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International Comparison of Transport Appraisal Practice

Annex 3 The Netherlands Country Report

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INTERNATIONAL COMPARISON OF TRANSPORT APPRAISAL PRACTICE

THE NETHERLANDS COUNTRY REPORT

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1. A brief history of appraisal practice

The Netherlands has a long history of using cost-benefit analysis (CBA) and multi-criteria (MCA) analysis in the appraisal of transport infrastructure and policy[1], but only since the year 2000 has there been a commitment to use CBA for a all large infrastructure projects. In this year, also a set of guidelines was published for applying CBA to transport projects in practice, which was meant to raise the general level of analysis and promote uniformity in the appraisal methods used. This was the so-called “OEI-guideline” (originally “OEEI”) (CPB and NEI, 2000).

Before 2000, many transport projects were evaluated using either CBA or MCA, but some other transport projects were not made subject to a formal evaluation procedure. And for those projects that were formally evaluated, the methods used diverged substantially. There was however a set of values of time in passenger transport (HCG, 1990) and freight transport (HCG et al., 1992), based on stated preference research, which was commonly adopted. These values were updated in 1998 (HCG, 1998) for passengers and 2004 (RAND Europe et al., 2004) and will be updated again for both passenger and freight this year (based on Significance et al., 2012).

An earlier attempt at unification was the publication by the Ministry of Finance of a textbook on CBA, MCA and Cost-Effectiveness Analysis (CEA) methods in 1982 (Ministry of Finance, 1992, Fourth Edition).

In the late 90ties, a method for ranking public transport projects was developed, called APRIORI (see for instance HCG and NEI, 1999). A cost-benefit analysis is carried out first, This CBA includes travel time and travel cost changes for travellers (including substitution effects), operating cost, revenues and investment costs. The CBA outcome, in terms of net benefit per investment, is then used as one of the criteria in the MCA. The MCA also uses criteria such as comfort, image, safety, emissions, noise and technical uncertainty. The MCA yields the final overall outcome (ranking of alternatives and a measure of the distance of the alternatives). The MCA in APRIORI makes use of the dominant regime method (Hinloopen and Nijkamp (1990)).

The year 2000 OEI-guideline on cost-benefit analysis (CBA) for infrastructure projects set a standard for appraisal methods for all large (without defining what ‘large’ is) governmental infrastructure projects (all modes). It was noted that the method could also be used for smaller projects.

One of the effects of the OEI-guideline was that MCA, which was used a lot before 2000, became much less popular. But as will be explained in the next subsections on The Netherlands, there are still cases where MCA is applied.

The OEI-guideline was evaluated already in 2002. Overall, it was seen to function well but some aspects of the method needed further elaboration (one of these was the inclusion of the impact of reliability of travel times as a benefit component, another was the inclusion of the impact of a project on nature). Therefore, the Dutch Ministry of Transport, Public Works and Water Management (now: the Dutch Ministry of Infrastructure and the Environment) together with the Dutch Ministry of Economic Affairs, started a research program. In December 2004, the results were

[1] Especially in the case of MCA, several Dutch researchers (or researchers working in The Netherlands) have made important methodological contributions (see for instance: Paelinck (1983), Nijkamp, Rietveld and Voogd (1990), Hinloopen and Nijkamp (1990)).

published in the form of appendices to the OEI-guideline: Dutch Ministry of Transport, Public Works and Water Management and Dutch Ministry of Economic Affairs (2004). An important issue discussed in these appendices is the monetary value of reliability of travel times, for which preliminary values, based on an international expert workshop were provided.

For road projects funded by the national government, not only the CBA framework used is the same between projects, but also the suite of transport models used to deliver inputs on for instance travel time benefits is the same. For passenger transport this is the Netherlands National Model/Netherlands Regional Models (LMS/NRM) suite. These models are sometimes also used for public transport projects, but for these projects other models are used as well, such as models developed for NS (Dutch Railways).

CBAs are also regularly audited, mainly by the CPB Netherlands Bureau for Economic Policy Analysis.

2. The current situation

In order to describe the current situation, we use a recently carried out CBA as an example: The societal CBA of a new fixed link (tunnel) across the Nieuwe Waterweg to the West of Rotterdam. Two main options were investigated: the Oranjetunnel (close to the North Sea), with two sub-options and the Blankenburgtunnel (closer to Rotterdam), with three sub-options. It was carried out by Ecorys (Dutch Ministry of Infrastructure and the Environment, 2012).

The key element of the appraisal is a table of project impacts (all relative to a reference scenario), the scores on the different criteria (in the rows), in this case for all five options (in the columns):

1) A number of effects that could not be quantified (let alone monetised), but for which the score is given by means of + and – signs (these are PM items, they cannot be inserted in the CBA):

<u>Local Impacts:</u>

- Soil and Water
- Nature
- Landscape, Archeology and Culture
- Spatial Quality.

2) The effects that could be quantified and monetised, and that are used in the CBA:

<u>Direct impacts:</u>

- Investment cost
- Maintenance and administrative costs
- Internal cost of the Ministry
- Travel time benefits
- Reliability benefits
- Effects on robustness of the network (here appears a row of + and – signs between the monetary impacts)
- Welfare effect travel cost

Indirect impacts

- Employment

External effects:

- Emissions
- Noise
- Traffic safety

These effects are given for two different scenarios with different assumptions on economic growth, employment, trade, migration, etc.

The travel time benefits are the main benefits of this project and come from the application of the traffic model (NRM) to the different options and to the reference situation. The values of time were published by the Ministry of Infrastructure and the Environment (Rijkswaterstaat, 2012). These are based on the national value of time suveys of 1998 for passenger transport and 2004 for freight, and have been updated since (both for inflation and for real income changes using income elasticities of the value of time). These values differ per scenario and per year. The values used for 2010 for the two scenarios are as follows:

Table 1 Values of time used in the appraisal of a road transport project (in 2011 euros per truck or per car driver per hour)

Travel purpose	2010 Global Economy scenario	2010 Regional Communities scenario
Freight	49.57	47.74
Business	34.36	33.44
Commuting	9.92	9.65
Other	6.86	6.67

(source, Rijkswaterstaat, 2011)

New values of time (and reliability) have been determined (Significance et al., 2012) and will be officially released later this year.

The CBA distinguishes between existing and new travellers and uses the 'rule-of half- for the latter. Is has been argued that there is an inconsistency in the values of time implied by LMS/NRM (based large on revealed preference data) and the appraisal values (based on SP data) and that a solution (also being more exact) could be the use of the logsum change for all the traveller benefits (de Jong et al., 2007a). Some comparisons between rule-of-half and logsums have been made, leading to large differences in the case of spatial planning policies (Geurs et al., 2010). However, this has not led to widespread use of logsums in evaluation.

The reliability benefits were simply calculated as 25% of the travel time benefits, following a literature review on this topic and recommendation by CPB (Besseling et al., 2004). More differentiated, though still preliminary, guidelines for the value of reliability have been available since 2004 (RAND Europe, 2004a):

Table 2 Preliminary Reliability Ratios for passenger transport by mode (purposes: commuting, business and other)

Mode	*Reliability Ratio*
Car	0.8
Train (interurban)	1.4
Bus, tram, metro (urban)	1.4

(source: RAND Europe, 2004a)

The reliability ratio is the value of reliability relative to the value of time. To use it in CBA, one needs to multiply by the value of time:

VOR= RR * VOT

where:

VOR= value of one minute of standard deviation

VOT= value of one minute of average travel time

RR= Reliability Ratio (=VOR/VOT).

The values from Table 2 have been used in very few studies, because of the difficulty to predict changes in reliability and the impact of a project on reliability (only some prototype forecasting models are available to do this, e.g. RAND Europe, 2004b). Most project appraisals have used the 25% surcharge on the time benefits for the reliability gains.

The welfare impact of travel cost changes has to do with lower travel costs for travellers (due to shorter distances) and also were calculated using the NRM transport model. In this same row of the table, the CBA also accounts for the impact of the project, through travel costs, on the fuel tax revenues.

For the calculation of the indirect effects, several methods are available. Ecorys (Dutch Ministry of Infrastructure and the Environment, 2012) used the input-output model REMI to give the impacts of reduced travel costs for commuting on the labour market. The resulting impacts on additional employment are then included in the form of reduced social security payments and additional tax income.

Also for emissions, noise and traffic safety, there are standard monetary values, based on willingness-to-pay methods. The guidelines on the Rijkswaterstaat website (http://www.rijkswaterstaat.nl/images/KBA-kengetallen%20omgevingskwaliteiten_tcm174-332341.pdf) also contains a value for smell, but apparently this is not used in practice for appraising transport infrastructure projects.

For each scenario studied (Dutch project appraisal typically takes place by comparing the project effects against two or three scenarios for the exogenous changes), the total discounted benefits and the total discounted costs are calculated, as well as the net discounted benefits (the difference between these two; NPV), the benefit-cost ratio (BCR) and the internal rate of return (IRR). The discount rate used is 2.5% plus a risk premium of 3% on all costs and benefits (so 5.5%). All prices now include VAT (see later).

The OEI guidelines do not include an MCA. The non-monetised impacts are only presented in a table, not further processed in any formal instrument.[2] However, for project evaluations for private sector organisations and local government and for Environmental Impact Reports (MERs), MCA is still used every now and then. An example is the MCA for the Airport Twente carried out for Vliegwiel Twente Maatschappij (Advanced Decision Systems Airinfra BV, 2009).

3. Recent developments

The values of time for passenger transport that are used at the moment for CBA in The Netherlands are based on SP research reported in Hague Consulting Group (1998). To get up-to-date values, the original outcomes from this SP survey were corrected for inflation using consumer price indices. Furthermore, the values were increased to account for real income growth, using an income elasticity of the value of time of 0.5. This elasticity is based on comparing outcomes from several previous Dutch value of time studies carried (Gunn, 2001) and is also consistent with the meta-analysis that Wardman (2001) carried out in the UK about ten years ago. However, later meta-analysis in the UK (with extended data sets) recently obtained an income elasticity of the value of time of 0.9 (Abrantes and Wardman, 2011). An even more recent meta-analysis on a combination of UK and international data (Wardman et al., 2012) found income elasticities varying between 0.68 and 0.85. These new findings are consistent with those of Börjesson et al. (2012) for Sweden. So there is the possibility that the current values based on the 1997 survey should be higher, because the income elasticity used was not high enough.

For freight transport, the current VoT is still taken from the stated preference survey (RAND Europe et al., 2004) and corrected for inflation and additional wage increases (which can differ between scenarios).

In the past, VAT was not included in the societal CBA (since this was seen as a transfer within society), but in recent CBAs, following recommendations from the CPB Netherlands Bureau for Economic Policy Analysis, VAT has been included.

[2] The Environmental Assessment Agency (PBL) had developed a ‘nature points’ system (Sijtsma, et al,, 2009) for the trade-off between ecological benefits and monetary effects, but this is no standard element of OEI.

In section 5 we'll discuss the new study to update the values of time and reliability in passenger and freight transport.

4. A discussion on the use of CBA in appraisal

In fact the practical value of CBA was also the topic of the evaluation of the OEI guideline (Dutch Ministry of Transport, Public Works and Water Management and the Dutch Ministry of Economic Affairs, 2004). This evaluation concluded that the main practical advantage of the CBA guidelines, and of CBA in general, was that it serves as a framework for a transparent description of the economic and social effects of the project. In the CBA, all effects of an investment project are systematically evaluated and, when possible, given a monetary value. The result is a social profitability analysis. CBA information is useful in almost every stage of policy preparation to facilitate decision-making. Since this evaluation, the basic position on this has not changed.

Two different types of CBA are carried out in practice:

- A quick scan ('kengetallen') CBA, that serves in the first stage of a project as a first filter to select between attractive and unattractive variants of a project
- A full CBA that serves in a later phase in a project to select the best projects and project variants.

The former uses rules of the thumb in many instances, whereas the second relies heavily on input from models, esp. transport models (the example for the tunnel near Rotterdam was a full CBA).

The outcomes of the CBA are not the only decision-criterion in the final decision-making about transport projects and policies. In practice in recent years, projects with a low BCR are not selected, whereas most but not all high BCR projects and policies get implemented. For instance road pricing had a good BCR (unless the system cost would be very high), but it had problems with public acceptability and has not been selected so far.

One of the discussion on CBA in recent years concerned the European legislation on local emissions. This sets precise upper levels for local pollution. So for a project, the question would be whether it would lead to pollution levels in excess of the standards. The combination of the transport model and an atmospheric pollution model deliver a forecast on this. Legal experts argued for simply comparing the predicted level and the standard. However, the outputs of the transport models and the pollution model have considerable uncertainty margins (partly due to their input variables). Often one cannot say with any degree of confidence that the concentrations of pollutants with a project will exceed the standards. A solution would be to forecast confidence intervals instead of point estimates (de Jong et al., 2007b). It is already common practice in The Netherlands to work with several scenarios, but calculating confidence intervals (as in risk analysis) is uncommon. To mitigate the problem, the concentration levels for pollutants are nowadays not calculated per project, but for all projects in an area together. This allows the possibility to compensate for increased pollution from some projects by other green projects.

5. Special topic: The inclusion of journey time reliability in the CBA

The so-called 'VOTVOR project' (Significance et al., 2012) for the Dutch Ministry of Infrastructure and the Environment was carried out to update the official values of time in both passenger and freight transport in the Netherlands and to deliver for the first time values of reliability based on an empirical foundation. We use the standard deviation of travel time as the measure for reliability, especially since all other possible measures of reliability would be much harder to incorporate in national and regional transport models.

Three travel purposes are investigated for passenger transport:

- Commuting
- Business travel (=travelling on employer's business)
- Other travel.

The modes covered for passenger transport are:

- Car
- Bus, tram, metro and train[3]
- Airplane[4]
- Recreational navigation[5].

The modes for freight transport covered in this project are:

- road;
- rail;
- air;
- inland waterways
- sea transport.

Questionnaires have been designed for interviewing travellers, shippers and carriers. These interviews contain three stated preference (SP) experiments. In these experiments, respondents are repeatedly asked to choose between two hypothetical alternatives for a trip or transport they actually made. The hypothetical alternatives are described in terms of travel time, travel costs and reliability.

Many respondents will not understand reliability expressed in the form of a standard deviation, so this concept cannot be used to represent reliability in the SP experiments (though we have used it later on in the modelling). Instead, reliability of travel time is presented by a series of five possible (equi-probable) travel times. Since this is the most important element in the SP experiment, in the survey design phase the research team carried out in-depth face-to-face interviews to determine the

[3] Train includes conventional train services as well as high speed rail (however, it turned out that we did not have enough observations to give separate high-speed rail VOTs).

[4] In the previous national VOT surveys of 1988-1990 and 1997-1998, airplane was not included.

[5] In the previous national VOT surveys of 1988 and 1997, recreational navigation was not included. However, a VOT for this mode is regularly needed, especially for the appraisal of proposed locks and bridges. Therefore, it was included in this project.

best concept and format for presenting reliability to respondents. The verbal presentation of five possible travel times turned out to work best in many respects (Significance et al., 2007; Tseng et al., 2009). Please note that the travel distribution presented is asymmetric, which will better reflect reality than a symmetric distribution. Therefore, the mean and the median will not be equal.

Figure 1 gives a choice situation for one of the experiments.

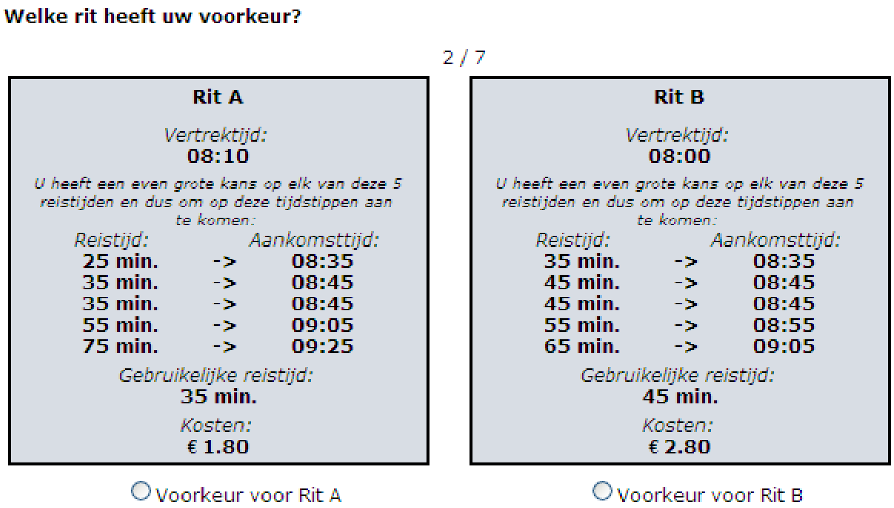

Figure 1 Example of SP question for car respondents

In Figure 1, 'Gebruikelijke reistijd' (=usual travel time) refers to the amount of door-to-door journey time for a one-way trip. It is based on the expected travel time at the moment of departure of the recent trip described by the respondent. 'Kosten' (=travel cost) refers to the total cost that a respondent has to pay for his one-way car journey. 'Vertrektijd' is departure time and 'Aankomsttijd' is arrival time.

In all stated preference experiments, respondents were asked to trade between improvements and deteriorations of travel time and travel cost, and in some experiments also between changes in reliability and arrival time. Only for respondents from firms transporting goods by inland waterways or by sea, we used a different and innovative choice context. Since for these respondents the standard choice context was not realistic, they were asked to trade between waiting times (for a lock or bridge or to be loaded or unloaded at a quay), reliability of these waiting times and the total transport costs.

For freight transport, 812 interviews were successfully carried out in 2010 with shippers and carriers, using computer-assisted face-to-face interviewing.

For passenger transport, 5,760 interviews were collected in 2009 using an existing internet panel. Initial models estimated on these data showed values of time that were much lower than the inflation- and income-corrected 1997 values. These differences could not be fully explained by differences in the socio-economic composition of the sample, attributes of the trips or differences in the design of the SP experiments. It was therefore thought that the lower values of time were caused by the different way in which respondents were recruited in 2009 compared to 1997.

Therefore, additional data was collected in 2011 using the same method of recruiting respondents as used in 1988 en 1997. In those years travellers at petrol stations/service areas, parking garages, railway stations and bus stops were asked to participate in a survey. In 1988 and 1997, a paper-based questionnaire was sent by mail to the address provided by the respondent. In 2011 a web link to the internet questionnaire was sent to the respondent's email address. In this way, 1430 interviews were successfully collected in 2011. Model results for the value of time based on the 2011 data were clearly more in line with the 1997 values than those for 2009. The 2011 data have therefore been treated as leading in the derivation of the final recommended values.

For freight transport, discrete choice models were estimated on the SP data. For the non-road models we used relative models, in which the attributes are measured relative to the observed levels. To obtain absolute money values of time and reliability from these models, additional data on the transport costs per hour (the so-called 'factor costs') are required. These values were provided by RWS-DVS.

For passenger transport, we estimated advanced discrete choice models (so-called panel Latent Class models) that allow the values of time to depend on the actual travel time and travel cost, on the size of the time and cost changes offered in the SP experiments and on other attributes of the respondents (e.g. education, income, age, household composition). We also account for unobserved value of time differences in the population and for the fact that our estimation sample is a panel, i.e. that we have multiple observations from each respondent.

The recommended values of time were calculated by weighting the sampled respondents to represent the distribution of time travelled in the trips recorded in the national travel survey OViN 2010.

Our contact at the Ministry says that the final report on the new Dutch VOTVOR study will be published in April 2013. This will also make the recommended values the new official values for CBA. But we can't reveal the VOTs and VORs before then. So maybe in the final report for DfT?

6. Special topic: Use of value of time in freight in various countries.

Different countries include different cost items in the value of time (VOT) or value of travel time savings (VTTS) in freight transport that is used in CBA of transport projects. An overview of this was provided in Vierth (2013). The key information is in the table below.

In the UK, the freight VTTS refers to the wage costs for the drivers. In Sweden, the VTTS only refers to the cargo-related costs, such as the interest on the capital in transit. It was based on a survey of the international literature. The Dutch freight VTTS includes both the wage and the vehicle costs, but also the cargo-related costs. The values in The Netherlands (by mode) have been based on SP interviews with shippers and carriers.

Table 3 Current practice in relation to CBA and the implied definition of freight VTTS in Sweden, UK, Germany and The Netherlands

		UK	**Germany**	**Netherlands**	**Sweden**
vehicle operating costs (VOC) VTTS (T)	km-based	elsewhere in CBA	elsewhere in CBA	elsewhere in CBA	elsewhere in CBA
Vehicle purchase costs (incl depreciation)	time-based	elsewhere in CBA	elsewhere in CBA	**“VTTS”** (any effects due to VOC will be removed)	elsewhere in CBA
staff costs VTTS (T)	time-based	**“VTTS”**	elsewhere in CBA		elsewhere in CBA
goods costs (VTTS (G)	time-based	**not used**	**not used**		**“VTTS”** incl. allowance for variability etc.

Source: Vierth (2013)

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