Social costs and benefits of investments in cycling

Summary

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Summary

Introduction

Since bicycle infrastructure is relatively cheap to implement, it usually is neglected or ignored in infrastructural programs of central and local governments in the Netherlands.
Still, the bicycle being a healthy, inexpensive and environmentally friendly means of transportation, it turns out to have great advantages when sustainability and economy are concerned. Also, the bicycle is going to be an alternative for the longer distances, once bicycle highways and electric bicycles are more readily available.
All this creates a growing need for an adequate framework for assessing investments in cycling infrastructure and other measures promoting bicycling.

The Ministry of Infrastructure and Environment in the Netherlands (MIE) uses the OEI methodology (Overview Effects Investments) to analyze the social costs and benefits of investments in infrastructure and other policy measures. For large infrastructure projects the use of this method is mandatory. For bicycle infrastructure, up till now this method has hardly been used, partly because the investment costs usually are relatively small. For smaller projects a social cost-benefit analysis (SCBA) is also a useful means of structuring the discussion and providing objective information for the purpose of decision making.

Therefore, MIE has commissioned Decisio and the Transaction Management Centre to execute a quick scan of the possibilities of applying the OEI tools to bicycle measures.

The main question of this research is:

"Is application of social cost-benefit analyses according to the OEI methodology useful for bicycle measures?"

In the quick scan the OEI methodology has been applied in three concrete cases , thus bringing to light the social costs and benefits of cycling projects:

1. Bike kilometer
Understanding the relationship between the social costs and benefits of a bicycle kilometer compared to a car and bus kilometer. In this case we collected general, widely applicable figures / indicators, thus providing a basis for the other two cases and other bicycle related SCBAs.

2. Bike Connection
Understanding the relationship between the social costs and benefits of a bicycle connection across a waterway /railroad /highway. As a case we have chosen a bike bridge in Utrecht, spanning the Amsterdam-Rijn canal linking Leidsche Rijn and Oog in Al in a more direct way.

3. Paid bicycle parking near stations

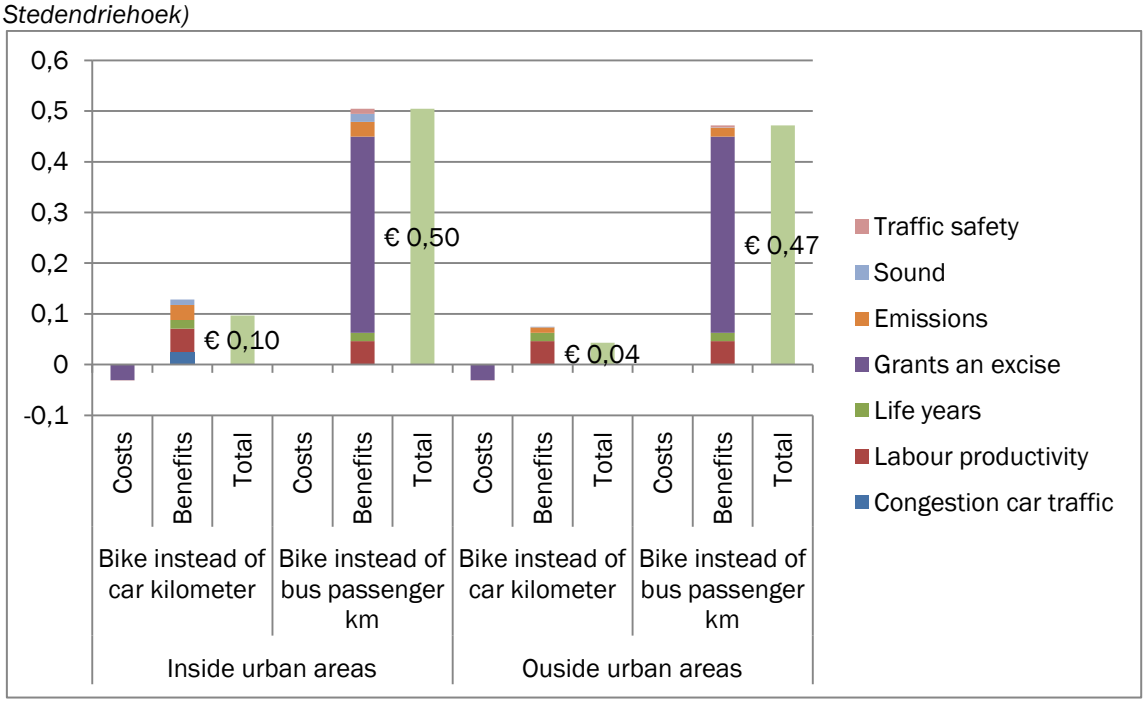
Understanding the relationship between the social costs and benefits of paid versus unpaid parking near stations. As a concrete case is chosen Utrecht Central Station.

Case 1 Average bicycle kilometer

In the first case, we gathered data about many different effects of transport by bicycle, car and bus. Ranging from health effects, environmental effects, impact on tax revenues to delay of other traffic participants. The figures S1 and S2 below summarize the results.

We have used two figures to clarify the impact on the network (the delay caused for other road users). The first figure is based on the characteristics of the Stedendriehoek[1]; here one car ride less yields a relatively limited benefit to the other cars. The second figure is based on the characteristics of the city of Alkmaar; here one car ride less yields relatively much gain in travel time for other motorists[2].

Figure S1 Social effects modal shift per kilometer (area with relatively little congestion, Stedendriehoek)



Figures S1 and S2 show that both inside and outside urban areas, and both in a less congested environment like the Stedendriehoek and a more congested environment like Alkmaar, a switch from car or bus to the bike has a net positive social impact. A switch from bus to bike yields a social gain

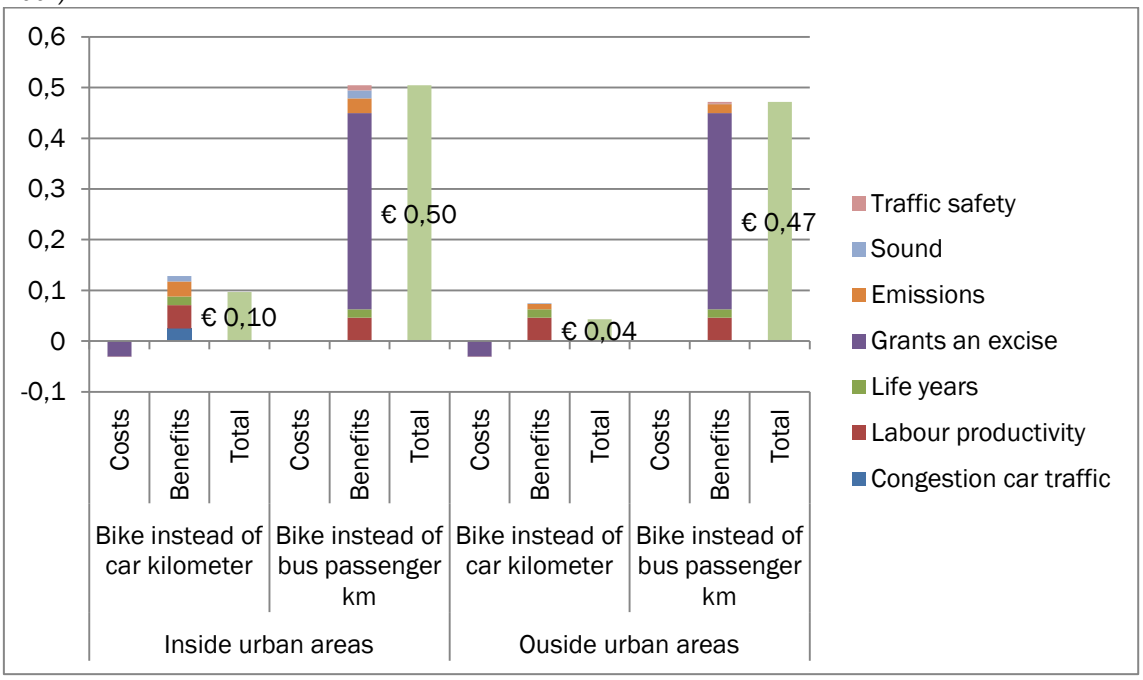
[1] lit. City Triangle: area spanning the cities of Apeldoorn, Deventer, Zutphen.

[2] Also, Figure S2 is based on a higher estimate of the health effects; figure S1 on a lower estimate

of around 50 cents. A shift from car to bike outside urban areas yields 4-7 cents per kilometer; in urban areas this is 10 to 41 cents.
The results can also be read as the amounts one (society) is willing to spend per passenger kilometer in order to have one person switch from car or bus to the bike.

Note that these effects are purely the effects on society, not on the traveler (travel costs, travel time). Also, this analysis does not involve any investment, hence no costs of investment (and maintenance). So, the direct effects do not show in the figures. If a concrete investment /action is involved, these effects can (and should) be determined, of course. This is done in the other two cases below.

Figure S2 Social effects modal shift per kilometer (area with relatively much traffic congestion; Alkmaar)



Looking at the distinct effects, we see that when one switches from car to bike, the main impact is the reduced delay of the other traffic. Of course, the magnitude of this effect strongly depends on the density of the traffic on the specific route, hence the large differences. A switch from bus to bike mainly saves government money[3]. An important caveat here is that it is far from clear that money can indeed be saved.
Generally speaking, public transport supply can be adjusted, hence grants may be reduced, only when it comes to larger volumes. This is particularly true for traveling in rush hour, since a better spread of public transport over the day leads to a better exploitation.

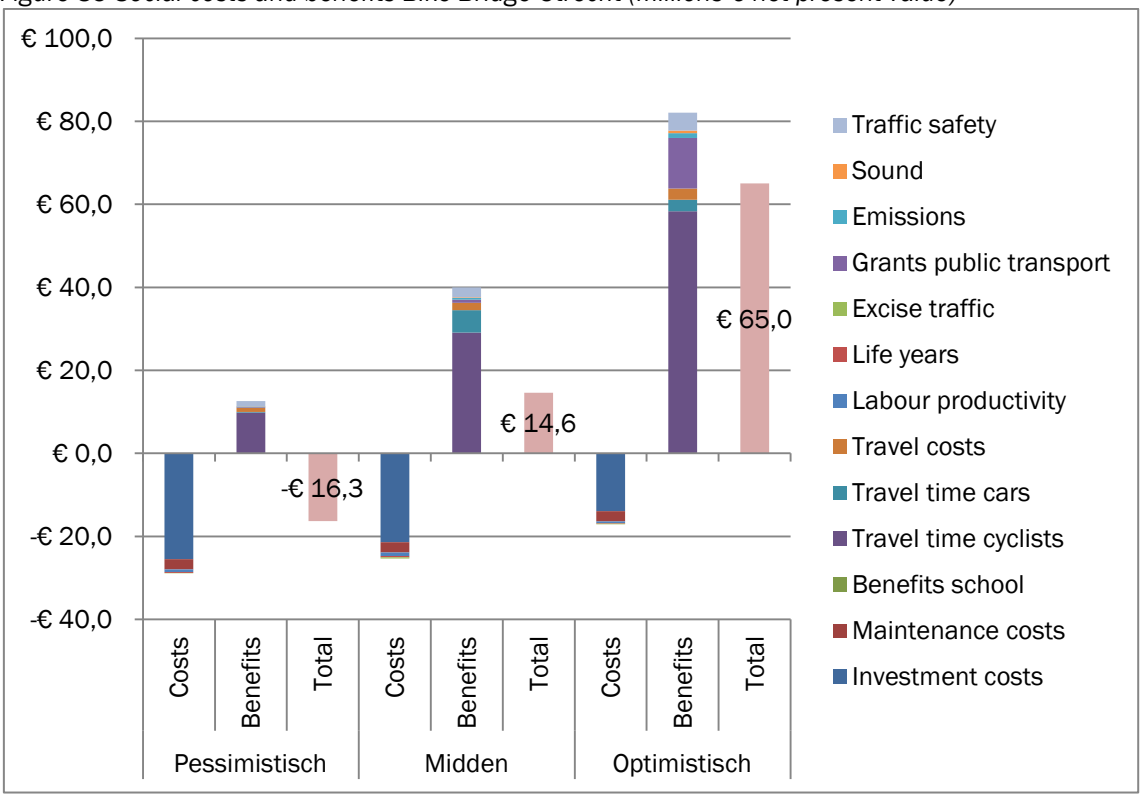
[3] Public transport is being subsidized.

Case 2 Bike bridge Utrecht

The second case is the bike bridge spanning the Amsterdam-Rijn canal linking Leidsche Rijn and Oog in Al. In the SCBA we compare the situation without a bridge (reference situation) to the situation when the bike bridge is built, and schools and a sporting facility are being demolished and rebuilt. (This is the scenario chosen by the Board of Aldermen and the City Council in 2011.)
As there is no information about the benefits (energy savings, a more pleasant building, etc.) of the new school buildings[4], we have designed several different scenarios. In these scenarios we use different values when estimating the valuation of travel time by cyclists and the number of cyclists using the bridge. Thus, the scenarios the extreme range of the cost effectiveness of the project.

As Figure S3 shows, the social cost is higher than the social benefits only in the most pessimistic scenario. It should be noted that in this scenario the cost of demolition and rebuilding of the schools are included, but not the benefits (nor the savings in maintenance and energy costs). Moreover, in this scenario we went with a low valuation of travel time by cyclists and low usage of the bike bridge. In the other two scenarios, the bike bridge has a very positive score in the SCBA.

Figure S3 Social costs and benefits Bike Bridge Utrecht (millions € net present value)



When we look at the distinct effects, it is obvious that in this case the biker's gain in travel time is by far the most important benefit. It is, therefore, particularly important to have a clear picture of the

[4] The existing buildings date from the fifties and are obsolete.

number of cyclists benefiting from new bicycle connections and of the travel time valuation to be used for the cyclists.

The travel time elasticity and the related modal shift is another important aspect that should be clarified. If the bike bridge leads to a shift from car to bicycle, the benefits are relatively high (saving travel time for the other cars), and if the project leads to a shift from bus to bicycle, the benefits can also be high (savings in subsidies[5] as a result of the adjustment of the timetable and the equipment to the reduced demand).

Case 3 Paid bicycle parking near stations

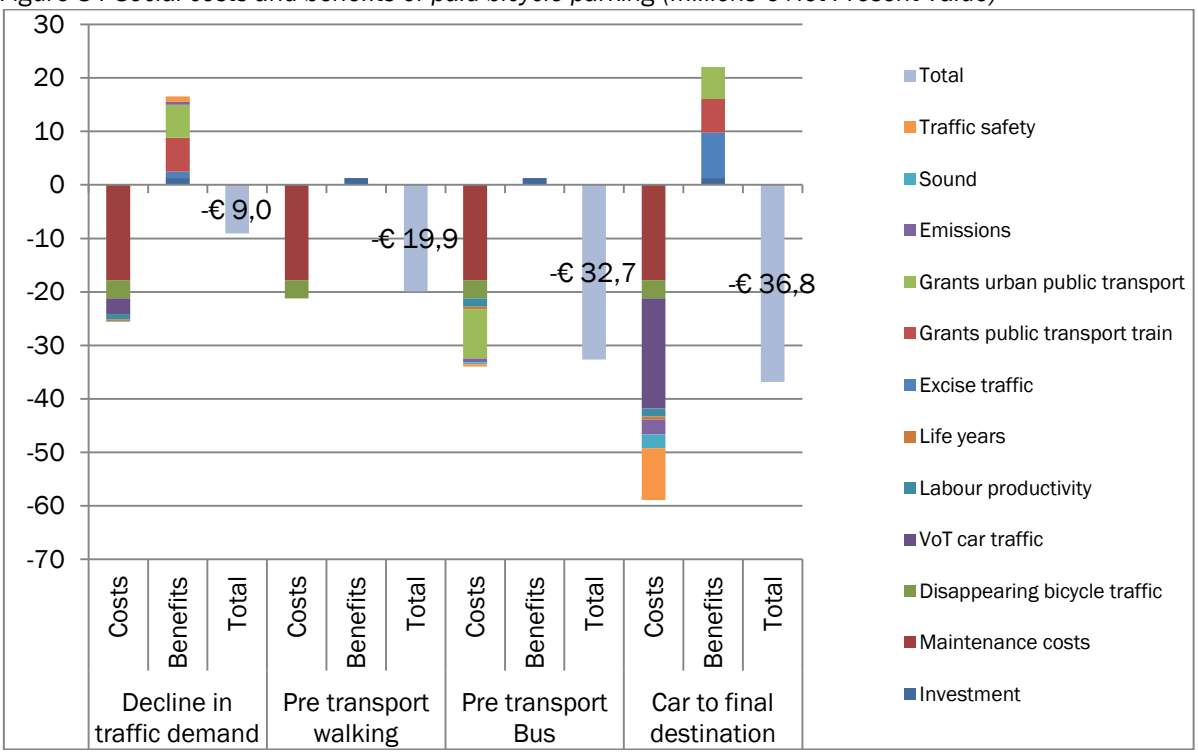
The third case is paid bike parking at Utrecht Central Station. What are the effects of the introduction of paid bike parking? The reference situation in the present analysis is the future situation in 2025 (22.000 bike parking places and as many cyclists per day) with parking free of charge. The alternative is the situation in which each cyclist has to pay a fixed fee (1 euro) per day. The effect of this on the demand and required supply is included in the analysis.

The main conclusion to be drawn from this case is that in all scenarios paid parking leads to a negative social cost-benefit balance. There is a logical explanation: the yields of paid bike parking are no social benefits. In the zero charge alternative, the parking costs are covered by all taxpayers, in the paid parking alternative only the actual users of the facility pay. This is a shift of costs, but is for the whole of society no additional income. In contrast, there are extra costs involved in the system of payment, its management and maintenance and the enforcement of the parking policy.
So, the result is a negative SCBA balance.

Looking at the purely financial effects, then we get a different picture. The revenues of paid parking are higher than the additional costs.
This case has made it clear that a SCBA/Business case provides useful insight in the benefits for the various beneficiaries, and thus forms a solid basis for the allocating of costs between different beneficiaries.

[5] Dutch: DV-subsidies

Figure S4 Social costs and benefits of paid bicycle parking (millions € Net Present Value)



A major gap in this case, though, is the question of the effect of paid bike parking on travel behavior. Which part of the travelers will adapt their behavior? And what will they do as an alternative? Not traveling at all, using the car to the final destination, taking the bus to the station, just walk?
These questions determine the detailed results of the SCBA. Since very little is known about this, we have compared four scenarios. In chapter four of the main report, you can see the result of this comparison.

Conclusions

In this study we have looked at several case studies, reviewed literature and compiled indicators in order to answer the question: *"Is the application of the OEI methodology useful for bicycle measures?"*.
The OEI methodology is required in social cost-benefit analyses of large infrastructure projects, but it also serves as a guide in many other SCBAs.
The cases that we have looked at in following OEI show that an SCBA may be a good tool for decision making, in particular for investments in cycling infrastructure, but also for other bicycle-related measures. Although, for example, the use of travel time valuation and the sensitivity of travelers for a change in bike-related costs and travel time are uncertainties, the current numbers already give a good indication of the bandwidth, and it is possible to weigh and prioritize distinct projects.

On the other hand, this exercise also makes clear that, despite the good basis, the methodology, indicators and traffic models are less evolved than in SCBAs of, for example, large infrastructure projects. A better basis of indicators can make bike SCBAs easier in the future. Also, the use of traffic models which include the bicycle, will be valuable in many cases. At the same time, even now a reasonably reliable SCBA can be performed on a lot of investment /measures by using well-founded assumptions and expert judgments, even though the range of outcomes will still be large in many cases. By filling the gaps, the SCBA tools for bicycle projects can be of an increasing added value.

Recommendations

For the instrument of the SCBA to become a proper tool, we need to do more research on a number of aspects, and make it accessible and interesting for relevant authorities. The recommendations are therefore divided into content and process recommendations.
Below you will find our key recommendations:

Content recommendations: develop a full-fledged SCBA methodology for the bike.

- Time Rating cycling: travel time valuation by cyclists is not well researched in the Netherlands, and internationally there is still little known. We therefore recommend to further investigate the travel time valuation by cyclists, thereby distinguishing between different groups of cyclists (commuting, students, etc.). It is important to include the health aspect, which cyclists may intrinsically take into consideration, as distinct from the travel time valuation. The bicycle should standardly be included as a modality in future travel time valuation studies commissioned by the government. This is more pressing since the bike is assigned an increasingly important role in integrated infrastructure programs as an alternative to other modes and, for example, is part of the program Beter Benutten[6].
- Elasticity: the travel time elasticity for the bike is unknown, and so is the price elasticity for bicycle parking. In addition, the cross elasticity's are unknown: if new cyclists appear, or cyclists disappear, what then is their alternative modality? It would be practical to be able to adjust for different kinds of urban areas when working with such elasticity's, at least if no suitable traffic models are available.
- Include the bicycle in traffic models: if public transport and cars are included in a traffic model, the bike is mostly excluded. But since bike use may be a relief to traffic and public transport, it is recommended to pay more attention to it.
- Chain mobility deserves more attention. The bike often bleeds the need for investments in public transport and roads, but is ignored most of the time.
- Ex post evaluations of bicycle measures: the impact of measures are rarely being evaluated. Does the use of bicycles increase when a socially safer route is being created? What is the effect of a (free) guarded parking, not just on the use of unguarded parking, but on bicycle use in a broad sense? To what extent are new connections or bicycle highways actually being used? Do people prefer living in a bicycle friendly neighborhood with no car parking in front of the house to

[6] Beter Benutten is the Dutch program for better use of road space (and time)

a less bicycle friendly neighborhood with the car in front? Plenty of policy-relevant questions about actions taken in the past are not (being) monitored. One should do this more often.

- Marginal costs of public transport use: the regional public transport often is an alternative to the bicycle. Hardly any information about the marginal costs of regional public transport is available. One should crucially distinguish between peak and non-peak travelers.
- Causality of health/productivity and cycling: the causality of cycling and health is hard to determine and it strongly varies over the population. Having unhealthy people use the bike more often, yields greater benefits than having healthy people cycle more. By applying the proper distinctions, the evaluations of health effects will be more to the point.
- Furthermore, as yet no study has shown a positive relation between cycling and productivity , only one between cycling and number of sick days. Still, healthy and fit employees are expected to perform better than less healthy employees on productive days.

Procedural recommendations

The central government, regional governments (in particular the budget holders for public transport) and municipalities should be seduced to take an interest in the instrument. This involves:

- Creating attention for the opportunities that bike and e-bike can offer as a solution of infrastructural problems. In many cases, a large part of the traffic bottlenecks are triggered by short trips. Smart use of the bike may provide solutions which not only are more cost-effective, but also may have additional social benefits. In the expert session this was likened to the "most environmentally friendly alternative" in the EIS.
- The rules of investment programs (MIRT[7] and similar programs in municipalities and regional governments) should 'obligatorily' include the assessment of possibilities of cycling measures as part of major investments in infrastructure or public transport.
- Being keen on the instrument of bike SCBA in assessing bicycle measures and investments, in order to create more awareness of the social costs and benefits of the bike over other modalities.
- Being keen on the use of the instrument in prioritizing investments in infrastructure or other expenses in the field of traffic and transport. Bike measures will presumably score high in comparison to other modalities.

Clearly, a number of substantive and procedural actions are in order to give the bike a firmer position when investment decisions on infrastructure and mobility are being made. Therefore, we propose a follow-up phase which initially aims at reaching agreement among stakeholders on what actions are needed and how these should be elaborated. For the elaboration we distinguish four target groups:

1. Government
2. Local authorities
3. Science
4. Interest groups

[7] The national (state) infrastructure investment program of the Netherlands

The goal of the next phase is to achieve a greater awareness of the effects of bike measures and bike infrastructure, and thus to yield a more informed decision. The different target groups may indicate the contribution they can make on a substantive, organizational and financial level.

The next phase aims at:

1. Increase of the awareness of the social costs and benefits of the bike over other modalities. The Bike SCBA should be the tool in assessing bike measures and investment.
2. Deployment of the tool of Bike SCBA in ranking investments in infrastructure or other expenses in the field of traffic and transport. Bike measures are expected to score well in comparison to other modalities, which can lead to social savings.
3. Creation of attention for the opportunities that bike and e-bike can offer as a solution for problems in infrastructure alternatives (also in MIRT projects). In many cases, a large part of the traffic bottlenecks are triggered by short trips. Here the bike can provide a cost effective solution which also may have additional social benefits.
4. Substantive improvement of the tool of Bike SCBA
    a. method (which effects are included in the Bike SCBA and how are these being calculated and/or described?)
    b. the addition of indicators
    c. Additional research (travel time valuation, elasticities / traffic models, etc.)

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