraded highways can have far-reaching consequences. Some of these consequences will be deliberate, such as the generation of revenue, but others may not have been foreseen. Intentional and unintentional consequences of tolling may include:

- **Cost Recovery.** Traffic and toll tariff levels may not be sufficient to cover all costs, including construction, operation and maintenance. In developing countries where traffic levels are low or where construction costs are high, it is unlikely that the toll revenues will ever cover more than operation and maintenance and perhaps a part of the construction cost. Tolling is therefore not a complete solution for low-trafficked highways requiring significant capital expenditure. Additional funding will be required from sources such as government subsidy, public (e.g. from development banks) or private borrowing.
- **Revenue Risk.** Whether the risk is held by the public sector, the private sector or shared, there is always a risk that outturn toll revenues may be insufficient to cover debt payments and operating costs which may lead to bankruptcy or sovereign debt guarantees to banks for payment of the debt.

¹ http://www.worldbank.org/transport/roads/toll_rds.htm



- **Diversion of Traffic away from the New Highway.** Price elasticity of demand and the provision of toll-free alternatives to the tolled highway, will affect the level of traffic on the facility. In turn this may mean that some potential economic benefits of the new highway are lost since the objective of new highway provision is to move people and goods more reliably and quickly.
- **Social Impacts.** Just as with any highway, toll highways can have positive and negative social impacts in the manner and location of their construction and in their operation. Of particular concern is the potential inequity that can result from charging low-income users, particularly those who use the road frequently.
- **Political and Public Opposition.** Political opposition to highway tolling has been significant in some countries. There is also a common misconception that tolls are a form of double taxation. Motorists often perceive that they are paying for the highway twice, by paying a toll and through their taxes, when in fact their taxes are being used to fund other highways.

WHAT IS THE USER PAY PRINCIPLE?

Tolling is a method for a motorist to pay only for the section of highway that they are using. This concept is often referred to as the “user-pay” principle because the toll highway is partially or completely funded by those choosing to pay for the use of the facility. Motorists using a toll highway pay directly for the benefits it offers whereas traditionally funded highways receive budgetary funds collected from all tax payers regardless of their use of the highway.

A highway network has very high economic and social benefits and is typically provided by the public sector either toll-free or at minimal cost in the same way as basic health care and education is provided in many countries. However, most other infrastructure networks such as railways, pipelines, power grids, water, broadcasting and broadband networks are all charged for. Many of these networks are provided by the public sector that would (and could) not provide these services free of charge.

The ‘user-pay’ economic principle recognizes that those responsible for the expenditure of scarce resources should bear at least part of the costs they impose. A second principle of ‘competitive neutrality’ suggests that the provision of one free transportation network, such as highways, leads to a distorted traffic allocation away from other modes of transport, such as rail.

Transport costs can be categorized as internal or external.²

- **Internal costs:** are incurred from the provision (construction, maintenance) and use of transport infrastructure. These costs are recovered from infrastructure users (“user-pays”) or from the public.
- **External costs:** stem from (mostly negative) side-effects of transportation, such as congestion, accidents, emissions and pollution, noise, and aesthetic factors which all negatively affect people and/or future generations. They are rarely borne by highway users.

²The challenge: sustainable road transport http://www.unescap.org/ttdw/Publications/TPTS_pubs/pub_2216/roadprice_ch1.pdf



The toll system design has a strong influence on the potential for the operator to toll equitably and the types of measures which may be required in order to charge motorists proportionately for their highway use.

The 'User Pay' principle is a 'sea change' in the economics of transport supply and demand. It relies on the user paying a fee for *all the internal costs* of the transport supply facility including the construction, operation and maintenance as well as vehicle operating costs. Internal costs can be quantified and attributed to those who benefit - highway users.

Charging for the external costs of transport infrastructure is still rarely undertaken. Congestion-charging in large cities goes some way to address the costs of the side-effects of transport. The German truck tolling system 'Toll Collect', which charges tolls according to the emission category of a vehicle, has been responsible for a dramatic improvement in fleet efficiency in Germany and its neighboring countries. Whilst effective, these measures do not fully recoup all external costs which are often difficult to fully quantify.

WHAT TOLL TO LEVY?

In reality, toll tariffs are a compromise between financial needs and economic benefits i.e. they provide sufficient revenue to service loans or recover budget but are not so high to make them unaffordable or to seriously discourage their use by motorists.

The level of tolls to be set by a government is highly dependent on the level of cost-recovery desired by that government. Toll tariffs can be:

- **Revenue-maximizing.** To recover as much of the cost, operation and maintenance of the toll facility as possible. Empirical evidence from South Africa has found that the point of revenue maximization has been found to occur where the toll tariff is about 75% - 80% of the perceived benefit to the user resulting in the traffic attraction to a rural toll highway of about 80% - 85% of the total corridor traffic³.
- **Welfare-maximizing.** To recover a *contribution* to the operating and maintenance costs of the toll facility whilst maximizing the economic and social benefit of the infrastructure. Tolls designed to maximize the social and economic benefits of a toll highway are lower than the revenue-maximizing tariffs in order to attract high volumes of traffic to the facility, thereby promoting the movement of people and goods. However a lower contribution of toll revenues will result in a higher contribution from government budgets towards the cost of construction, maintenance and operation of the facility.

³ Specialist Study on the Potential Impact of the Proposed N2 Wild Coast Toll Highway on Traffic Diversion, Tolplan (Pty) Ltd, 22 April 2008

- **Operation and Maintenance Cost Recovery.** To recover the ongoing operating and maintenance costs of the toll facility (the construction cost having been paid out of government budgets). Many toll highways and bridges in the USA recover their operation and maintenance costs only, the capital cost of the facility being funded by the State Government.

Toll tariffs will also vary according to:

- **Vehicle classification.** In general, the larger the vehicle, the more damage that it inflicts on the road pavement and the higher the toll tariff.
- **Time of day or day of week.** Variation by time of day is typically used where congestion causes considerable delays to travelers.
- **Cost of highway construction.** Tolls vary across a country or region because of the different costs of highway construction through different areas (e.g. for toll highways that include expensive structures like a tolled tunnel, tolls tend to be significantly higher on a per km basis).
- **Social considerations.** Some countries make political decisions to encourage the use of new facilities by specific types of users or vehicles, for example High Occupancy Vehicles.
- **Geographical area.** Area pricing schemes exist in Singapore and London. Both systems are fully automated and tolls vary by time of day and day of the week to reflect congestion levels.
- **Loyalty programs and other discounts.** With the introduction of electronic tolling systems, social and commercial discounts and loyalty programs are becoming easier to administer.

Other systems of area tolling rely less directly on highway use. Vignette systems are generally economical to operate, overcome criticisms of toll variability by charging flat fees for access to the highway network and provide an incentive to users to maximize their use of the highways rather than use less safe and more congested highways. The main disadvantage of vignette systems are that the cost to the highway user is not directly related to their use of the highway and users are charged the same amount regardless of distance travelled.

Toll systems are classified as either 'open' or 'closed'.

- **Open System.** A system is typically described as 'open' when there are no toll booths on the entry or exit ramps to the highway. The tolls are collected at points along the highway and are therefore not directly related to actual distance traveled by the user.
- **Closed System.** All exit and entry points are monitored and tolls collected on exit, so that all travelers make payments and the payments are directly related to distance traveled.

The toll system design has a strong influence on the potential for the operator to toll equitably and the types of measures which may be required in order to charge motorists proportionately for their highway use. It is more equitable to charge per distance travelled on a toll highway and distance-based tolling is easily implemented for a closed toll system where no movements can be made toll-free. If the toll system is open, local discounts may be needed to ensure that relatively short trips that straddle a plaza are not charged at the same toll tariff as much longer trips. Under an open system, there may be local trips that take place on the highway between plazas which are intentionally or unintentionally not charged for at all.

HOW TO TOLL EQUITABLY AND PROPORTIONALLY?

A tolling strategy should be designed to ensure that no users are severely disadvantaged in comparison with other users of the highway. Various strategies are used in practice to promote tolling on an equitable basis including:

- **Level of Service Improvements.** Tolls should only be introduced on highways which have received significant upgrading or on new highways of a high standard.
- **Local and frequent user discounts.** For highways with high volumes of local, frequent traffic passing through the toll plazas, local and frequent discounts should be considered to reduce the financial burden on these users.

- *Provision of a parallel toll-free highway.* A free parallel highway ensures that those unable or unwilling to pay a toll can still have access to the highway network. It is generally preferable to locate toll plazas away from population centers and offer local users toll discounts rather than provide a toll-free alternative route.
- *Discounts by payment method.* The cost of toll collection varies significantly according to the technology installed. Many toll concessions reward their users with discounts when they use more cost-effective payment techniques such as electronic tags.
- *Distance between toll plazas.* Some countries specify the distance between toll plazas to ensure that users are not over-burdened with toll payment requests, to allow local toll-free movements between plaza locations (if the toll system is open) and to minimize the cost of toll plaza construction and operation.
- *Cross subsidy between different parts of the network.* Some existing highways have been tolled in order to provide revenue for construction of new segments of the network.

WHICH TOLL TECHNOLOGY TO USE?

Getting the approach to tolling right, given the situation of the particular highway and the options available, is important in terms of public acceptability, revenue yield, ease of implementation and operating costs. Where schemes are poorly designed leakage through toll avoidance, pilferage or fraud can be significant.

There are three basic toll collection options: manual tolling; mixed tolling; and fully electronic tolling. The traditional method of collection is manual payment of cash or coins at a toll plaza. The main drawback of this system is that it is slow and therefore requires more toll booths/lanes than any other to achieve the same traffic throughput.

Successful fully electronic systems are now operating worldwide. The latest new generation of tolling is known as 'Open Road Tolling' (ORT) where drivers do not need to slow down to pay their toll and there is no toll barrier. Electronic systems require all users to carry tags in their vehicles or the vehicle registration plate to be registered to an account. As toll gantries are passed, the tag or registration plate is identified and the toll account of the highway user instantly debited.

TOLL EVASION AND ENFORCEMENT

There are many ways to avoid tolls. However with good policing, sensible design and rule of law the problems can be overcome. Typical techniques to defraud toll highway operators of toll revenue include:

- *Abuse of local discounts and exempt vehicle status.* Strong safeguards must be in place to ensure that only those meeting strict criteria receive a discount or exemption status.
- *Unregistered vehicles.* A small but common problem for electronic toll highway operators is the cost and ability of operators to trace drivers of unregistered vehicles which can result in both significant revenue losses and high collection enforcement costs.
- *False/unreadable/obscured licence plates.* Systems that rely on licence plate matching can be liable to toll evasion by the use of false, unreadable or obscured licence plates.
- *Pilferage of the toll revenues.* Often governments have considered privatization of toll collection because of the difficulty of ensuring that toll revenues are not removed illegally by members of the collection or counting team.
- *Informal Tolls.* In some countries "informal tolls" or fines/fees levied by police, bandits, or others, can be considerable, and make a significant difference in driver's behavior.
- *Diversion around toll plazas.* If a parallel highway exists, some diversion around toll plazas is expected. However diversion around plazas on informal roads such as farm accesses can take place resulting in safety concerns and loss of toll revenue.
- *Toll ticket transfers.* Drivers have been caught using toll tickets for shorter distances than actually travelled.

Toll fare evasion levels on highways are rarely published and can vary significantly by highway project depending on the location of the project, the ease of fare evasion and enforcement practices. One method of mitigating the revenue lost due to toll evasion is to pass the risk to the toll highway operator. This puts the onus on the Concessionaire to ensure that its system is robust with respect to toll evasion. Most concessionaires charge an administration fee that covers the cost of tracing the violators and the revenue lost from untraceable violators.



Failure to properly enforce toll evasion can threaten the financial viability of a toll highway. Most governments permit a charging authority (public or private) to take civil enforcement action against drivers who fail to pay a highway user fee. Tolling Regulations are generally passed in law to establish the 'right to toll', define an 'offence' and prescribe measures to enforce payment. A charging authority is typically permitted to recover an unpaid toll as a contract debt including any collection fees, penalty or costs that may apply.

SUMMARY

Highway tolls can provide a new, stable and dedicated source of funding of highway infrastructure. By applying the 'user pays' principle, governments can direct scarce budget resources elsewhere and the highway user pays for the service offered by the highway in the same way that railways, pipelines, power grids, water, broadcasting and broadband networks are paid for.

Potential consequences of tolling include the uncertainty that toll revenues will be sufficient to cover all the costs of construction, maintenance and operation (revenue risk). Toll highways are rarely self-financing, often still requiring substantial public subsidy and may create long term liabilities for governments. High toll tariffs can result in diversion away from the highway onto less suitable routes, resulting in the loss of some of the potential economic benefits of the highway accruing from improvements in travel time reliability, time savings, vehicle operating costs and highway safety.

The financial feasibility of a toll highway is directly linked to its revenue-generating potential which, in turn, is directly related to the toll tariffs charged to users. These tariffs are a balance between social, environmental and financial constraints ranging from revenue-maximizing tariffs to welfare-maximizing tariffs. Potential techniques to promote tolling on an equitable basis should be considered and will vary according to the nature and location of the toll highway.

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