THE NORTH SOUTH LINE: EXPLAINING COST OVERRUNS AND TRAFFIC SHORTFALLS

Mig de Jong, Delft University of Technology, www.migdejong.com, M.dejong@tudelft.nl

ABSTRACT

Internationally, major transport infrastructure projects are plagued by cost overruns, delays and benefit shortfalls. These problems are explained in different ways, including technical explanations, psychological explanations and political-economic explanations, which all lead to different solutions. The explanations have primarily been tested statistically. To further our knowledge on the processes to which these explanations are applicable, a case study is examined: The Amsterdam North South Line.

The North South Line (*Noord-Zuidlijn*) is a new metro link that is currently under construction. This project already suffers from cost overruns of over 120%. After the last major cost overrun was reported, the alderman resigned. An independent committee was installed, that was assigned to advise the board of aldermen how to continue. This committee, chaired by former minister Veerman resulted in a clear advice: continue building. However, this advice appears to be little robust.

Studying the North South Line it appears that a positive image of the situation is consciously created in order to get funding approved. We can recognize the 'salami technique' to feed cost overruns step-by-step, bit-by-bit to citizens and representatives and the systematic overestimates of the benefits of the North South Line. The number of passengers is overestimated, because growth expectations of the past are still being used, although these have not been realised. Furthermore, the travel timesaving is estimated too high, because extra travel time to the underground metro stations was not considered. The benefits of the project are thus overestimated cumulatively, in a rather systematic fashion.

This seems to contradict technical explanations for cost overruns and traffic underestimates. It seems as though the North South Line is suffering from problems like optimism bias, planning fallacy and group think, all part of the psychological explanations. Political-economic explanations assume intentions, which are difficult, if not impossible, to prove (unless someone admits it, which people have in other cases, on an anonymous basis). The pattern however shows us that there is a drive towards continuing construction, and preparing the parties involved for investment in a project that has proven to be subject to serious problems.

Keywords: Amsterdam, Benefit Shortfalls, Cost Benefit Analysis, Cost Overruns, Explanations for Failure, Megaproject, Metro, North South Line, Strategic Misrepresentation

1. INTRODUCTION

Major transport infrastructure projects have a history of cost overruns, delays, and overestimated travel demand forecasts. Major projects have been examined statistically (Flyvbjerg et al., 2002, 2003a, 2003b, 2004, 2006; Flyvbjerg, 2005, 2007a, 2007b), leading to conclude that costs are underestimated and benefits are overestimated systematically. This leads to suboptimal prosperity and decreased faith in infrastructure projects, in planners and civil servants, in policy and government. Several theses have been proposed to explain these problems: technical explanations, psychological explanations and political-economic explanations (Flyvbjerg, 2005, Cantarelli et al, 2010).

This paper will focus on a single case: The Amsterdam North South Metro Line, and its mid-construction evaluation by the Veerman Committee. This project is, like so many other large-scale projects, plagued by construction problems, cost overruns and opposition. As a result of new cost overruns, the Veerman Committee was enacted, to give advice on the continuation of construction of the metro line. The Veerman Committee concludes that it is a good idea to complete the North-South Line. This conclusion is based largely on the cost benefit overview the committee created. However, this overview appears to be flawed.

This paper will examine which of the explanations for these flaws are best suitable. The paper aims to:

1) evaluate different explanations for the problems associated with major transport infrastructure projects in order to create more insight in the explanations,
2) evaluate the results of the Veerman Committee, and
3) evaluate the progress of the North South Line.

In section 2 the problems associated with major transport infrastructure projects will be discussed: cost overruns (2.1) and traffic shortfalls (2.2). There are different explanations for these problems, which will be discussed in section 2.3. Section 3 describes the emergence of the North South Line (3.1) and of the Veerman Committee (3.2). In section 4 the cost benefit overview of the North South Line as it was made by the Committee Veerman will be discussed. The different alternatives that were and were not considered (4.1), the costs of the metro line (4.2), the benefits (4.3), and more specifically passenger numbers (4.4) and travel time benefits (4.5). In section 5 the different explanations for the problems will be discussed (5.1), as well as other problems that have arisen in the construction of the North South Line (5.2). The paper ends with a brief view into the future (5.3).

2. MEGAPROJECTS

2.1 Underestimation of Costs

All over the world large-scale transport infrastructure is being created, and all over the world cost overruns and schedule overruns occur (Hall, 1980; Wachs, 1989, 1990; Altshuler & Luberoff, 2003). Bent Flyvbjerg (2005, 2007a, 2007b; Flyvbjerg et al., 2002, 2003b, 2004) systematically investigated 258 projects on cost overruns and schedule overruns (table I). This includes only line infrastructure; roads, railroads, bridges and tunnels, spread across Europe, North America and the rest of the world. Of these projects no less than 86% included cost overruns, with an average of 28%. For rail projects the numbers are more negative; rail projects on average have more cost overruns than road projects: 44.7% on average.

Table I – Cost overruns of large-scale transport infrastructure projects.
Source: Flyvbjerg et al., 2002: 285.

	Type	Rail	Bridges & tunnels	Road	All
Europe	Number of projects	23	15	143	181
	Average cost overruns	34.2%	43.4%	22.4%	25.7%
	Standard deviation	25.1	52.0	24.9	28.7
North America	Number of projects	19	18	24	61
	Average cost overrun	40.8%	25.7%	8.4%	23.6%
	Standard deviation	36.8	70.5	49.4	54.2
Rest of world	Number of project	16	0	0	16
	Average cost overruns	64.6%	—	—	64.6%
	Standard deviation	49.5	—	—	49.5
Total	Number of projects	58	33	167	258
	Average cost overruns	44.7%	33.8%	20.4%	27.6%
	Standard deviation	38.4	62.4	29.9	38.7

For urban rail projects the results are similar to overall rail projects (table II), although the results on a regional level differ. European urban rail projects do not perform as well as elsewhere, although the sample is too small to make statistically significant statements about the different regions.

Table II – Cost overruns of large-scale urban rail infrastructure.
Source: Flyvbjerg, 2007a: 15.

Urban Rail	Number of projects	Average cost escalation (%)	Standard deviation
Europe	13	43.3%	21.3
North America	18	35.8%	30.4
Other	13	59.2%	53.6
All	44	44.9%	37.3

2.2 Overestimation of Traffic

The benefits associated with large-scale transport infrastructure are not always being realised. Worldwide, there is overestimation of rail passengers. Flyvbjerg (2003a, 2007a; Flyvbjerg et al., 2006) analysed 210 projects (of which 27 were rail projects) on realised traffic in comparison to estimations (table III). The comparison was made between traffic in the first year after opening and the traffic expectation at the moment of the go/no-go decision; although 3 years after opening might have been better (Berveling et al., 2009). The differences are quite large, especially for rail transport projects: 39.5 percent of predicted traffic, so the traffic estimations are 65.3% higher than the realisation. For roads quite a different picture emerges; many road projects have more traffic than expected, although the differences between projects are quite high.

Table III – Difference between forecast and actual traffic in 210 transportation infrastructure projects. Source: Flyvbjerg, 2007a.

Project type	Number of projects (n)	Quartiles (25/50/75%)	Average difference (%)	Standard deviation
Rail (ridership)	27	-70/-54/-25	-39.5	52.4
Roads (vehicles)	183	-18/0/28	9.5	44.3
All	210	-24/-4/24	3.2	48.2

For urban rail projects the differences are even larger (table IV), although the sample size is quite small (24, of which two were disregarded as statistical outliers). On average, passenger numbers are 50.8% lower than the expectations, which is an overestimation of more than 103% of actual passengers. Here the difference between regions is statistically significant, with Europe doing relatively well (23.5% overestimation), while North America (60%) and other locations (54.3%) have far worse statistics.

Table IV – Difference between forecast and actual traffic in 22 urban rail projects, excluding 2 statistical outliers. Source: Flyvbjerg, 2007a.

Region	Number of projects (n)	Quartiles (25/50/75%)	Average difference (%)	Standard deviation
Europe	4	-40/-22/-6	-23.5	23.5
North America	8	-69/-63/-53	-60.0	17.0
Other	10	-70/-57/-50	-54.3	27.5
All	22	-68/-54/-40	-50.8	26.1

2.3 Different explanations for failure

Analysis of the different problems has given several different explanations for cost overruns and traffic shortfalls. *Technical explanations* focus on the way the estimates are made on beforehand. These problems include imperfect forecasting techniques, inadequate data, honest mistakes, incompleteness of estimations, incomplete studies before approval, poor project design and implementation, poor project management and reporting, price rises and bids from contractors that were higher than expected and other inherent problems in predicting the future (Flyvbjerg, 2005, Cantarelli, 2010).

The problems cannot only be explained through inexperience, lack of knowledge or inadequate technology. Both cost overruns and traffic forecast overestimations have not decreased as time passed. Apparently there is a consistent element in the cost overruns. After all, years of experience with large-scale infrastructure are available, while the methodologies have improved. Even though, apparently no learning seems to take place (Flyvbjerg 2007a, 2007b, Flyvbjerg et al, 2003a). *Psychological explanations* explain cost overruns and traffic overestimations on imperfections of human reason. Humans tend to overemphasize their own abilities, and to be overly optimistic about the future, rather than rational weighting of gains, losses and probabilities (Lovallo & Kahneman, 2003, Wachs, 1986). In this fashion benefits are overestimated and costs underestimated. Positive scenarios are given prominence, while scenario's involving mistakes, miscalculations and risks are overlooked upon (Flyvbjerg, 2005). In some organisations pessimistic opinions are suppressed, while the more optimistic visions are rejoiced upon in a process sometimes termed groupthink. This leads to the undermining of an organization's critical abilities (Lovallo & Kahneman, 2003).

However, this large statistical databases and analyses that show a continued "optimistic" bias cannot only be explained through goodwill alone. *Political-economic explanations* explain cost overruns, schedule overruns and benefit deficiencies in terms of deliberate strategic choices. Project funds are scarce, and projects that look good on paper can more easily be financed than projects that don't. Politicians, planners and forecasters are said to deliberately underestimate costs and schedule, while overestimating benefits in order to gain approval and funding, in a process termed strategic misrepresentation (Altshuler and Luberoff 2003; Pickrell 1992; Flyvbjerg, 2003a, 2005, Hall 1980; Wachs, 1986, 1989, 1990, Kain 1990,). Flyvbjerg terms this strategic misrepresentation; planners use the cost underestimations to get approval for projects. Wachs refers to this as either advocacy (1986), or plain lying (1989, 1990).

The difference between traffic forecast overestimates for road and rail (table III) might actually have to do with the fact that roads on average do better in cost-benefit analyses than railways (Flyvbjerg et al., 2006: 15). To get projects realised it is probably more important for advocates of rail projects to overestimate benefits. Cost-benefit analyses are more positive when benefits are higher, and traffic benefits are the most important benefit of most transport infrastructure projects. Indirect effects are part of the benefits but are usually estimated to be smaller than 30% of the direct benefits (Annema et al., 2007).

Different explanations might help explain cost overruns in different projects. At project level, there is often discussion on which of these explanations best describe the process in which a project has led to cost overruns and traffic shortfalls. One such project is the Amsterdam North South Line.

3. NORTH SOUTH LINE

3.1 Background

The North South Line has been built after many years where the word “metro” was taboo in Amsterdam. This taboo resulted from the negative experience in the 1970s with the eastern metro link (map I, lines 53 and 54). In order to build this eastern metro, large parts of old neighbourhoods were demolished, which led to huge riots in the city of Amsterdam. Since then the Amsterdam metro has expanded, but only with so-called “fast trams”, which were constructed above ground, and only required limited demolishing of housing (map I, lines 50 and 51).

When the taboo started to lose ground, Different paths for new metro lines were discussed. This included the East West Line, a metro link that, from a network perspective, was very promising; it connects the large western urban expansion neighbourhoods to the city centre. Partly this connection already exists, two tramlines use the tramlines from the west of the city centre to the western neighbourhoods, which are aboveground. However, a completely different trajectory has been chosen, from north to south. The North South Line will link the Office District ‘Zuidas’ through the city centre, to the Central Station in the north of the city centre (Bureau voor Economische Argumentatie, 1995).

The decision to build the metro was taken in 1996 by the municipal council, which was followed by a referendum. More people voted against the metro than in favour of it, but the amount of opponents was lower than the cap required to make the referendum valid. This is customary for referenda. The metro was to be constructed in an innovative way: a tunnel was to be drilled, rather than dug. This would allow for the metro to require as little demolition as possible. To further reduce the number of buildings to be demolished the metro stations would be placed deeply underground, under the existing buildings. The metro system chosen was the one that is currently being used, in order for existing (and future) train material to be used on both the existing and the new metro lines.

After the construction of the North South Line started, in 2003, a series of problems have come to light. Leakages appeared in the construction works of the metro stations and several buildings subsided. As time passed it became clear that construction would take many years more than expected and costs would be much higher than forecasted. Almost on a yearly basis the Amsterdam municipal council was asked to approve of a higher budget. This process of slowly gaining approval of much higher costs than forecast is often termed salami tactics (Flyvbjerg et al., 2002: 181). This way construction is not halted because the budget suddenly becomes much higher than expected.

Map I – Future metro map of Amsterdam, with the North South Line in Blue (52). Source: Wikimedia commons.

3.2 Veerman Committee

After new cost overruns became apparent, a committee was enacted in March 2009 to give advice the Amsterdam Mayor and Municipal Executives (*College van Burgemeester en*

Wethouders) which steps were to be taken next. This Committee, led by former minister Veerman, was asked to focus on three issues:

1. The projects' progress; including investigation of different alternatives for continuation of the project, and an overview of the costs and benefits of the project
2. The organisation of the North South Line
3. The financing of the North South Line

Here the focus is on the first element: the assessment of the costs and benefits, including different alternatives that were examined.

For large-scale infrastructural projects a standardised cost benefit analysis (CBA) is currently obligatory in the Netherlands (Wortelboer-van Donselaar & Lijesen, 2008). In a CBA all positive and negative effects of a project need to be mapped, before a project can gain approval. This does however not make the cost benefit analysis leading. A project with a negative CBA can still be constructed. It is only a tool for assessing projects in a concise matter, before any decisions are made. Because the North South Line predates this obligation, a CBA was not obligatory, and no cost benefit analysis was made using customary methodology, nor has any form of CBA been released.

The committee made an overview of costs and benefits, which was a required, but not a real cost benefit analysis. The committee based the cost benefit overview on three different reports. Decisio (2008) investigated the costs and particularly the benefits of the North South Line, Ecorys & infram (2009) did a review on this report, and they updated it wherever possible and the Netherlands Institute for Transport Policy Analysis (Bakker et al, 2009) has reviewed the Ecorys report. These reports are not at all as positive as the Veerman Committee is.

4. COST AND BENEFITS OF THE NORTH SOUTH LINE

4.1 Alternatives

The Veerman Committee compares the completion of the North South Line to two alternatives: Stopping construction and only building the North Line, which is the part of the line from the Central Station to the north of the city (Table V). In the alternative where only the North Line is being constructed the benefits of the line are estimated to be negative, minus 8.7 million. The benefits are only € 2.3 million and exploitation would cost € 11 million.

Table V – Costs and benefits according to the Veerman Committee (2009: 20)

	Current expenditures	Future cost	Future benefit
Stopping construction	1.1 billion	0.6 billion	Nil
Building only the north line	1.1 billion	0.8 – 0.9 billion	- 0.01 billion
Completion of the line	1.1 billion	Max. 1.8 – 2.0 billion	1.0 – 2.0 billion

The negative benefit of completion of only the north line is a remarkable conclusion. This is the only part of the line that is not parallel to the existing metro line, and in this area many redevelopment projects around future metro stations are being constructed. There are even talks of adding a third station along this line, because it would be such an improvement compared to the existing bus lines, of which many are halted or rerouted when the complete line is finished. The travel time benefits in particular are located in this part of the city, as well as the expected price rises (which are a direct result of the travel time benefits). Apparently the benefits of the project are mainly located in the city centre, although public transport is quite good there as it is. The explanation has to be found in the bus lines. According to the municipality these bus lines would not be rerouted from Central Station to the metro stations if only the north line is completed, allowing for little benefits. However, we might argue that there is a need to reroute these bus lines anyway, because very little room is available around Central Station for these buses. However, it is true that the benefits would be smaller, when an extra transfer is required at Central Station.

In a complete cost benefit analysis it is crucial that a comparison is made with credible alternatives. The Dutch CBA Guideline “OEI-richtlijn” (Eijgenraam et al., 2000: V) states that project effects can be defined as the difference between developing a project and the reference case, which is defined as do-minimum, rather than do nothing. Without a good reference case it is impossible to make a good analysis of the effects of a project. Decisio (2008) investigated the benefits of the North South Line. Decisio clearly states that they did not use a reference case. They did evaluate an alternative that can be described as “Stopping the North South Line”, but that is a do-nothing case, rather than do-minimum. The guideline states that the reference case is a combination of the best appropriation of resources, and the best possible other solutions for bottlenecks (Eijgenraam et al., 2000: V). In Amsterdam that would mean that a good design for the public transport system without the North South Line would have to be calculated. In this alternative a logical and necessary redesign of the tramlines that are parallel to the future North South Line should be included. This would not have to include many new physical rails, but at least a redesign of the services. And of course if these measures would be costly, these would then in turn become benefits for the North South Line in the CBA.

Beyond this reference case several other alternatives need to be included as well. There are more alternatives than the before mentioned ones. One of these alternatives is the ‘premetro’, which was proposed by the Amsterdam Socialist Party (SP), which is currently in the opposition. This alternative would include the completion of the existing north line, as well as an improved tramline through the city, using existing tracks and parts of the stations currently under construction. In a later stage this could be transformed into a “real metro”.

This alternative is not necessarily better than the current alternatives, but for a good cost benefit analysis it is important that the result of this type of alternative or other relevant alternatives are known as well.

4.2 Cost

The cost of building the north south line is estimated to be around 3.1 billion euro (2009 prices). The original budget was 1.4 billion euro (2002 prices). Currently 1.1 billion euro has already been spent on the project, according to the Veerman Committee. In order to decide whether the project is to be continued and they do not to include these costs. The committee furthermore states that € 600 million is to be spent on current obligations and other costs (table V). This seems like quite a lot of money, but if this were true (because of existing contracts) there is little that can be done about it.

The Veerman Committee states that future cost is maximized at 2 billion euro, of which € 500 million is a risk reservation. If this were true the committee has a risk reservation of 33% (0.5 of 1.5 billion). However, internationally the cost overruns for rail projects average 45% (Flyvbjerg et al., 2002), while in Europe the average is 34%. This is very similar to the number given here: a risk reservation of 33% would meet the average cost overruns. However, the North-South Line is not an average rail project. It is an urban rail line for which cost overruns are on average 43 % in Europe. Furthermore this line includes tunnelling, the project is more complex than average, is located in a heavily urban environment, and is being built using new technologies. All of these are risk factors, which should make us careful in assuming that this project will be completed within budget.

To make things worse it appears that these risk reservations are part of the real cost analysis, rather than real risk reservations. These costs are costs of which it is uncertain to a degree whether these funds will have to be spent, but of which it is likely that some will (Known unknowns). In this case the likelihood of future cost overruns is larger. Former alderman of Amsterdam Herrema expects that more cost overruns would occur as well (Nova, 2009). However, the cost analysis is relatively well done, compared to the first estimates (of only € 1.4 billion) and compared to the benefit analysis that the Veerman Committee presented as well.

4.3 Benefits

The benefits of large projects are subject to debate. There are risks of double counting of benefits, discussion on the appreciation of external effects, problems with indirect effects in general and particularly the size of the economic effects of projects. However, in this case the direct benefits are debatable as well. The Veerman committee states that “the material social benefits of the full completion are estimated to be € 1.5 billion on average”. This is an average of a range of 1 to 2 billion euro, an estimation that is made by the Veerman

commission by themselves, and that does not appear elsewhere anywhere. From the research done by other parties a different picture emerges (table VI).

Table VI – Total benefits according to different researchers

	Benefits (billions)
Decisio (2008)	1.0 – 1.6
Ecorys & Infram (2009)	0.6 – 1.0
Veerman Committee (2009)	1.0 – 2.0

The Veerman Committee used the data from the report of Ecorys & Infram (2009): 0.6 – 1.0 billion euro benefits. Instead of directly assuming these numbers, the committee decided to revise the data. Both Ecorys & Infram and Decisio use a risk discount of 3% and a real risk free discount of 2.5%. This leads to a combined discount of 5.5%. However, the Veerman Committee states that the risks towards the benefits of this project are very low, allowing for a risk discount of only 1.5%; resulting in a combined discount of 4%. This allows the committee to estimate the benefits at 0.8 – 1.5 billion euro.

There are two problems with this type of reasoning. Firstly, stating that the benefits of North South Line are relatively risk free seems strange given the fact that the project thus far appeared to be very risky, and the fact that some of the data might be flawed. Secondly, and from a methodological perspective a more important issue, the Dutch CBA guidelines prescribe that a risk discount of 3% is common, but that two extra scenarios can be added to estimate risks better through a sensitivity analysis. This includes a scenario with a risk discount of 1.5% and one scenario with a risk discount of 4.5%. So it is useful to estimate the effects of a scenario with a risk discount of 1.5%, but a scenario with a risk discount of 4.5% should be included as well (VenW/EZ, 2004).

The next step taken by the committee seems to be even more problematic. The committee states that if the benefits grow by 2% yearly, the total benefits rise to 1.5 – 2.4 billion euro. On this basis the committee states that estimation of the benefits as 1.0 – 2.0 billion euro is very well considered. This is an exceptionally strange step, given the fact that all growth already has been included in the benefits analysis by Ecorys & Infram (2009), and is probably overestimated as it is, as we will see in the next two sections. To include an estimated growth figure again would be double counting of growth.

Even the reports made by Decisio and Ecorys & Infram are probably overoptimistic, the benefits in these reports are probably overestimated. For example, Decisio (2008) uses an unlimited time horizon, although 20-30 years is common in this type of investigation. This might seem worse than it actually is, because benefits in the far distant future accumulate to relatively little because of accounting. However, it is important that the accounting is done properly, and forever is a long time. And there are more problems, which will be discussed in 4.4 and 4.5.

4.4 Passenger Numbers

Both Decisio (2008) and Ecorys & Infram (2009) assume that 160,000 passengers a day will use the North South Line. Decisio based this estimation on one single economic scenario, the European Coordination scenario. There are two problems in this approach. Firstly it is advised to use more than one economic scenario (Annema et al, 2007). And secondly, this is the scenario that has the strongest growth of public transport, while even in other scenarios the growth of public transport in the Netherlands is probably overestimated (De Jong & Annema, 2010: 30-34). Decisio even states specifically that the total use of the North South line will be 160.000 to 240.000 passengers, a range on the basis of which they estimate their benefits as well. However, 240.000 passengers actually includes extension of the North South Line to Amstelveen, which is not completely unthinkable, but would require many extra investments, which are not included in the cost of the North South Line. It is thus pointless to include these passengers when estimating the benefits of the metro line.

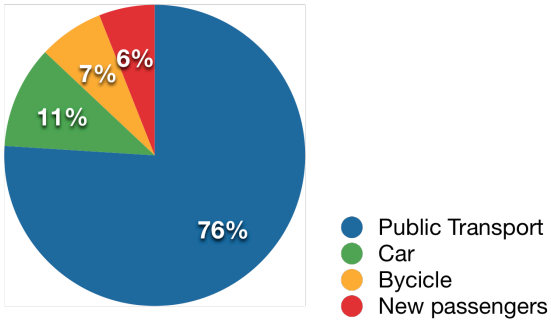
160,000 passengers daily is an exceptionally high estimate. The current use of the total Amsterdam metro system (both above and underground) is around 295,000 passengers on a representative weekday (table VII). The North South Line would have to achieve more than half the number of passengers of these lines combined. Even though the current lines extend over 42.5 kilometre of rail track and 52 metro stations. The North South Line is only 9.5 kilometre in length, includes 6 new stations and 3 existing ones and will partly run parallel to existing metro lines. The metro does connect a busy and important area, but the total number of passengers appears to be somewhat high.

Table VII – Metro passengers in Amsterdam. Source: Amsterdam Municipal Transport Company (GVB).

Metro line	Passengers 2009	Passengers 1995
Line 50	100,000	-
Line 51	61,000	48,000
Line 53	61,000	55,000
Line 54	74,000	71,000
Total	295,000	170,000

This estimate of 160,000 is based on a growth estimate of public transport of 88%, in the period 1993-2005 (Bakker et al, 2009). This has not been achieved at all. The eastern metro lines 53 and 54 (Map I) grow with 9.9% and 3.5% respectively in the period 1995-2009 (a different, and slightly longer period). Line 51 is growing much faster, with 27.8% in the same period. However, this line was extended with 3 extra stops in Amstelveen, southwards, and runs trough the ever-growing Amsterdam Zuid train station and was connected to the very successful line 50. The total growth of public transport use in Amsterdam in the 1993-2005 period was around 10%. The growth rate of 88% thus seems to be a clear overestimate.

Chart I – Modal shift: former transport modalities of future metro passengers. Source: Infram & Ecorys, 2009



Of all passengers 76% is expected to be current users of public transport, 7% of the passengers would currently bicyclists, while 6% would be new travellers (Infram & Ecorys, 2009). The city centre of Amsterdam is very difficult to reach by car, and parking is very expensive. Many people thus use public transport in this area, as well as bicycles (Amsterdam is arguable the bicycle capital of Europe). Using a bicycle is of course better for the environment (and health) than the metro, so the modal shift from bicycle to metro is actually unwanted. Only 11% of future passengers would be current car users, although the most common argument for the metro line is that it would create a modal shift from car to public transport. However, since the total number of passengers might well be smaller than expected, the modal split might well appear to be different as well.

4.5 Travel Time Benefits

The travel time benefits are based upon passenger numbers, travel time gains and value of time. The travel time gains might well be lower than the Veerman Committee assumes. Decisio (2008) and Ecorys & Infram (2009) assume travel time gains of 6 minutes per passenger. This appears not to be much, but seems logical given the fact that the existing east lines run parallel to the North South Line and the city centre already has good public transport lines (mainly trams). Bakker et al (2009: 8) state that the stations will be placed underground very deeply: up to 20-26 metres underground. This leads to extra vertical travel time; of up to 1 to 1.3 minutes per passenger. This travel time, which consists of using lifts or escalators, are usually considered to be valued very negatively by passengers. Normal waiting time and before and after transport are usually accounted for with a time value of 1.5 – 1.8 times the actual travel time. Together this leads to a travel time experience increase of 1.5 – 2.3 minutes per journey, assuming they use one deep underground train station per journey (they might actually use two or none, depending on the stations they use). On a travel time gain of 6 minutes this is definitely not negligible.

Furthermore, Bakker et al (2009) state that there might well be too little appreciation for the negative valuation of transfers for passengers. The new design of the Amsterdam public transport system will probably include more tramlines to be placed crosswise on the North South Line (and thus also on the east lines, which run parallel to the North South Line). This

will make a transfer necessary; in many cases an extra transfer. This is logical from the network perspective, but transferring is often valued very negatively by travellers. In some models transfers account for an extra 8 to 10 minutes added valued time. These passengers might actually have to deal with the vertical travel times as well.

Considering all of this the estimation of benefits appears to be too high. Internationally the passenger numbers appear to be overestimated by 100% of actual traffic; 50% of the estimation. That seems like a reasonable indication of the overestimation of the passenger numbers at the North South Line. The travel time benefits are probably too high as well, leading to more inflation of overall benefits. Considering these problems it is the more striking that the results were translated using mathematical tricks, making them even more positive than they already were.

5. DISCUSSION

5.1 Which explanation for the bias in costs and benefits best fit the evidence?

The problems described here raise many questions. Why did the researchers use traffic expectations dating from 1993? Why did the researchers never use a plausible reference case? Why were other alternatives disregarded? The alternatives that were investigated seem to be way too limited to provide for a good analysis. It does seem like the methods in estimating the benefits are flawed, which is part of the technical explanations for failure of major projects. However, more questions can be raised.

Would it not have made more sense to use more recent passenger data and expectations? Why was a real cost benefit analysis never done? Why is the estimate of the Veerman Committee so much more positive than those made by other researchers, who did their research on behalf of the committee? Why does the committee change the numbers of the parties working for them, even though these organisations are known to be proficient? It is striking that the Veerman Committee asked several competent parties for advice, but neither of these advices was accepted as such. The committee used several parts of these reports to draw up their own conclusions. This could well be related to optimism bias: if the committee expects much better from this line than the other researchers do. Many psychological factors can influence the outcomes of this type of research, including planning optimism, cognitive dissonance reduction, and group pressure.

However, we have to concede that something is going wrong here. It can't be the case that all our experience with large-scale infrastructure leads to continuous underestimation of costs and overestimation of benefits without someone turning the switches in the positive direction. It does remain very difficult to pinpoint who is doing what exactly, and almost impossible to prove one's intentions. It appears as though these results, which all point in the same direction, were aimed at achieving one end goal: to continue building the North South Line. Flyvbjerg et al. (2002) use the term *strategic misrepresentation* to describe this process. It is a strange phenomenon that projects where costs are underestimated and

benefits are overestimated do have a better chance of being constructed than projects where they aren't. This is termed the *megaproject paradox*. It is difficult to prove this in a single case study, for two reasons. Realisation is only expected in the distant future, which transforms the discussion into a 'tis-'tisn't argument, without any real prove. And the parties involved will (and do) deny everything.

There should never be an excuse to consciously try to get projects realised through strategic misrepresentation, because it undermines the trust in institutions, in planners, civil servants and politicians and in major projects, which makes it more difficult to realised large-scale projects in the future as well.

5.2 Which other problems arose building the North South Line?

When the decision was made to build the North South Line, more mistakes have been made. Building a metro line, while attempting not to demolish any buildings is not the most efficient way of construction. Building stations much closer to ground level would have saved a lot of money, even when huge compensation would have been given to local residents. The new metro station "Ceintuurbaan" (map I), in the small Ferdinand Bolstraat is the prime example of this problem. The station is to be built 16.5 to 26.5 metre below ground level, with the two metro tunnels on top of each other, to prevent any of the existing housing to be destroyed. These houses are not monumental houses; they are relatively common older houses from the 20th century. The attempt to demolish as little housing as possible was a huge factor in the costs of the current metro line. We could state that the North South Line is a prime example of a "do no harm project"; because the municipality wanted to keep everybody happy, and not to harm any stakeholders, a compromise arose, a compromise that is far from ideal. This led to both extra costs and extra risks.

Furthermore, the North South Line would have been better off if an automatic metro line would have been build, like the French VAL (Véhicule Automatique Léger). Because this metro line is completely automatic, trains can follow each other up in a much higher frequency. Higher frequencies are not only better as such, but it also removes the necessity to build long metro stations, because trains could be much shorter. Because stations could have been smaller, they would have required less construction space, and less would have to be demolished to get them closer to ground floor. The total cost for automatic metro (including personnel costs) is lower than for the current system, and the only (official) reason to build another metro using the current system was that the metro cars would be compatible. This seems like a petty reason, because an automatic metro would have not only saved a lot of money, but also it would have allowed for a better metro link.

Another issue is the trajectory choice. Building the east west line would probably have been much more cost efficient. Connecting the western parts of Amsterdam to the city centre, and possible to Amsterdam north would probably have generated much more traffic. The current trajectory runs parallel to the existing metro (53 and 54, map I), connecting to a part of the city that is already served well by metro lines (Amsterdam South). Amsterdam West however

lacks a radial metro line, and parts of the aboveground lines in this direction are already available in Amsterdam West.

5.3 What happens when the North South Line has finally been completed?

Many involved parties systematically state that once the North South Line has been finished everybody will be satisfied. However, that remains to be seen. If foreseen passenger number, and thus benefits will not be realised the cost effectiveness of the line will remain open to discussion. In that case the popularity of the metro line will remain very low.

Currently it is quite uncommon for large projects to be evaluated *ex post* and the actual benefits will probably be quite disappointing. Probably, once the project is completed, the organisations involved in the construction of the North South Line are not tempted to evaluate the actual costs and benefits. The parties involved have nothing to gain of such research, while others who want to investigate this will have much difficulty obtaining the required data. However, it is important that this project will be evaluated, to prevent the cost overruns and traffic shortfalls for other projects.

In any case, the idea that large-scale projects, and particularly metro lines, indiscriminately lead to cost overruns will stick for a while in Amsterdam. This undermines support for building future metro lines, like an East West Line in Amsterdam, but also any type of megaprojects elsewhere. Not only trust in this type of project is decreased, but also trust in planners, decision-makers, civil servants and politics in general is being harmed by these problems.

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