International comparison of the design of toll systems in road traffic and their effects on mode and route choice

Bachelor‘s Thesis of Shuyan Peng

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Introduction

Since the establishment of the autobahn, Germany, unlike other countries, has never levied a toll on private cars, only on trucks over 3.5 tons. In May 2015, the German Federal Ministry of Transport and Finance agreed that the only way to make up for the lack of investment in transport infrastructure was to increase tolls, which would ensure the long-term maintenance of the infrastructure. As a result, the German Bundesrat approved a bill on freeway tolls to be charged to cars starting in 2016. However, due to citizen opposition and various pressures, the proposal did not come into force for a long time. As of October 1, 2021, Germany introduced new prices for truck tolls. In order to establish a toll for private cars that is suitable for the German economy and policy, it is necessary to understand how tolls are charged and priced and to gather information about how other countries charge tolls and how they affect people's travel after they are charged.

Implementation of toll systems

➔ Time-based toll

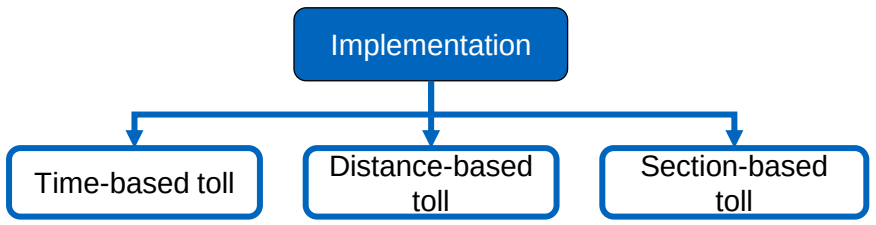
In a time-based tolling system, road users must be allowed access to the released infrastructure for a specific period of time. The user pays a virtually identical usage fee for several days for access to a restricted area.

➔ Distance-based toll

In the concept of distance or area-based tolling system, a vehicle is charged for the total distance it travels within a defined area.

➔ Section-based toll

This term is used to define explicitly unique and relatively expensive infrastructure such as a bridge, a tunnel, a mountain pass, a highway concession, or an entire road network.



Comparison of toll systems

The advantages and disadvantages of the three implementations can be seen by comparing the highway toll prices from different countries using the same implementation.

➔ Distance-based toll

+ the same and fair for each person
+ cheaper price per year using distance-based tolls than time-based tolls per year

- daily travel tolls are higher than time-based tolls
- leads to road congestion
- the economic pressure on the government

➔ Section-based toll

same as distance-based toll

➔ Time-based toll

+ purchase vouchers online or at offline stores
+ more ways for non-citizens to purchase vouchers in advance

- not suitable for internalizing external costs or incentivizing more sustainable behavior
- price differences are so slight compared to the vehicle's cost price
- impedes the free flow of traffic

Effects of toll systems

➔ Effects on traffic outcomes

Congestion pricing has a significant impact on traffic volume, travel time, and public transport travel. In general, after the congestion charge, traffic flow was significantly reduced compared to before, delays started to decrease, and people started to travel from private cars to public transport trips. Moreover, the implementation of congestion pricing results in a significant increase in public transportation trips.

➔ Effects on economics

Since transport companies essentially need to transport goods in trucks of more than 3.5 tons per day, their transportation costs will increase significantly. Furthermore, the tolls for trucks are often higher than those for private cars, and since most countries charge distance-based toll fees for trucks, transport companies need to spend more cost or time to plan new transport routes. The increased cost also means higher freight or commodity prices.

➔ Effects on environment

Traffic emissions may cause adverse health problems for nearby residents and workers and pollute the surrounding atmosphere, especially during traffic congestion. The concept of tolling has been introduced to highways as to reduce pollution. The results learned that the implementation of highway tolls resulted in a significant reduction in greenhouse gas and pollution gas emissions.

Recommendations for the introduction of a toll in Germany

By analyzing the definition of toll system, the comparison of tolling methods and prices in different countries, and the changes in route planning and travel patterns before and after tolling, I would like to give some suggestions and opinions on tolling on highways in the light of the current policy and situation in Germany.

➔ Charging implementation

The suggestion is to use vignette for passenger vehicles or tolls in specific areas.

➔ Price establishment

Different prices should be charged according to different vehicle performances.

➔ Environment and transport industry

- The existing truck tariff of the transportation industry should be followed.
- Different prices should be charged.
- Tolls should be charged appropriately to reduce the number of trips people make using private cars.