



memo

Infrastructure cost allocation per vehicle category

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The Dutch Truck Toll consists of three components: an infrastructure charge, an external cost charge for noise and air pollution and an external cost charge for CO₂-emissions. European directives for toll – specifically 1999/62/EC - prescribe that there is a maximum amount that can be charged for each component. In the case of the external cost charges this maximum is based on the emissions of vehicles. In the case of the infrastructure charge this maximum charge is based on the road infrastructure costs that can be allocated to trucks, specifically the weighted average motorway infrastructure costs.

This memo summarizes the methodology used to determine the maximum weighted average infrastructure costs for the Dutch truck toll. Furthermore, it provides the maximum rate resulting from these calculations, using the latest data. The truck toll is implemented for the Dutch motorway network and several alternative routes. Therefore, this memo focusses on the motorway infrastructure costs only.

TM Leuven (2018)¹ describes how the maximum toll charge is determined. The method used for the infrastructure costs is described in detail in Chapter 3 of CE Delft (2014)². This memo is just a summary of the methodology. The justification of this method can be found in CE Delft (2014). All prices and cost levels in this memo are at the price level of 2023.

1.1. Definition of infrastructure costs

The infrastructure costs are separated into four different categories:

- **Construction** costs: All costs regarding the construction of new infrastructure.
- **Renewal** costs: All costs regarding the renewal of existing infrastructure to bring the quality back to the level of the previous works. The renewed infrastructure has a lifespan of more than 1-2 years.
- **Maintenance** costs: All non-renewal costs with the aim of bringing the quality back to the level of the previous works. This is mostly small-scale maintenance works with a lifespan of less than 1-2 years.
- **Management** costs: All costs regarding services that are needed for efficient use of the infrastructure (e.g. police, traffic management and others)

¹ TM Leuven: [Bepaling maximum tarief vrachtwagenheffing 2018](#)

² CE Delft: [Externe en infrastructuurkosten verkeer, 2014](#)

For the urban infrastructure the costs of parking places are considered part of the construction costs as well. These are allocated separately to only cars and vans.

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1.2. Separation between fixed and variable costs

There is also a separation between fixed and variable costs. Fixed costs are independent of the traffic intensity on the roads, whereas variable costs are dependent on how intensive the road is used. The four cost categories are divided between the fixed and variable costs. This results in the following categories and the corresponding costs in million euros:

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- **Fixed costs** consist of:
 - 100% of the construction costs, € 2.980,19
 - 40% of the renewal costs, € 308,37
 - 67% of the maintenance costs, € 189,34
 - 100% of the management costs, € 243,85
- **Variable costs** consist of:
 - 60% of the renewal costs, € 458,91
 - 33% of the maintenance costs, € 62,35

1.3. Allocation per vehicle category

For the allocation per vehicle category the 'equivalent factor method' is used. Despite the name there is not a single equivalent factor, but rather a combination of relevant 'cost drivers'. There are four cost drivers used:

- Vehicle kilometres
- Passenger Car Equivalent (PCE) kilometres
- Second power axle loads
- Fourth power axle loads

1.3.1. Allocation per cost type

Each of the individual subcategories of the infrastructure costs is allocated to each vehicle category using a mix of cost drivers. The list below is used for the allocation of the motorway infrastructure costs. For other roads different mixes are used and include category specific infrastructure like parking and bike paths.

- Fixed costs:
 - Construction costs:
 - 89% based on the PCE kilometres
 - 11% based on the fourth power axle loads
 - Renewal costs:
 - 20% based on the vehicle kilometres
 - 4% based on the second power axle loads
 - 76% based on the fourth power axle loads
 - Maintenance costs (Motorways):
 - 35% based on the vehicle kilometres
 - 50% based on the PCE kilometres
 - 15% based on the vehicle kilometres of trucks above 12 tons
 - Management costs:
 - 30% based on the vehicle kilometres
 - 70% based on the PCE kilometres
- Variable costs:
 - Renewal costs:
 - 20% based on the vehicle kilometres
 - 4% based on the second power axle loads
 - 76% based on the fourth power axle loads

- Maintenance costs:
 - 32% based on the vehicle kilometres
 - 4% based on the second power axle loads
 - 64% based on the fourth power axle loads

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This means that 89% of all the construction costs are allocated based on the PCE kilometres of each vehicle type and 11% using the fourth power axle loads.

1.3.2. Axle load calculations

The second and fourth power axle loads consist of the axle damage factor of each vehicle category times the vehicle kilometres. The axle damage factor is calculated for each individual axle using the following formulas:

For the second power axle loads:

$$\text{Axle damage factor} = (\text{axle configuration factor} * (A / A_{std}))^2$$

For the fourth power axle loads:

$$\text{Axle damage factor} = (\text{axle configuration factor} * (A / A_{std}))^4$$

- The axle configuration factor reduces the damage factor for axles that are configured in tandem or tridem (found in Table 138 of CE Delft (2014))
- A is the actual axle load in tonnes
- A_{std} is the standard axle load equal to 10 tonnes.

It is assumed that the total vehicle load is equally distributed over each axle, because there is no data on the actual load distribution. Table 135 of CE Delft (2014) contains data for the axle loads per vehicle type.

1.4. Results

Using the aforementioned methodology the weighted average motorway infrastructure costs can be calculated for each vehicle type. The required data can be found in CE Delft (2014): Table 133 gives the vehicle kilometres of each vehicle category and Table 136 gives the PCE values. Detailed data for each cost category and for each truck category is used as well.

Trucks are responsible for 4.801 million kilometres driven on Dutch motorways and 1.204 million euros of the motorway infrastructure cost. This corresponds to 8,1% of the total kilometres driven on Dutch motorways and 39,1% of the total Dutch motorway infrastructure costs.

The resulting weighted average motorway infrastructure costs - in price level of 2023 - is **0,3453 euros per truck kilometre**. These costs were used in Table 3 of TM Leuven (2018).

1.5. Comparison to newer report

TM Leuven (2018) used CE Delft (2014) to determine the maximum allowed weighted average infrastructure charge for the truck toll. CE Delft (2022)³ is an updated version of CE Delft (2014). This newer version has updates to the total costs, kilometres driven and occupancy rates. The price level is updated from 2010 to 2018. There are some changes to the methodology as well:

³ CE Delft: [De prijs van een reis, 2022](#)

- Maintenance costs are now considered 71% fixed and 29% variable instead of 67% and 33% respectively
- The fixed renewal costs are now for 22% based on the vehicle kilometres instead of 20%
- The variable maintenance costs are now for 37% based on the vehicle kilometres instead of 32%
- Extra subcategories for electric vehicles are introduced

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The changes in the fixed renewal costs and the variable maintenance costs also affect the share of the 2nd and 4th power axle loads in the allocation of the costs. CE Delft (2022) does not elaborate on what these new shares are. It is assumed that the ratio between the 2nd and 4th power axle loads did not change, or change marginally at most, with the most still being allocated using the 4th power axle load.

These updates result in weighted average motorway infrastructure costs of **0,2890 euros per truck kilometre**.

1.6. Maximum toll levels

The maximum allowed weighted average infrastructure charge is equal to the infrastructure costs that can be allocated to the trucks. The weighted average infrastructure charge is **0,0745 euros per truck kilometre**. This is far lower than both the weighted average infrastructure costs of CE Delft (2014) and CE Delft (2022). The total weighted average truck charge is **0,1667 euros per truck kilometre**. This price includes the charge for noise and air pollution and the charge of CO₂-emissions as well.