THE IMPORTANCE OF PUBLIC TRANSPORT
THE SOCIETAL EFFECTS DELINEATED

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ABSTRACT

What are the costs and benefits of public transport to society? Are all costs and benefits fully incorporated in the standard system for assessing the societal effects of public transport investments: cost-benefit analysis (CBA)? Are all policy goals, with respect to public transport, properly addressed in a CBA? The public transport debate in the Netherlands often focuses on the question of whether the benefits of public transport receive sufficient attention in the standard system for assessing the societal effects of investments. Recently, the KiM Netherlands Institute for Transport Policy Analysis and CPB Netherlands Bureau for Economic Policy Analysis studied this question. This paper presents the study's main findings. The study aims to help ensure that expectations regarding public transport and CBA results are more attuned to one another.

The study first illustrates to what extent public transport in general contributes to accessibility, quality of life and social participation. The view that emerges from present transport use is primarily based on analysis of the Netherlands National Transport Survey and is completed with results of previously published studies. Unsurprisingly, public transport acquires its greatest share in mobility during rush hour periods to urban areas; in fact, during these periods public transport is used for approximately 40% of journeys longer than ten kilometres. The problems related to traffic jams are also at their most acute in these areas; however, convincing (more) people stuck in traffic jams to switch to public transport is by no means an easy task. Despite these traffic jams, travelling by public transport would take at least twice as much time for 90% of all car users during rush hours.
The highest level (35%) of all kilometres travelled by public transport, is attained by the highly diverse group of adults who do not possess driving licences; other target groups, such as the elderly, disabled people or low-income households do not reach this level. Public

transport's role in the mobility of these aforementioned groups does not exceed or barely exceeds that of the average resident of the Netherlands. Elderly, disabled people or low-income households mainly use passenger cars, just like the average Dutch person.

While the average public transport performance data regarding these policy objectives reveals little about the effects of specific public transport projects, a cost-benefit analysis (CBA) is revealing in this regard. CPB and KiM reviewed the results of CBAs performed on public transport projects. We specifically focussed on identifying effects which were frequently overlooked in practice, and therefore not included in the CBA. We provide practical and theoretical founded guidelines for including these effects in future CBAs. Guidelines are presented for the following effects: avoidable parking costs, missed excise income, benefits of 'no longer needing to stand while travelling' and all manner of 'other' comfort and public safety aspects.
The various goals for which policymakers harbour expectations regarding public transport are reflected in the standard system used to assess the societal effects of investments (cost-benefit analyses or CBAs). However, the CBA system can be improved for public transport projects, because certain costs and benefits have previously been overlooked or forgotten. Regarding individual projects, this can have a considerable effect on the costs or benefits calculated, although, on average, the effect is relatively limited.

1. INTRODUCTION

Politicians have great expectations from public transport. It is often stated that not all the benefits of public transport are sufficiently incorporated in the standard system for assessing the societal effects of investments: cost-benefit analysis (CBA). The first question we raise therefore is:

> What, according to policymakers, is the importance of public transport over the past decades?

We use the answer to this question to verify if the expressed expectations and goals set are indeed visible in public transport's performance. In a quantitative analysis we focus on questions like:

> Who actually uses public transport services? Why? When? What are the costs of public transport and who pays them? Are particular groups of people more dependent on public transport than others?

In order to answer these questions, we compare public transport with other transport modes. We also consider to what extent the actual use of public transport meets the pre-defined goals, or the expectations behind them. Knowledge of general performance characteristics is useful in the search for new, beneficial public transport projects and their appraisals. A well-considered judgement about the additional societal benefits of public transport projects (the extension, change or curtailing of existing public transport), however, must be based on a more thorough approach: a cost-benefit analysis.

In a cost-benefit analysis (CBA), all welfare effects should be considered and expressed in money terms whenever possible. A broad welfare perspective is used to assess the effects: anything people value should be considered. This returns us to the original questions:

> What welfare effects must be taken into account in a CBA? And maybe more important: what welfare effects are often overlooked in present CBA practice? How large are these effects, and how can they be incorporated in future CBAs?

Having answered these questions, the next logical step is to consider the following questions:

> What are the CBA results of Dutch public transport projects, also in comparison with British projects? Where can we find public transport projects with good expectations for additional welfare benefits?

Answering the above questions will enhance our understanding of the effects of present public transport projects. Our main aim is to improve the decision-making process for future public transport projects. A more elaborate discussion is provided in the study *The Importance of Public Transport, the Societal Effects Delineated* (Bakker and Zwaneveld, 2009), a joint effort of the KiM Netherlands Institute for Transport Policy Analysis and the CPB Netherlands Bureau for Economic Policy Analysis[1].

1.1 Structure of this paper

This paper provides a brief outline of the KiM-CPB study *The Importance of Public Transport, the Societal Effects Delineated.* Chapter 2 discusses public transport's performances regarding the goals that policymakers expect public transport to contribute to. Here, several questions are raised: Who uses public transport and how often? What do users pay for the use of public transport, and what are the authorities' contributions?

Chapter 3 considers the CBA methodology regarding public transport projects. For approximately 150 Dutch public transport CBAs, we present the CBA results in terms of added welfare. Having provided an overview of all the effects that must be considered in public transport CBAs, we then discuss in greater detail the effects that, in daily practice, are often not expressed in money terms or that trigger intense discussions. We propose sound procedures to adequately take into account these effects in future.

[1] This study in Dutch language is free available on the websites of KiM and CPB in Pdf (http://www.verkeerenwaterstaat.nl/kennisplein/3/8/382632/Het_belang_van_openbaar_vervoer.pdf).

Chapter 4, in conclusion, explores whether or not the goals expressed by policymakers for public transport are evident in the present CBA methodology.

2. PUBLIC TRANSPORT'S PERFORMANCES

2.1 In providing public transport, what goals are policymakers targeting?

Over the years a wide spectrum of political movements, at varying levels of government, has regarded public transport as a means of contributing to various societal policy objectives. The established policy objectives differ widely in nature:

- Contribute to the accessibility of cities and regions and a relief of road congestion;
- Ensure environmental protection and enhance traffic safety by means of reduced use of private cars;
- Ensure social participation and other social objectives: providing equal and equitable access to transportation to anyone, anywhere and at any time;
- Spatial planning: spatial planning policy objectives are hardly elaborated for public transport in The Netherlands. Although in various Dutch policy documents a relationship between public transport and land use is recognized, specific and measurable objectives for public transport could not be identified;
- Improve economic competitiveness and contribute to economic goals: public transport can contribute to less travel time, better accessibility and create system efficiency. Provide opportunities for spatial development (e.g. for offices).

Over time, however, the focus shifted between the various objectives, and this focus may also vary between government levels. In recent decades, the government cited various societal goals as the reason for it becoming involved in public transport. This chapter details how various societal objectives are achieved with public transport in its present form.

2.2 The contribution of public transport to societal goals and its costs

The Netherlands conducts an extensive, annual National Travel Survey, based on one-day mobility diaries for approximately 50,000 people each year. The figures in this section are largely based on analysis of this survey[2].

The use of public transport

Every day about one million people in the Netherlands use public transport. This accounts for 5% of the Dutch population (of 16.6 million people as of 2009). Public transport also accounts for 5% of all trips undertaken in the Netherlands: trains account for 2% of all trips; buses, trams and underground metros for 3% of all trips. As the average train trip is relatively long, public transport's share in kilometres travelled is larger: 11% of all person-kilometres

[2] RWS-AVV (2007). Mobiliteits Onderzoek Nederland.

travelled in the Netherlands (train 8%; bus, trams and underground metro: 3%). In rural areas public transport's share is lower than these averages; in and around big cities it is higher. When limiting the focus to trips longer than 10km in morning peak hours, within or directed to the Netherlands' five largest cities, public transport's share in trips rises to more than 40%. These are the times and areas where car traffic congestion is most severe.

Public transport’s limited (nationwide) contribution to mobility is understandable. Public transport does not provide a competitive travel time to about 90% of all car trips; in fact, travelling by public transport takes twice as long (or more) as travelling by car, even in peak hours. Consequently, despite car congestion, it is not easy to attract car users with improved public transport. For longer distances, public transport's travel time is more competitive. This is because a public transport trip typically has more stages. In addition to the travel time spent in public transport vehicles, time is needed to cover the distance between departure address and the first bus stop or train station, and between the last stop and destination's address. The amount of time involved with other access and egress modes, like walking and cycling before and after transport, is less weighty in the total door-to-door travel time for longer distances. Logically, public transport's share in total trips is larger for longer distances.

What is public transport used for?

Public transport is primarily used for travelling to/from work or school. Nearly half of all passenger-kilometres travelled in train trips and two-thirds of all kilometres travelled in bus, tram and underground metro trips, are spent commuting to work or education. The more than 600,000 students who possess free public transport cards in the Netherlands are well represented in these figures: one-quarter of all kilometres travelled in train trips, as well as one-quarter of all passenger kilometres travelled in bus, tram or underground metro trips, are made using that free student transport card.

Who uses public transport?

Particularly adults who do not possess driving licenses make comparatively much use of public transport. For this group, 35% of their trip kilometres are undertaken by car (as passengers), and another 35% of their trip kilometres are undertaken using public transport. A similarly high share of public transport use is not observed among other target groups, such as elderly people, disabled people or low-income households. Among adults the absence of a driving license is apparently more relevant for public transport use than age, disabilities or income.

Travel mode choice and possession of driving licence

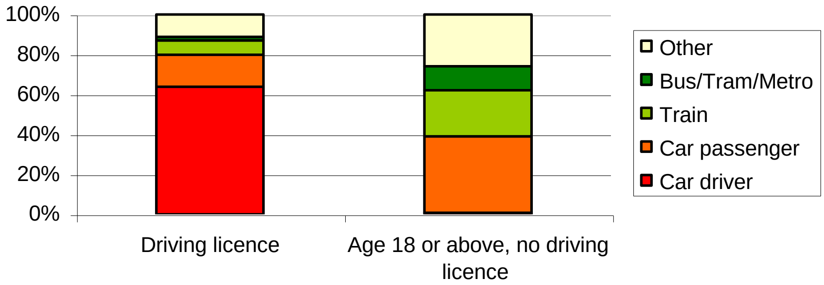

Figure 1 *– Transport mode choice by driving licence possession. Based on trip kilometres; per category travel modes count to 100 percent. Source: MON2007data analysis.*

In terms of the share of trip kilometres undertaken using public transport, the elderly, people with disabilities and members of low-income households do not use public transport significantly more often than the average Dutch person. Similar to the average Dutch person, these target groups make (much) more use of cars, bicycles and travelling by foot. Consequently, generic subsidies, which favour public transport but make no distinction between target groups, are less effective when the particular aim is to support the mobility of the elderly, disabled people and members of low-income households.

Elderly people

Compared to the average Dutch person, elderly people make less use of public transport. Of course, the fact that the elderly no longer participate in labour or education, and consequently travel less, plays an important role in this. However, even when corrections are made to account for these factors, the elderly still do not rely on public transport more frequently than the average Dutch person does. Bicycling and car driving decrease slightly with age, but so too does the use of public transport. Only at very advanced ages (80 years and older) does the use of public transport increase to about 5% of all personal trips, which is as much as the average Dutch person.

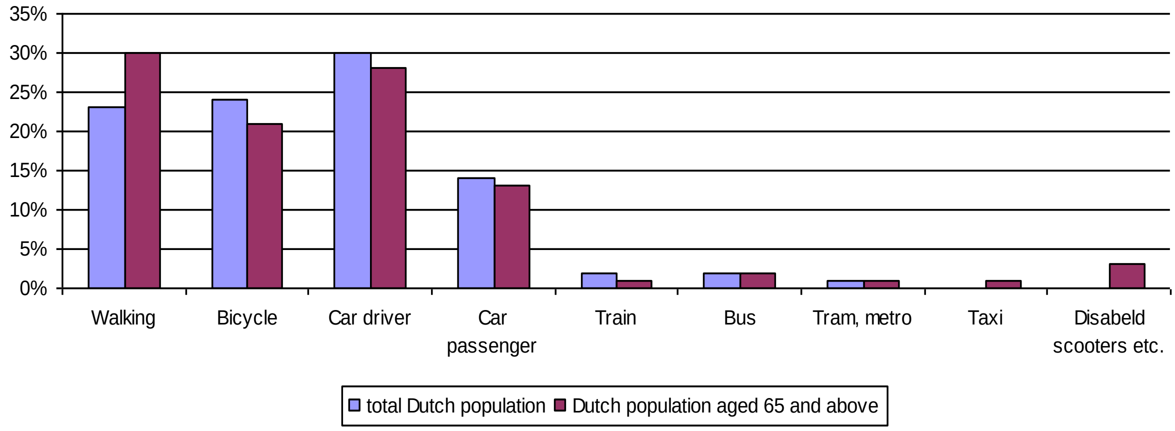

Figure 2 *– Transport mode share of trips travelled by total Dutch population and the Dutch population aged 65 years and above. Source: MON2007 data analysis.*

People with disabilities

People with mobility disabilities travel less: they make 30% less trips and travel 20% fewer kilometres than people without such disabilities. With regard to the trips they do make, public transport does not claim a larger share than in the average Dutch person's transport mode choice. The group of mobility disabled people, and the group of elderly people, overlap significantly: more than half of all mobility disabled people are aged 65 or above. People with mobility disabilities make about twice as many trips with taxis or motorised scooters for disabled people, etc. (not adapted cars or wheelchairs) as trips with public transport. This is particularly the case for relatively short distances. Expressed in kilometres, the share of public transport among people with disabilities does exceed the share of taxi and motorised scooter use.

Low income households

When the Dutch household population is divided into four income brackets, people in the two lower brackets (earning up to 22,500 euro annually) travel 64% to 71% of all their kilometres by car, compared to 76% to 81% in the two higher brackets. People from households at (or near) the so-called social minimum level (between 7,500 and 15,000 euro annually) travel twice as many of their kilometres with public transport as do people from households with (much) higher incomes. Also walking and cycling have higher shares in the mobility of lower income household members. But even people from lower income households travel two-thirds of all their kilometres by car, as a driver or as a passenger, and in order to do so they generally use comparatively older cars.

Approximately one-quarter of all public transport kilometres in the Netherlands are travelled by people from households with an annual income of 22,500 euro or less. These households account for one-sixth of the Dutch population[3]. People from the two lower income brackets do therefore use more public transport, but generic subsidies that favour public transport (keeping it cheap for everybody) mean that the largest part of the subsidy supports higher income people.

[3] Excepting pensioners and students with a free public transport card.

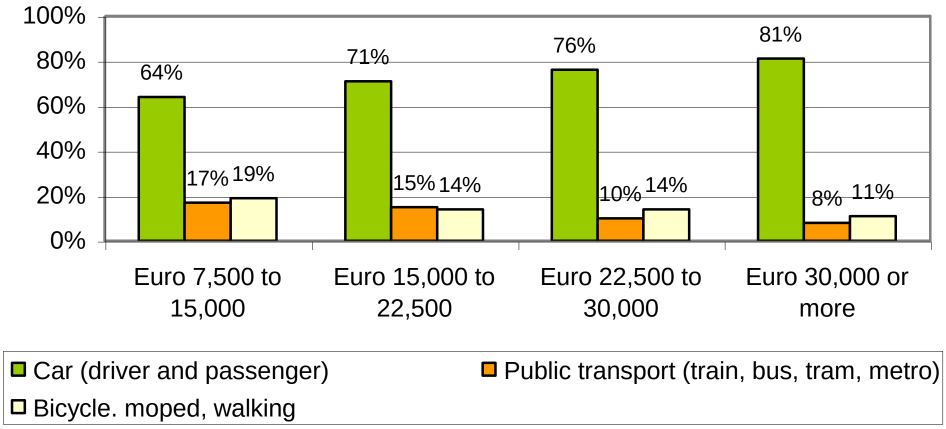

***Figure 3** – Transport mode share in kilometres travelled for people from different income brackets (net annual household income in 2003). Pensioners and students with a free public transport card excluded from figures. Source: OVG 2003 data analysis (OVG is an earlier version of MON Netherlands national travel survey).*

External costs of public transport use

On average a public transport traveller causes less environmental damage than a car traveller. The external costs of using busses and trains (unsafety, pollution, noise and land use impacts) are almost always about half of the costs of a passenger kilometre per car (KiM/CPB analysis on data CE, 2003). Nonetheless, this does not mean that the addition of public transport services automatically creates a better environment or more safety. Environmental or safety benefits merely arise when people stop using cars. In practice the effects of additional public transport services are generally disappointing: only three or less of every ten new public transport users are former car drivers. The other new public transport users would not have made that trip previously or would have walked or cycled; these additional trips cause extra emissions.

Public transport: who pays for it?

The amount of money paid annually for a certain transport mode by travellers and authorities can be related to that particular transport mode's performance over the course of one year. This provides an indication of the average expenses (actual costs paid) per passenger kilometre for the various transport modes in the Netherlands. In part the travellers' expenditures on transport flow to the authorities (taxes, mainly concerning car travellers). These tax revenues must be deducted from the government's subsidy expenditures in favour of transport, in order to obtain a correct rendering of total transport costs per passenger kilometre (as far as it is paid for with travellers' and government expenditures).
Costs that are currently not paid for (e.g. environmental damage, unsafety, congestion costs or income which might be derived from alternative spending) are excluded from this rendering. Table 1 presents a correct estimation of actual traveller and government

expenditures per realised passenger kilometre, although it clearly does not provide a proper overview of all the societal costs and benefits. A full cost benefit analysis (CBA) does this however, including all social costs and benefits that are not paid for.

Table 1 – *Average expenditures (costs actually paid) per passenger kilometre (2007, in euro cents). Including expenditures on vehicle purchases, vehicle use, operating costs and expenditures on infrastructure investments and maintenance. Source: various, see Bakker & Zwaneveld (2009), annex F.*

	By travellers	By public authorities	By travellers plus public authorities minus taxes[4]
Passenger cars	22	4	16
Train	8	16	23
Bus, tram, metro	11	32	41
Taxi	22	47[5]	68

3. COST-BENEFIT ANALYSIS OF PUBLIC TRANSPORT PROJECTS

In the Netherlands, at present, the usual course of action is to support the decision-making process of large-scale infrastructure investments with an analysis of all the related societal effects. In such a cost-benefit analysis (CBA), all the welfare effects of a certain project are determined and, as much as possible, effects are expressed in money terms. Welfare is viewed as a broad conception; that is, anything that people value should be taken into account.

3.1 Outline of costs and benefits

Table 2 provides an outline of all the welfare effects of public transport projects. This table also includes some relevant distributional effects. In order to provide a proper overview, however, we have used common terms and avoided double counting. Some rare effects are excluded[6]. The table is based on research of existing public transport CBAs in the Netherlands and a literature review. Various effects are discussed in detail in Bakker & Zwaneveld (2009). The typical key benefits of public transport projects are travel time and costs savings, although reliability and comfort are also involved. By their very nature, public transport projects primarily intend to make travelling faster, more comfortable, more reliable

[4] Expenses of authorities minus taxes directly received from travellers (value added taxes, fuel taxes, vehicle purchase taxes, vehicle possession taxes), plus travellers' expenditures.
[5] Several taxi transport subsidy schemes in favour of elderly, people with disabilities, clients of health insurances and students, which are largely contracted and paid for by authorities make up a very substantial part (about two thirds) of total taxi expenditures in the Netherlands.
[6] We refer to (i) costs related to marketing and supervision of public transport projects, (ii) impacts on molest risks for travellers and staff, (iii) differences in spatial development costs to be paid for by government.

or cheaper. These so-called direct transport effects generate welfare benefits to existing and new travellers.

Table 2 *– Welfare effects: outline for public transport projects*

Direct effects on travellers	
Travel time savings (wait time,	
in vehicle time, transfer time, reliability)	- commuting to work
Travel comfort	- business trips
	- commuting to school
	- social or recreational trips
Comfort during travel time	- differences between modes (e.g. rail bonus)
	- crowdedness of vehicles, platforms, escalators
	- vehicle interior
	- stations, stops, platforms
Change of fares	- related with operating results
Construction nuisance	
Option and non-user values	
Congestion travel time effects	- crossing car traffic (less car traffic or new split-level solutions)
	- congestion time impact on railway goods transport
Direct effects on infrastructure manager and public transport operators	
Operational revenues and costs	- ticket revenues minus operating costs
Investment costs	- including uncertainties about cost estimations
	- including uncertainties about decisions
	- including optimism bias
Maintenance and management costs	
Wider economic benefits (additional)	
Agglomeration (dis)benefits	- increasing/decreasing productivity
Imperfect competition (change)	
Exchequer consequences of higher/lower GDP	- more/less labour participation
	- longer/shorter working time
	- less/more productive jobs
Other budget effects	- e.g. fuel taxes
Avoided subsidies/Parking operating results	
Cross-border effects	
External effects	
Local emissions	- by vehicles
Global emissions	
Noise nuisance	
Traffic safety effects	
Occupied space	- by infrastructure
Effects on quality of life and barrier-effects	

Value of nature	
Recreational values	
Distributional effects	
(incl. non-additional wider economic benefits)	
Availability for and use by social target groups	- related to non-user value
Increase of GDP	- by (dis)economies of agglomeration
	- by more/less labour participation
	- by longer working times
	- by less/more productive job acceptance
Redistribution of income, effects on expenditure	
In general: (dis)advantages per population group, region, users against non-users	

3.2 What are the CBA results of Dutch public transport projects?

Like all large-scale infrastructure projects in the Netherlands, the decision-making about public transport projects is also usually supported with CBAs. Our research found 150 CBAs of Dutch public transport projects. Table 3 provides an overview of reviewed projects. We selected projects for which the CBA results could be compared to other projects. The table shows that public transport projects vary in the contributions they made to welfare.

Although Table 3 contains only 25 projects, we found a total of 146 CBAs for small and large Dutch public transport projects. Around one-third (50) of all the considered CBAs revealed that the projects had more benefits than costs. CBAs clearly do not always provide negative results for public transport projects, as is sometimes assumed in the Netherlands.

It remains unclear whether this collected sample is representative for all Dutch public transport projects. Projects for which a transport operator or regional authority was fully responsible are probably missing from this overview. Many of these (often small-scale) projects are not subjected to CBA studies, or the CBA studies are not publicly published. Most of the CBA studies (127) concern rail projects that were considered in the framework of a program appraisal. These CBAs were conducted by ProRail[7], often in cooperation with the NS, the Dutch train operator. By way of illustration we included six of these CBAs (three with positive and three with negative contributions to welfare) in Table 3.

When aggregating all social benefits and costs, small-scale public transport projects appear to slightly more often have a positive outcome. Table 4 provides an overview of the project size and benefit-cost ratio for the 25 public transport projects. In five of the seven projects valued under 50 million euro, benefits outweigh costs. However, to the contrary, in only one out of three projects valued above 100 million euro did the benefits outweigh the costs, which is not much less than the average for all projects.

[7] ProRail is the rail infrastructure provider for the Netherlands' railway network.

***Table 3** – CBA outcome of Dutch public transport projects. CBA results are copied from original studies. CPB and KiM leave the responsibility of correctness of data to the original authors.*

Project name and description	Year	Benefits minus costs: net present value (million Euro)	Benefit-to cost ratio
Public transport network *Brabantstad*. Central city version: bundling of regional transport, new railway stations, headway 15 minutes for local trains	2003	4,816	6.8
Maarheeze station: opening of new railway station between Eindhoven and Weert. Data derived from business case study.	2005	Ca. 20	Ca. 5
Hemboog station: opening of new railway station, project example of a program containing 88 projects aiming to make better use of the railway network ('Benutten en bouwen'), 25% of them had b/c ratio ≥ 1	2004	17-72	2.1-5.8
Upgrade of railway line *Utrecht-Arnhem*: version max. 11 instead of 9 trains per hour, speed max. 140 km/h	2001	74	1.6
Transfer facilities Dordrecht station. Project example of program containing 29 projects, 50% of them had b/c ratio ≥ 1	2004	6	1.6
Eastern part of the *RijnGouweLijn*, changing heavy rail track Gouda-Leiden in light rail	2003	112	1.5
Utrecht – Den Bosch; project example of a program containing 10 'small' rail infrastructure projects, 60% of them had b/c ratio < 1	2007	1.84	1.4
Schiphollijn, new railway between Amsterdam and The Hague. Prices scaled up to price level 2007.	1969	Ca. 400	1.3
HSL Zuid, high speed railway from Amsterdam to Belgian border. Prices scaled up to price level 2007.	1994	Ca. 500	1.2
Pilot free public bus service on motorway between Leiden and The Hague	2004	0.1	1.2
Kolibri Q-liners: regional intercity bus services in Groningen and Drenthe provinces	2006	-1	0.9
Hanzelijn: new railway between Lelystad and Zwolle	2001	-59	0.9
OV-SAAL: extension of the Schiphol-Amsterdam-Almere-Lelystad railway, considered is the so-called 'no-regret' project version	2007	-72	0.8
Randstad Holland tour ('*Rondje Randstad*'), a project aiming to run on existing railway tracks 6 intercity trains every hour between the four biggest cities plus a high speed line between Utrecht and Rotterdam/Den Haag.	2001	-1,090	0.7
Upgrade of railway line *Utrecht-Arnhem*: version max. 11 instead of 9 trains per hour, max. speed 160 km/h	2001	-272	0.5
Metro connection through the *IJ-meer*, supplying 8 trains in peak hours between Amsterdam Central/Southern Axis and Almere	2006	-464	0.5
Vleuten-Geldermalsen: extension to 4/6 tracks. Project example of a program containing 88 projects aiming to make better use of the railway network ('Benutten en bouwen'), 75% of them had b/c ratio < 1	2004	-660 – 0	0.3-1.0
Flevolijn partially extension to four railway tracks. One of three versions with all of them had b/c-ratio < 0.5	2008	-177	0.3
Kolibri, new tramway in city of Groningen	2006	-98	0.3
Randstad Holland tour ('*Rondje Randstad*'), a project version supplying a magnetic levitation train circle line between the four biggest cities in Randstad Holland (full new tracks including 12 new stations, headway 6 minutes).	2001	-4,724	0.2
Breda station (renewal of intercity railway station including real estate development). Project example of a program containing 29 railway station projects, 50% of them had b/c ratio < 1	2004	-63	0.2
Enschede railway yard adjustment. Project example of a program containing 10 small railway infrastructure projects, 40% of them had b/c ratio < 1	2007	-6	0,2
HSL Oost, high speed railway Amsterdam – German border	2000	-4,885	0,1
Leeuwarden – Groningen, the fitting in of one additional intercity train per hour on existing track between currently operated trains	2006	-141	0,0
Zuider Zee line (version HST1), high speed railway Amsterdam - Groningen	2006	-5,100	0,0

We have also examined 39 public transport projects in Great Britain, which represent a typical sample of UK public transport studies (see Bakker & Zwaneveld 2009, annex E). What was most striking is that all these projects have a benefit/cost ratio above one, which is easily accounted for in view of the guidelines of the UK Department for Transport (UK DfT). UK DfT states that projects with benefit/cost ratios below 1 have very little chance of being allowed (Dft 2008). Similarly striking is that 60 percent of all British projects had a net present value less than 112.5 million euro. In the Netherlands, projects with an investment budget below this amount are supposed to be paid by regional authorities from an own decentralized budget, and in that case CBAs are not compulsory in project appraisals. This confirmed our impression that many smaller Dutch public transport projects remained beyond our view.

Table 4 *– Project size and benefit-cost ratio of 25 Dutch public transport projects. Investment, management and maintenance costs. Net present value, million euros.*

	<5	> 5-50	> 50-100	> 100-500	> 500-1000	> 1000	Total
B/c ratio >1	3	2	-	2	1	2	10
B/c ratio <1	-	2	1	4	4	4	15
% b/c >1	100%	50%	0%	33%	20%	33%	40%
Total	3	4	1	6	5	6	25

3.3 Are no effects overlooked in public transport CBAs?

A closer look at CBAs reveals that some welfare effects are often not expressed in money terms, are treated rather differently, or are not even mentioned at all in the CBA. This is as true for costs as for benefits. Some of these costs and benefits prove to be substantial, while others have only a marginal effect. For this reason we cannot state in general that CBA outcomes will be more often positive or negative when these effects are properly expressed in money terms. This situation will differ from case to case. The following overlooked effects were identified:

Wider (economic) effects

When travelling becomes ‘cheaper’ (or in other words travel friction diminishes by less travel time, less travel costs or more travel comfort), this may affect the economy. How large the additional impact is has been debated for some time. It turns out to be a complicated problem. The Dutch CBA guideline for infrastructure project appraisal indicated that wider economic benefits amount to 0 to 30 percent of the direct effects. A new British method for identifying and calculating the wider economic benefits proves this estimation to be reasonable.

Avoided additional parking costs

To some extent better public transport may result in less car use. Less car use means less demand for *public* parking space, which is an additional *beneficial* societal effect often overlooked in public transport project appraisal studies. We could not find estimations for these costs in literature, or we strongly disagreed with the estimated parking costs to society. Research on this issue (Bakker & Zwaneveld 2009, annex D) identifies both costs and benefits of parking. As a result we estimated a value of half a euro cent per avoided passenger car kilometre in the Netherlands. To give an example of our argumentation, costs of providing *private* parking space must not be included in this figure, because private parking space suppliers also receive benefits from parking space, because otherwise they would not provide it. In other words: many private parking space costs are already internalised and the effects on them are not additional.

Reduced excise income

Less car use results in less environmental damage, but also in less fuel tax revenues for the treasury. Both effects to the Dutch society should be taken into account. Since the latter is mostly overlooked, the costs of reducing car use will increase by about 3 to 4 euro cents per avoided passenger car kilometre.

Value of public transport as a fallback (option value)

The option value of public transport is the amount people are willing to pay to be able to use public transport in case of necessity, as a fallback option, although these people normally would not use public transport. This is a societal benefit usually not included in CBAs. The option value particularly applies to circumstances in which the question is to be accessible with public transport in one form or another, or not at all. Based upon a literature review, we recommend to first assess the changes in option value qualitatively and quantitatively. Only rarely will it be possible to express the option value in money terms. Incidentally, new public transport projects may even lower option value, for instance when bus or tram stops are closed in order to increase the speed of public transport. People who are capable of walking only limited distances may therefore lose the option to use public transport. In practice option values appear to have a limited impact on benefit-cost ratios.

Benefits of increased frequency of service

Public transport is usually operated in a certain service interval ('headway'). Bakker & Zwaneveld (2009) compared several international studies (e.g. Douglas Economics, 2006) of the impact of waiting times on public transport travel time, and this has resulted in new key indicators to be used in CBAs in order to express the effects of a changed frequency of service in money terms. Most times (when frequency of service is less than 6 times an hour) the benefits of shorter headways are overestimated in present practice in the Netherlands. This is because it is often assumed that people arrive randomly at stops, while in reality most people consider time-tables in advance and try to minimize their waiting times. On the other hand, the value of waiting time in public transport is often underestimated in present practice: one minute of waiting time is often valued as one and a half minutes of in-vehicle travel time, whereas two and a half minutes appears to be the more reasonable estimate.

Benefits resulting from a better chance of finding a seat

People dislike travelling in overcrowded public transport. Certainly for longer distances they prefer sitting to standing while travelling in a bus or train, and they are willing to pay for a comfortable seat. Surveys of travellers reveal that, for instance, if 30% of all passengers in a train coach need to stand, *all* travellers on that coach regard this as equally as regrettable as a 50% longer travel time. Because these substantial social benefits usually are not taken into account in CBAs, the CBAs' return on investment of public transport projects may improve considerably if they are taken into account. Based upon the international literature, Bakker & Zwaneveld (2009) provide key indicators to use in CBA practice for this purpose. These benefits will of course only occur in infrastructure projects that actually increase the share of travellers having a seat in comparison with the reference situation. And when it is still possible to optimize the reference situation by increasing the number of buses or train coaches without extra infrastructure, this will be preferable from an economic welfare perspective.

Other comfort aspects and fear of crime

When a public transport project positively influences the comfort of passengers or their feelings of security, this implies benefits that are frequently not quantified in CBAs. The benefits for a multiplicity of various other comfort and security aspects could add an additional 30% on top of the present public transport fares (Steer Davies Gleave, 2000), which is indeed a substantial benefit.

4. Are policy goals reflected in a CBA?

Answering this question was the main reason for conducting this research project. This final chapter systematically considers whether all policy goals identified in section 2.1 recur in a public transport CBA as a cost or a benefit.

Accessibility of cities and regions and the relief of road congestion

Both these goals are incorporated in a CBA. An improvement of a certain public transport connection is reflected in the direct (accessibility) benefits: mostly time savings for previous and new users of public transport. The possibility of future use of public transport whenever necessary (option value) can also be considered as a part of the accessibility. The impact on congestion (the value of time losses) is virtually always incorporated in CBAs.

Environmental protection and safety by means of reduced use of private cars

Many politicians desire more public transport as a means of improving the environment and increasing traffic safety. Indeed, public transport results in less disturbance for the environment, less pollution, and less traffic unsafety per passenger kilometre. The value of a change in environmental disturbance, pollution and traffic safety is part of the external effects in a correct CBA, and is usually also incorporated in the analysis in practice. However, owing to the fact that cost-benefit analysis focuses on *additional* effects on the environment and traffic safety, in CBA practice the impact of these effects turns out to be smaller than one might have expected. Initially, extra buses and trains worsen the environment, because they produce additional noise, pollution and traffic unsafety. An improvement in these fields only occurs when extra public transport use in fact leads to less car use. Both aspects can be treated correctly in a CBA: the adverse effects of extra trains and buses, and the advantageous effects of fewer car kilometres, are both part of the costs and benefits in the analysis.

Social participation and other social objectives

The use of public transport by certain target groups, or the possibility for them to use public transport, can be expressed in a CBA. The benefits derived from actual use by these target groups are taken into account as a direct effect.
Since many people attach value to the (possible) use of public transport by certain target groups, such as the elderly, disabled people or low-income households, it is useful to represent these distributional effects. Up to now, it is not usual in Dutch CBA practice to monetize possible effects in this field. This subject is related to the earlier discussed option value of public transport. Apart from that, Chapter 2 clearly showed that elderly and disabled people do not use public transport for a larger share of their trip kilometres than the average Dutch person.

Competitiveness and contribution to the economy

Improved accessibility is good for economic growth. A better public transport connection saves, for instance, travel costs to companies, partly due to the effect of more people travelling with public transport instead of cars, which reduces road congestion. Moreover, improved commuter transport renders work more attractive, which leads to a better performance of the labour market. People are thus enabled to accept more suitable jobs, and also perhaps ones with higher salaries. The ability to travel more affordably affects the economy, and indirect economic effects will result. Many of these indirect effects will only result in a redistribution of prosperity; however, it is not impossible that additional effects will occur. All economic effects of investment in public transport are recognizably represented in a CBA: frequently as a direct effect, and infrequently as an indirect effect.

The improved public transport accessibility of a certain region may result in that region becoming increasingly competitive, leading to more business activity in that region. While this may be in the interest of that particular region, it will be at the expense of other regions. Thus, it is essentially a redistribution effect.

Spatial planning policy objectives

Policymakers may also advocate for public transport in the belief that it will contribute to certain spatial planning policy goals. Chapter 2 clarified that official Dutch policy documents rarely set goals for public transport to achieve in the field of spatial planning. It therefore remains unclear to what exact spatial results public transport is supposed to contribute. In this paper we will formulate one probable interpretation of the desired spatial results, while Bakker & Zwaneveld (2009) also discuss some of the other interpretations.
It is likely that policymakers want to raise real estate values by means of public transport improvements. Debrezion et al. (2006) proves that the price of Dutch homes located within 250 metres of railway stations have, on average, a 25% higher value compared to homes located 1.5 or more kilometres from stations. De Graaff et al. (2007) demonstrate the rents of office blocks within a 500 metre distance of stations as being 18% higher than offices located 7 or more kilometres from stations. The question is: are these higher prices *additional* welfare benefits? The answer must be no, because these higher prices solely stem from skimmed time savings. Employees can be expected (*ceteris paribus*) to be willing to pay more for homes with shorter commuter times. The same is true for employers with regards to offices that are easier to access. Although people might also value public transport connections to destinations they will rarely visit, their willingness to pay for time savings will increase with higher commuting frequencies. The demonstrated increase in real estate prices therefore is a reflection of direct effects, which are usually already taken into account in CBAs: time savings and option values.

5. Conclusion

Policymakers have formulated goals to which public transport must contribute. This study shows how performance, in relation to these goals, clearly features as a benefit in CBAs and proposes improvements to aspects of the CBA system. As a result, the expectations placed on public transport and the results of CBAs can now better be aligned.

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