For centuries, road pricing systems were used for the finance transport infrastructure, which have been more and more modified and technologized. Historical tolls changed into high-tech systems with accurately distance-record of traveled miles, usable for correct allocating of costs, more efficient utilization and environmental issues as so-called external effects. But not all countries in the world use these possibilities, which lead to the content of this thesis with a comparative and evaluating view on these systems.

First, there is a general look to toll systems in its effects, effective ranges and operating purposes. As part of mobility pricing and shape of road-pricing, primarily the financial aspect is the basic motivation for the collection of tolls. Here, the systems differ in various aspects, so that additional targets like traffic management and environmental protection are given.

The effects of traffic management influence in addition already effects on environmental factors. Thus, traffic avoidance and relocation strategies (modal split), cause in addition the transport impacts, reducing emissions as a positive environmental impact. Basically, these effects are caused by the monetary burdens that must not necessarily be based on usage.

Furthermore, used systems differ in usage-based or access related systems. Usage-based systems (depending on distance or track sections) ensure the allocating of the effective use of infrastructure leading to cause-based internalization. In access-related (time-based) systems, the right of usage is acquired over a period of time, not considering the actual burden on the infrastructure.
Apart from the different survey methods, a distinction of tolled infrastructure and comprehensive vehicle is executed. The range is thus between network-wide systems for all motor vehicles and truck-toll system on highways only, which the focus of this thesis is placed on.

If, additional to financial aspects, the other effects should be achieved, truck-tolling systems are used, providing a distance-related basic. These are graded according to pollutant classes and gross vehicle weight of trucks. On the one hand side, the usage-based allocating of costs, on the other hand, a positive influence on environment issues take place. In these kind of systems, business impacts such as changing fleets towards environmentally friendly vehicles and traffic reduction processes through better utilization rates and tour planning, are proved.

Distance-related systems are both more accurate and more expensive caused by the necessary higher technical infrastructure and administrative tasks. This is leading to a continuous use of time-based systems. These can achieve both the financial, which just partly depend on usage, as well additional effects. Thus, differing prices with regard to the specific vehicle category, achieve a positive influence on environmental effects. From the perspective of traffic management, these systems lack both the significant influence on the modal split to other traffic infrastructure (only minor effects on the overall traffic load is given), as well as the possibility of transport routing changes.

Beside these effects, toll systems based on the overall road network, lead to negative consequences for the lower traffic network through "toll runaways". This effect could be seen on the example of Germany very well, where gradually parts of the lower traffic network have to be integrated in the toll system or getting closed for trucks. This effect is significantly lower on time-based systems.

In principle, the use of toll-systems for trucks on the higher traffic network is recommended especially in countries with a high proportion of cross-border and transit traffic, in order to involve these users in the allocating cost issue.

This thesis has shown that the design of toll-systems may differe by specific local circumstances. All systems are able to achieve the financial aspects in general or in pre-financing reasons. However, it is generally recommended, choosing distance-based toll systems on the overall road network by taking the most available parameter graduation, to cover (external) costs and reduce the negative environmental impacts as well as those on lower traffic networks.
Moreover, on this basis, the greatest impact on traffic volume and behavior can be taken and therefore the best possible effects of traffic management will be implemented.

Patrick Treiber
July 2012