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Are Cost Overruns Merely a Bad Thing?

Shedding light on the other side of cost overruns in big road infrastructure projects in the Netherlands

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Abstract

Cost overruns are present in almost every context and almost always regarded to be a problem. A lot of research has been done on the subject, quantitative well as qualitative research. Mostly with the purpose of finding a 'solution' or 'cure' for cost overruns. This research reviews the explanations for cost overruns in contemporary literature and concludes that explanations show an overall negative bias. Furthermore, it demonstrates the possibility of a more positively charged explanation founded in literature and shows that these explanations might apply to changes regarding scope and laws and regulations. According to the methods of the most prominent researches on cost overruns, two cases were selected in order to be examined in order to determine whether these explanations could apply to changes in projects that cause cost overrun. Both cases, '*A10 Tweede Coentunnel/ A5 Westrandweg/ N200 Halfweg*' and '*N50 Ramspol – Ens*', showed promising results that could be interpreted as a more positive explanation for cost overruns. The conclusion of this research is that such an explanation is plausible in the context of large road infrastructure projects in the Netherlands but that further research should be done in order to provide more confirmation.

Keywords: Cost overruns, roads, infrastructure, infrastructure planning, projects, explanations, the Netherlands

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List of abbreviations

ToD = Time of decision to build

rToD = Real time of decision to build

RWS = Rijkswaterstaat

MI&E = Ministry of Infrastructure and Environment

BLD = Baten Lasten Dienst

DBFM = Design Build Finance and Maintenance

1 | Hiding is impossible, face the misery called cost overrun!

Cost overruns seem to be around us everywhere. The construction industry has a reputation for delivering projects over budget and headlines regarding projects with cost overrun are not hard to find (Jackson, 2002). A quick scan on this subject results in numerous reports in the media about cost overruns in projects of all sizes on different scales ranging from 1404 million euros on an estimate of 4606 million euros for the upgrade of the Panama canal, to 53.000 euro on an estimate of 165.000 euro for a cycling lane in the village of Hellendoorn in the Netherlands (Gemeente Rijssen-Holten, 2012; Wilkinson, 2014; Hellendoorns Nieuwsblad, 2015). Furthermore, besides media attention these overruns also generate political attention as the following headline illustrates: “House of representatives wrathful about cost overruns on Utrecht central station overhaul project” (Financieel Dagblad, 2015).

Two well-known cases of major cost overruns in infrastructure projects in the Netherlands suggest that the Netherlands might be no exception regarding this subject. The cases of the Betuweroute and the HSL-South were so severely over budgeted that attention for cost overruns in the country intensified (Cantarelli, 2011; Cantarelli et al., 2012). Moreover, after the Randstad Accessibility Plan budget rose exorbitantly within 10 months, there was political interest for cost overruns and this triggered to scientific community to conduct research on this subject (Nijkamp & Ubbels, 1999). The research of Nijkamp & Ubbels (1999) showed that cost overruns are present in the Dutch context in rail, road, tunnel and bridge projects implemented between 1957 and 1996.

More recent studies show that cost overruns in the Netherlands are smaller compared to the rest of the world. This might be explained by the fact that the Dutch data compared to the rest of the world consists of more recently implemented projects (Cantarelli et al., 2012a). However cost overruns have been a problem in the Netherlands for the last 20 years (Cantarelli et al., 2012b) and especially road infrastructure projects prove to be vulnerable to cost overruns (Cantarelli et al., 2012c). Moreover, for road infrastructure and tunnel projects the Netherlands perform similar to the rest of the world. Bridge projects on the contrary seem to perform better albeit that this is based on a small number of cases and is not statistically significant (Cantarelli et al., 2012a).

1.1 | Problem statement

Cost overruns are everywhere and although they have been researched for some time, they do not seem to disappear. Furthermore, projects related to cost overruns in infrastructure in the Netherlands are funded with public money. The fact that cost overruns do not seem to disappear could be the result of people simply ignoring the solutions, but it also could be because there is a part of cost overruns that simply exists because it is inherent to a project and should occur in order to reach feasible results. The fact that public money is involved makes it problematic that it is not known why these overruns keep occurring.

Furthermore, although it becomes clear in the last section of the introduction that there the story behind cost overruns is complex and not easily to generalize, in the media as well as in contemporary literature there seems to be a rather negative focus on the subject of cost overruns. Little light has been shed on the possibility of less negative or even positive explanations for cost overruns and most reports and research heavily rely upon quantitative data. Although these might all be right, it would only be fair and of common sense to investigate if other possibilities could be true as well.

1.2 | Research goals

Cost overruns are often judged in quantitative research which does not tell the whole story. The qualitative research that has been conducted on the subject has a strongly negative attitude towards cost overruns. The goals of this research include assessing if in contemporary literature more positively charged explanations to cost overruns are present and if there proves to be ground for reasoning that such explanations could exist. Moreover, exploring the Dutch reality of cost overruns in road infrastructure and creating a solid strategy to assess whether more positively charged

explanations are present in this context. Finally, the goals are met if there will be more clarification on the subject of cost overruns in the context of large road infrastructure projects in the Netherlands and if it provides the inspiration and ground for further research into the positive aspects of cost overruns. In doing so this research should contribute to scientific knowledge and engage in the contemporary discussion on cost overruns.

1.3 | Research questions

The main question that will be central for this research is:

Is a more positively charged explanation possible for changes in large road infrastructure projects that lead to cost overruns in in the Netherlands?

The following sub-questions will be answered in order to answer the main question:

1. How do cost overruns relate to projects and how can they be measured?
2. What are the main explanations for cost overruns according to contemporary literature?
3. Are there any positively charged explanations and what is the overall bias regarding the explanations?
4. Is there ground for reasoning that there are other explanations possible to explain cost overruns?
5. What could be the content of such an explanation and how could it be demonstrated in practice?
6. Are positively charged explanations found in practice in the Netherlands?

1.4 | Structure of thesis

Chapter 2 contains a literature review of concepts and theory related to large infrastructure projects and cost overruns. It provides an overview of how cost overruns are measured and how they are explained.

Chapter 3 introduces the Dutch context and argues that here is ground for reasoning in contemporary literature that another explanation is possible. This explanation is its conditions to be a valid explanations are also discussed.

Chapter 4 explains the methods used in order to conduct this research. This includes the explanation of how and why the cases were selected.

Chapter 5 contains two case studies: '**A10 Tweede Coentunnel/A5 Westrandweg/N200 halfweg**' and '**N50 Ramspol-Ens**'. The results found in practice are presented in this chapter.

Chapter 6 discusses how the results of the previous chapter could be interpreted.

Chapter 7 explains the conclusions of this research. Furthermore, the limitations to the research are identified and areas discussed.

2 | The negative focus in contemporary literature

This chapter will be structured around the first three sub-questions. The first section will start to shed light on the subject from the perspective of project management after which it will be explained how cost overruns are defined in contemporary research. A division in change causes is used to categorize cost overruns and the negative focus in explaining cost overruns is exposed.

2.1 | Project management

Although project management does not originate from planning theory it is well represented in spatial planning and transport and land use planning, it is most prominent in infrastructure and spatial development (Busscher et al., 2013). In regards to the implementation of policy decisions on specific investments like line infrastructure, it is even considered to be 'the way to go' (Glasbergen & Driessen, 2005). It is agreed upon that a certain endeavor may be called a project when it has certain characteristics: having certain pre-defined goals and objectives, being unique in a sense that it stands free from established organizational routines and practices, being of temporary nature and have rather clear boundaries physically as well as in time (Engwall, 2003; Maylor et al., 2006; Newell et al., 2008). These projects can stand on themselves or be a part of program that hosts more projects that have their own scope (Lycett et al., 2004; Pellegrinelli 2011a). Programs can help to better address the context and contents of change in the context (Pellegrinelli et al., 2011b). It are these changes that project management is not well equipped to deal with since it is traditionally focussing on the realization of a goal that has been set at the beginning. At a moment that it is merely impossible to have all information or knowledge available to make informed decisions on the exact desired outcome of a project (Engwall, 2003). Tension between these external pressures and the predefined goal of a project that can lead to cost overruns, delays and shortfall in expectations (Flyvbjerg et al., 2003a) However, these failures are also ascribed to incompetent management and insufficient project control (Busscher et al., 2013). *Figure 1* illustrates different projects with different boundaries, in time as well as in space. The square represents the scope of a project as seen from a retro perspective.

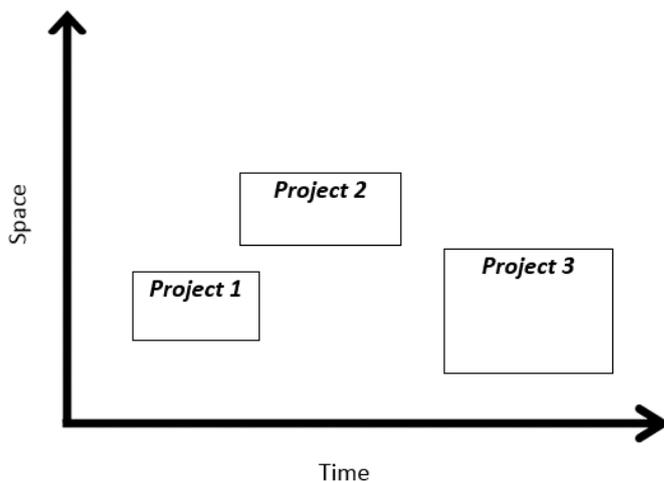


Figure 1: an illustration of different projects with different boundaries in space as well as in time

2.2 | Cost Overruns

Cost overruns are not uncommon and are seen everywhere around the world. They have been a constant factor that has applied to nearly all large projects for the last 70 years at least (Flyvbjerg, 2003a; Flyvbjerg, 2003b; Flyvbjerg 2004; Flyvbjerg et al., 2005; Flyvbjerg 2007; Cantarelli, 2012). Flyvbjerg (2003a) describes the object that is entangled with cost overruns as an 'animal' that gobbles up millions and millions of dollars. Major transport infrastructure projects are a widespread phenomenon and cost overruns are more frequent than underruns (Cantarelli et al., 2012). The examples given by Flyvbjerg et al. (2003b) show a distressing image: the Channel Tunnel had an 80

percent overrun with a total cost of about 6200 million euros and the great Belt link had a 68 percent overrun with a total costs of about 720 million euros. Examples like these are not hard to find and continue to be subject of discussion in contemporary literature (see for example Love, 2011; Odeck, 2014; Sözüer & Spang, 2014). Although road infrastructure projects prove to be the projects that suffer the least from cost overruns, these projects still overrun 20,4 percent on average and have been constantly present over a 70-year period (Flyvbjerg, 2005) like mentioned above. Moreover, also in road infrastructure exceptions of enormous overruns are observed (Sözüer & Spang, 2014).

Generally cost overruns are measured as actual construction costs minus estimated costs expressed as a percentage of the estimated costs. These actual costs comprise real and allocated costs at the time of completion of the project, estimated costs are the forecasted costs for a project at the 'Time of formal Decision to build' (ToD). In many circumstances reliable information that could serve as a basis for cost estimates is not available as data for decision-makers to make an informed decision at the ToD (Flyvbjerg, 2003a; Flyvbjerg, 2007; Cantarelli; 2011; Cantarelli et al. 2012). According to Cantarelli (2009) it would be ideal to base the estimated cost on the real decision to build (rToD) since this moment gives a view of the 'true' cost overruns. The real decision to build can be defined as the moment before the formal decision to build in which decision-makers informally decide upon the project. The reason for this would be that cost estimates usually become more accurate over time and the formal decision takes place after the real decision, thus using forecasted costs from a later point in time will result in smaller overruns. However, it is difficult to pinpoint this moment exactly. The time between the ToD and completion of the project is called the implementation phase (Cantarelli, 2009). The changes in a projects or amendments caused by the changes in the context or external pressures can result in cost overruns (Chang, 2002). *Figure 2* summarizes all above and represents a project with cost overrun. It shows the boundaries of a project and the changes that occurred within the project that contribute to the total cost overrun. These changes are represented by the crosses. Since the total cost overrun can only be analysed in retrospect, this is also the perspective from which the table is presented.

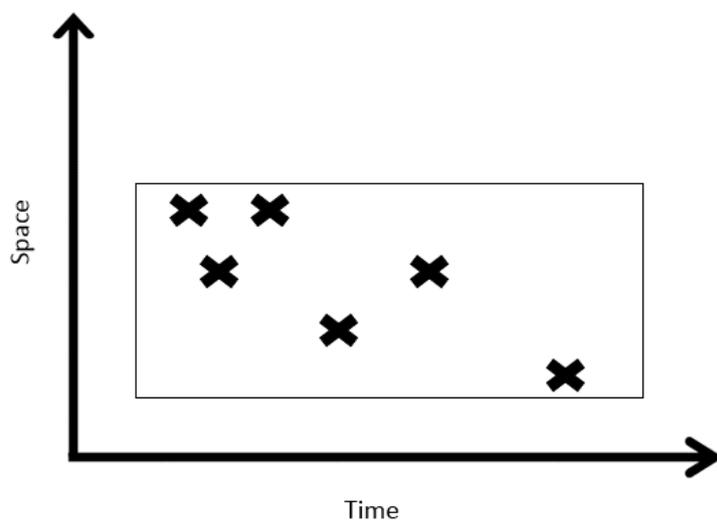


Figure 2: a single project with changes that contributed to the total cost overrun marked in space and time

2.3 | Analyzing cost overruns

The changes in a project that contributed to the total cost overruns in the project illustrated by the crosses in *figure 2* can be categorized according to the main element of change they relate to. These elements are derived from the research on the causes of change effects in construction of Chang (2002) combined with the research of Verweij et al. (2015). Furthermore, the framework of Brunet & Lind (2014) that is used to analyze how changes in a project contributed to cost overruns in a similar fashion served as a basis. These four main elements to which changes that contribute to the total

cost overruns in large road infrastructure projects relate are: changes in scope, changes in laws and regulations, errors/omissions and external factors. *Table 1* shows how changes can be placed in relation to the main element in which the change occurred. Identifying how changes in the elements contribute to cost overrun and explaining them separately will help creating a structured overview of how these and subsequently help to explain cost overruns in general.

Table 1: changes in the different elements resulting in cost overruns in a project

When and in which element do cost overruns occur?	Implementation phase
Scope	✘ ✘
Laws and regulations	✘ ✘
Errors/Omissions	✘
External factors	✘

The division made by Chang (2002) shows three main elements. It is a classification based on compensable, excusable and non-excusable causes. The first mainly within the control of the commissioning party and mostly related to additional requirements and scope changes. The second as a result of external factors that is beyond the control of all parties and the last can be the result of actions regarding mistakes that can be made by all parties. These descriptions are in line with the division used by Verweij et al. (2015) in their research on the causes of contract changes in the Dutch context. Moreover, their research uses a fourth category: changes in laws and regulations. Changes in laws and regulations can have significant effects on projects as Williams (2000) points out with his research on the influence of changes in safety regulations on projects.

2.4 | Explanations for cost overruns

In contemporary literature a number explanations or reasons for cost overruns can be identified. Flyvbjerg (2003b) argues that there are three main explanations for cost overruns: *technical, psychological and political-economical*. It is argued that technical explanations account for cost overruns in terms of “*imperfect forecasting techniques, inadequate data, honest mistakes, inherent problems in predicting the future, lack of experience on the part of forecasters, etc.*” (Flyvbjerg 2003b, p.8). Genuine mistakes can be made as a result of insufficient description of the tasks but also because of the lack of competence of employees or lack of resources devoted to the project within the organization (Sözüer & Spang, 2014). When competitive tendering is used, this might play a role during construction because of the lack of a mandate for design reviews and checks and verifications might also contribute to errors and omissions made in the process (Love, 2011). Moreover, it is possible that ‘mistakes’ regarding cost estimates or provision of information occur purposefully in order to generate a more favorable forecast for the project (Flyvbjerg et al., 2007). *Psychological explanations* account for cost overruns through the mechanisms called *planning fallacy* and *optimism bias*. *Planning fallacy* is characterized by managers making decisions based on delusional optimism, involuntary spinning scenarios of success and overlooking the potential for mistakes and miscalculations. *Optimism bias or over-optimism* is explained as a flaw in the human mind and although it seems to be omnipresent it can be easily be tempered by reality checks. *Political-economical* are about strategic or deliberate misinterpretation of misinformation. This can result in purposefully overestimating benefits and underestimating costs of a project in order to make it more likely that their project will be realized. These explanations are about deliberately misleading or even lying in order to gain political or economic advantages.

Cantarelli et al. (2010) have conducted a literature review on 23 papers regarding project management and cost overruns in particular. The explanation categories are based upon earlier work

of Flyvbjerg (2003b). They provide the following four explanation categories are: *technical*, *economical*, *psychological* and *political*. *Technical explanations* mainly consist of causes like price rises, poor project design and implementation, and incomplete estimations, cope changes, uncertainty, inappropriate organisational structure, inadequate decision-making processes, and inadequate planning processes. They are considered to be 'honest' mistake or a result of lack of experience. They argue that *economical explanations* can be seen in a lack of incentive to provide accurate forecasts because would not be in their own interest to do so as a result of a lack of resources. This lack of resources leads to competition and competition leads to deliberate underestimation of costs in order to make the project more attractive than other projects. Furthermore, when resources are inefficiently used cost overruns can also occur because resources that are spent on inferior projects cannot be recovered. Lastly, deliberate underestimation to receive funding and getting the project started and keep money flowing in because of the dedicated funding process can also result in cost overrun. *Psychological explanations* here are also mainly focused on *planning fallacy* and *optimism bias* in the way they are explained above. *Political explanations* comprise of deliberate cost underestimation or benefit overestimation, manipulative behavior and strategic behavior caused by several political mechanisms, asymmetric information and organizational and political pressure. It is generally agreed upon in the literature to be the main explanation for cost overruns. Cantarelli (2012c) contends the many scope changes that occur in the earlier stages of the implantation phase is a result of strategic misinterpretation. Furthermore, Flyvbjerg (2005) and Brunet & Lind (2014) also argue that purposefully pose 'unrealistic' estimations to get a project started or just not being able to see that an estimation is unrealistic because actors do not want to see it is, is an explanation for scope changes that lead to cost overruns

Brunet & Lind (2014) build on these explanations as a basis for their research but substitute the *technical* explanations for *lack of competence* and *bad luck*. The first is explained by stating that the actors do not have a specific bias nor where affected by psychological mechanisms but lacked the competence to estimate them correctly. The latter as unexpected events that occur. Events that could not have been foreseen, even from the perspective of knowledgeable and unbiased actors. Projects can be highly influenced something that is not easy to predict like the weather conditions. These projects can be sensitive to these conditions. Rainfall for example can have significant impact on the construction of highways (El-Rayes & Moselhi, 2001; Sözüer & Spang, 2014). The overlap with the *technical* explanations of Flyvbjerg (2003b) and Cantarelli (2010) and its capability to explain the different parts of the *technical* explanations, it can also be seen as an extension of the explanations for this category. Moreover, *bad luck* describes externalities such as unpredictable weather events well. In *table 2* the overview of contemporary literature shows the explanations for cost overruns, grouped according to the main elements of change. A rather negative focus on the explanations of cost overruns

Table 2: Explanations of how changes in the different elements contribute to cost overruns

<i>When and in which element do cost overruns occur?</i>	Implementation phase
Scope changes	Strategic misinterpretation of information Optimism bias
Changes in laws and regulations	Deliberate misinterpretation Lack of competence/resources
Errors/Omissions	Lack of competence/resources Strategically overlooking matters in order to make project more feasible Competitive tendering puts contractor under too much pressure/ overestimating own capabilities Lack of checks and balances by commissioning party
External factors	Events could in no way have been foreseen and impossible to take into account because of the unpredictable nature of these events

The acceptance of the line of reasoning based on these rather negatively formulated explanations that imply that cost overruns should be prevented can be seen in the fact that more recent publications like Love (2011), Brunes & Lind (2014) and Love et al. (2014) use these explanations as a basis for their research. Furthermore, all these explanations have in common that they are inclined to prevention of cost overruns and label cost overruns as a solely negative phenomenon that should be prevented. The explanations can be summarized by the four categories Brunes & Lind (2014) use.

1. *Political/strategic manipulation*: this category comprises all explanations related all forms of manipulation, misinformation and lying in order to gain from it politically or economically.
2. *Psychological bias*: this category comprises cost overruns caused by the mechanisms of *planning fallacy* and *cognitive biases*.
3. *Lack of competence*: Although the actors had no specific bias and where not affected by psychological biases, they underestimated the costs or overestimated the benefits as a result of a lack of competence to do so in a correct manner.
4. *Bad luck*: Events occurred that could not have been foreseen in any way.

3 | The plausibility of another explanation

By addressing literature related to changes in projects in relation to project phases, it will be demonstrated that another explanation for cost overruns is plausible, at least in Dutch large road infrastructure projects. In the first section the Dutch context will be introduced and a distinction within the implementation phase will be made. Then literature about the distinguishable parts will be reviewed in order to determine whether they provide ground for reasoning that another explanation might be possible. The last section describes who such an explanation might look like and how its presence in reality can be determined.

3.1 | Introducing the Dutch context

In the Dutch context two phases can be distinguished between the ToD and completion of large a road infrastructure project. This is a result of how these projects are organized. Rijkswaterstaat (RWS) has traditionally been the organization that is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands and is a part of the Dutch Ministry of Infrastructure and the Environment (MI&E) (RWS, 2015). Although RWS is a central actor it does not operate in a social vacuum. Moreover, the operations of RWS are influenced by a number of other actors in the (social) network in which it operates (Geel et al., 2003). MI&E and RWS together produce the Multi-Year Programme for Infrastructure, Spatial Planning and Transport (MIRT). In this programme large water, rail and road projects of national importance are included (Ministry of Infrastructure & Environment, 2014). For this research however only projects concerning road infrastructure are relevant.

Projects in the Netherlands that are included in the MIRT-program are ought to be organized according to a certain structure. In general this means that a project will run through three phases and that four key decision moments can be identified (Ministerie van Verkeer en Waterstaat 2004; Ministry of Environment and Infrastructure, 2011). *Figure 3* gives a schematic overview of the different phases and key decision moments of a typical large road infrastructure project in the Netherlands. The red rectangle marks the period between the (r)ToD and completion of the project also referred to as the implementation phase. After decision moment *D3* construction starts. This can be seen as the division between the two phases. The pre-construction phase can be described as the time between the ToD and the start of construction. The period between the start of construction phase and commissioning of the infrastructure is called the construction phase (for example: Flyvbjerg; 2004; Cantarelli, 2012; Love, 2013).

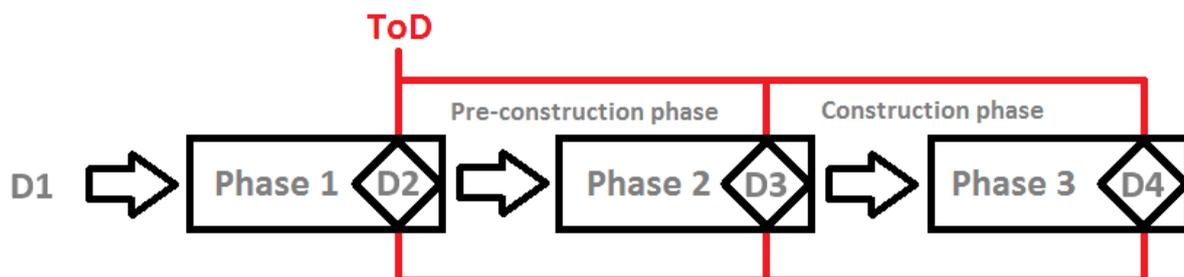


Figure 3: Schematic representation of Dutch planning project (after Ministry of Environment and Infrastructure, 1997; Ministry of Environment and Infrastructure, 2011)

Although *figure 3* is highly simplified it is accurate enough to mark the pre-construction and the construction phase. As the figure shows the exact moment of a key decision is not represented as an exact point marked with a dot but it may differ where exactly this moment lays within a phase. Decision D1 marks the start of the exploration phase (phase 1) of the project. In this phase the problem, chances and the process are explored and a problem definition will be formulated. Near the end of this phase key decision 2 (D2, preference decision) will be taken. At this moment the

parties commit to the preferred alternative chosen over the other alternatives explored in phase 1. The preferred alternative includes scope and budget agreements. Phase 2 is called the plan development phase ending with a project decision (D3). All legal procedures have to be done for this decision to be taken. After this decision construction can start depending on the manner of tendering. In the final phase (Realization phase) the last key decision is made: the completion decision. Ex post evaluation of the project is what remains (Ministerie van Verkeer en Waterstaat 2004; Ministry of Environment and Infrastructure, 2011). *Table 3* shows how the explanations for cost overruns can be structured according to the main element of change that causes overrun and the face that it occurs in.

Table 3: categorizing explanations for cost per change element and phase

When and in which element do cost overruns occur?	Pre-construction phase	Construction phase
Scope changes		
Changes in laws and regulations		
Errors/Omissions		
External factors		

3.2 | Research that provides ground for other explanations

As *section 2.4* showed, psychological biases an accepted explanation for changes regarding scope that result in cost overrun. Although this seems to be widely accepted, the ‘optimism bias’ might also be affected by the selection of “best projects” (Salling & Leleur, 2015). Moreover, it proves to be hard to actually prove that cost overruns are a result of the bias and several studies found limited or no evidence that benefit-cost ratios affect project selection (Eliasson & Fosgerau, 2013). However, this does not mean that it is proven that the phenomenon does not exist (Eliasson & Fosgerau, 2013; Salling & Leleur, 2015). This explanation might also apply to the construction phase (Brunes & Lind, 2014). In both the preconstruction as the construction phase, additional requirements might cause scope change (Sözüer & Spang, 2014). Love et al. (2013) acknowledge the fact that it is ‘normal’ for a project to have an increase in costs between the ToD and the start of the construction phase. A contingency of 35 to 60% should be taken in to account. This rather broad range might be explained by that increasing complexity of projects make it harder to be accurate, especially estimations further into the future (Vickerman, 2007) Additional requirements might be demanded by a higher authority, a change in the political situation, public participation or might even be the result of a civil initiative. It are these additional requirements in both phases and the rather broad contingency combined with the ‘integration of infrastructure planning and spatial planning’ that is observed in Dutch practice (Struiksmas & Tillema, 2009) that can serve as a basis for another explanation.

In the Netherlands it is considered a task of the government to guarantee safety in road infrastructure through laws, norms and regulations (Wynia, 2006). Changes in laws and regulations can be seen as an investment in quality (Teulings et al., 2003). In some cases changes in laws or regulations can and should be foreseen. If in these cases this has not been done, this points in the direction of the in *chapter 2* mentioned explanations that refer to deliberate misinterpretation or a lack of competence. Though in pre-construction phase it is might not always be fully clear which regulations will apply to the project because of the fact that the scope is not fully clear yet as the above mentioned contingency pointed out. Moreover laws and regulations can change due to lawsuits or other unforeseen events that ask for immediate changes in laws such as accidents and the result of the investigation for the cause. Furthermore, shifts in the political landscape can cause

change that effects project as well (Hsieh et al., 2004). *Table 4* gives an overview of the explanations for cost overruns mentioned in *chapter 2* as well as the possible explanations from this chapter. Changes in a project regarding errors and omissions and external factors do not provide ground for explanations other than earlier mentioned. The only change is that the explanations have been adapted to the phase in which they occur and consequently, to the party that is responsible for it in that phase.

Table 4: explanations of how changes in the different elements and phases can contribute to cost overruns

<i>When and in which element do cost overruns occur?</i>	Pre-construction phase	Construction phase
Scope changes	Strategic misinterpretation of information Optimism bias Additional requirements demanded Integration of infrastructure and spatial planning	Strategic misinterpretation of information Optimism bias Additional requirements demanded
Changes in laws and regulations	Deliberate misinterpretation Lack of competence/resources Investment in standards/quality	Deliberate misinterpretation Lack of competence/resources Investment in standards/quality
Errors/Omissions	Lack of competence/resources within the commissioning organization Strategically overlooking matters in order to make project more feasible	Lack of competence/ resources within the contractor organization Competitive tendering puts contractor under too much pressure/ overestimating own capabilities Lack of checks and balances by commissioning party
External factors	Events could in no way have been foreseen and impossible to take into account because of the unpredictable nature of these events	Events could in no way have been foreseen and impossible to take into account because of the unpredictable nature of these events

3.3| An investment in quality

The previous section makes clear that changes that occur related to scope and to laws and regulations could also be explained by other than the explanations found in contemporary literature. Thus, when an explanation for a change regarding these elements of a project that contributes to cost does not fit any of the explanations, another explanations must be true. The four explanations mentioned at the end of *section 2* can serve as a check since these four categories summarize all explanation well. .

It is recognized that how a project influences the quality of life is a highly complex issue (Massam, 2002). However because including such a complex subject is beyond the scope of this research, the choice has been made to assess quality more simplified. *Figure 4* shows the network in which RWS operates and how the operations of RWS can be influenced by the actors in this network. The arrows represent manners in which citizens can influence decisions. This can be through direct participation in projects (Arnstein, 1969) as well as through the mechanisms related to the chosen representatives.

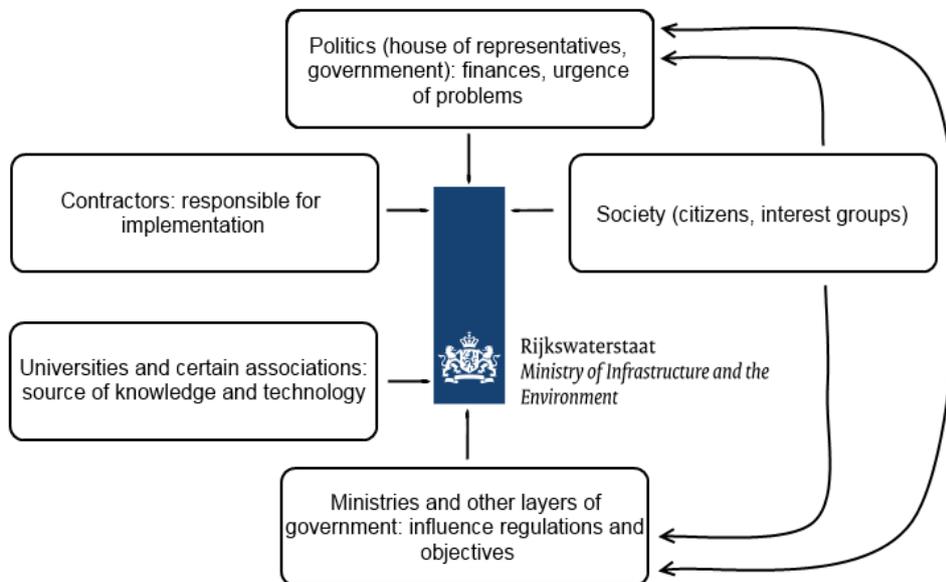


Figure 4: the network in which RWS operates and the mechanisms able to influence project decisions (after Geel et al., 2003)

In spite of observed societal changes, the emergence of a network society and the tension between these fields, the Dutch manner of governing and the decisions that come from this are considered to be legitimate (Hendriks, 2002; Doesburg, 2011). Since people are able to express their preferences through their chosen representatives in a legitimate democracy it is argued that when at least two levels of government agree on an investment (one that legitimately imposes it, the lowest level of government safeguards local interests) and there is little or no controversy around the investment, it can be seen as a legitimate investment. This only flies when the in *chapter 2* mentioned explanations do not apply. Finally, in order to determine that the investment is overall beneficial, the cost-benefit ratio should be positive. The CBA is most common manner to assess the quantifiable aspects of the investments in terms of social, environmental and economic effects (Bristow & Nellthorp, 2000) and recognized as a valuable tool (Jones et al., 2014).

The 'investment in quality' could also be a logical consequence of a mismatch between the simplification of reality in project-based working and the complex reality, albeit through the same mechanisms. This might be a logical consequence of the earlier mentioned 'integration of infrastructure planning and spatial planning' or moving away from 'line-oriented planning' of infrastructure to 'area-oriented' planning of infrastructure that is observed in the Dutch practice (Struiksma & Tillema, 2009). Moreover, Struiksma & Tillema (2009) argue that infrastructure planning and spatial planning do not solely seem to close in on each other, they are getting more and more entangled over time. And that the MIRT, of which the exact translation is Multi-Year Programme for Infrastructure, Spatial Planning and Transport, is an example of this because it has evolved to a programme that combines infrastructure planning with spatial planning. The recommendations of the Elverding committee (2008) are in line with this: promoting a broad reconnaissance phase in which the scope of the project has to become clear in order to realise the objective for the region rather than merely the predefined goals. It seems that the budget increase that can be a logical consequence of this policy. It could even cause budget decrease in other or future projects because

goals that would have to be realized in those projects get realized more efficiently by recognizing early on that these goals can be easily realized with a scope increase.

In summary the proposed extra explanation for cost overruns could be the result of two phenomena that are both related to an investment in quality. The first should be explained as an investment that comes forward through additional requirements that are made as a result of a legitimate decision that overall is not disadvantageous or through laws or regulations that safeguard the quality or safety for its citizens. The second as a result of the fact that projects try to put rather rigid boundaries in a complex reality. Because of this it might in some cases in the early phases of a project occur that changes regarding scope that are beneficial to the project are made that could not have been known beforehand. In any case, when one of the four at the end of *section 2.4* mentioned fit as an explanation for the change, it cannot be seen as an investment in quality as explained in this section.

4 | Case selection & data collection

This first section of this chapter will describe the necessary steps that have to be taken in order to select valid cases according to standards in contemporary literature. It will be explained how the data was processed and which cases were selected. Finally, the qualitative aspects research regarding the research of the cases are discussed.

4.1 | Case selection

The selection of the cases and the manner in which overruns are determined are in line with Cantarelli (2011) who has recently published fairly large number of articles on cost overruns in the Netherlands and is in line with the most prominent publications on cost overruns. Projects that could apply for selection had to fit the following criteria based on Cantarelli's (2011) research:

1. *Costs*: the costs of the project at completion are larger than 20 million Euros (2010 prices) and is a project that is likely to attract public or political attention because of considerable direct and indirect on community, environment and/or budgets.
2. *Time*: The project has to be completed within the range of 2010-2015
3. *Project type*: This research focusses solely on road infrastructure projects as they are described in the previous chapter
4. *Data availability*: Data on both the cost at the ToD and in the year of completion should be available.

Furthermore, if the project is not the same project upon the moment of completion as it was on the ToD, the project is excluded. The two projects with the biggest percentage of overrun to which these criteria apply to will be selected as cases for this research. *Table 5* shows the list of projects that fit these four criteria, the year of completion and the cost at the year of completion.

Table 5: Projects that fit the criteria and might apply for project selection, the year of completion and costs in the year of completion.

Project	Year of completion	Costs in year of completion (2010 prices)
A4 Burgerveen - Leiden	2015	557,65 mln
A10 Tweede Coentunnel/A5Westrandweg/N200 Halfweg	2014	1969,29 mln
A2 Holendrecht-Oudenrijn	2013	1069,2 mln
A2 Maasbracht-Geleen	2013	149,81 mln
A28 Utrecht-Amersfoort	2013	170,32 mln
N50 Ramspol-Ens	2013	119,49 mln
A2 Oudenrijn-Everdingen	2012	92,18 mln
A9 Alkmaar-Uitgeest	2012	47,43 mln
A12 Zoetermeer-Zoetermeer Centrum	2012	21,48 mln
N9 Koedijk-De Stolpen	2012	59,07 mln
N57 Veersedam-Middelburg	2011	178,7 mln
A2 Rondweg Den Bosch	2010	238 mln
A2 Tangenten Eindhoven	2010	566 mln
A7 Rondweg Sneek	2010	64 mln
A12 Utrecht-West, benutting	2010	46 mln

In order to determine the percentage of overrun the following steps have to be taken, these steps were confirmed to be the appropriate steps to take in interviews and are based on the steps Cantarelli (2011) takes in her research on Dutch infrastructure projects. These are the following steps:

1. *Determine total budget for each MIRT year:* Derive the total costs of the project for each year from the realization tables of the MIRT reports.

2. *Remove the BLD-contribution (contribution for granted services for a project):* in the period of 2006-2011 the BLD-contribution was included in the budget. Since this was a temporary custom and it is based on effort (expressed in financial terms) that the organization has make anyway, the BLD-contribution will be excluded as well.

3. *Correct values for inflation:* In order to determine which projects have the most overrun and in order to compare them in terms of percentages the costs have to be expressed at the same price level. The MIRT reports use the price level of the year before publication and thus have to be indexed. The GWW index from the Netherlands National Accounts is used. This is an index for “ground, water and road construction”. Furthermore the choice has been made to use the ‘closed’ surface index for roadworks. This because this index is concerned with asphalt roads.

4. *Exclude VAT in values:* in cost overrun research project costs are typically presented without VAT. In the MIRT reports VAT is included. For costs presented within the range of 2001-2012 a VAT-tariff of 19% applies and for 2013-2015 a VAT-tariff of 21% applies.

5. *Determine formal decision to build:* for all projects the ToD is indicated. For the project selection the definition of the ToD used by Cantarelli (2011) is used as well. In the cases the moment that is closest to the real decision to build as it is mentioned in chapter two will be identified and used in order to gain insight in the ‘real’ cost overrun.

6. *Determine the cost overrun:* the cost overruns can be calculated with the following formula:

$$\frac{(\text{actual costs}) - (\text{estimated costs at ToD})}{(\text{estimated costs at ToD})} \times 100 \%$$

This will result in the percentage that the project is over budget compared to the budget at the time of the decision to build. This results in the values presented in *table 6*.

Table 6: Project data after taking all steps necessary to determine cost overrun

Project	Year of completion	Costs in year of completion (2010 prices)	Year of ToD	Costs in year of ToD (2010 prices)	% overrun
A4 Burgerveen – Leiden	2015	460,16 mln	2007	492,56 mln	-6,58%
A10 Tweede Coentunnel/A5Westrandweg/N200 Halfweg	2014	1731,3 mln	2002	968,92 mln	78,68%
A2 Holendrecht-Oudenrijn	2013	963,21 mln	2006	942,4 mln	2,21%
A2 Maasbracht-Geleen	2013	134,96 mln	2011	136,97 mln	-1,47%
A28 Utrecht-Amersfoort	2013	153,45 mln	2010	153,45 mln	0
N50 Ramspol-Ens	2013	107,65 mln	2009	79,22 mln	35,89%
A2 Oudenrijn-Everdingen	2012	84,62 mln	2009	132,91 mln	-36,33%
A9 Alkmaar-Uitgeest	2012	43,55 mln	2012	43,55 mln	0
A12 Zoetermeer-Zoetermeer Centrum	2012	19,72 mln	2012	19,72 mln	0
N9 Koedijk-De Stolpen	2012	54,23 mln	2009	56,34 mln	-3,74%
N57 Veersedam-Middelburg	2011	159,66 mln	2002	140,59 mln	13,57%
A2 Rondweg Den Bosch	2010	204,02 mln	2002	290,39 mln	-29,75%
A2 Tangenten Eindhoven	2010	485,18 mln	2003	526,24 mln	-7,8%
A7 Rondweg Sneek	2010	54,87 mln	2004	68,26 mln	-19,62%
A12 Utrecht-West, benutting	2010	39,43 mln	2006	96,24 mln	-59,03%

When these steps are taken four projects that fit the criteria remain. Only cases with a larger cost overruns than 20% were included. The two largest cases of overrun, in absolute numbers and in percentage have been selected. These cases are 'A10 Tweede Coentunnel/A5 Westrandweg/ N200 Halfweg' and 'N50 Ramspol-Ens'.

4.2 | Data collection

Quantitative and qualitative data have been obtained. Quantitative in order to determine the figure of cost overrun and select the cases, qualitative data regarding the in-depth research of the cases according to the qualitative research approach. Qualitative research is aimed at providing explanations for certain phenomena and conducting naturalistic inquiry in real-world rather than experimental or manipulated settings and answering the 'what is', 'why' and 'how' questions. Furthermore, the method acknowledges the complexity, detail and context of data when building explanations (Ritchie & Lewis, 2003). In this research the story behind the observed overruns is important. As mentioned above, the theoretical analysis argues that a more positive explanation for cost overruns could exist that can be explained only by examining the observed overruns up-close. Only by obtaining the contextual knowledge, focussing on the causes of the overruns and learning about the specific choices made in the particular cases, explanations for cost overruns observed in literature can be confirmed or denied in reality. Since the object, especially in the Dutch context where infrastructure planning and spatial planning got more and more entangled over time (Struiksmā & Tillema, 2009), is closely related impact on social life and is highly influenced by decision based on interactions in this social context, merely a qualitative analysis of this phenomenon is not adequate. However, this does not mean that insights from quantitative research is not useful or untrue. On the contrary, research based quantitative research proves to be a solid base underlying cost overrun research. Teisman et al. (2009) and Flyvbjerg (2006) emphasize on the importance of the case study method assess complex subjects and find explanations through researching a phenomenon in-depth in its context and forming knowledge. *Table 8* summarizes the data collection and methods.

Table 8: types of data used and data sources

Part of research	Type of data required	Method
Theoretical foundation	Literature	Literature review Sciencedirect; Google Scholar; RuG library; Reference list of articles, scanned on all terms related to cost overruns
Case studies	Quantitative data: budgets of projects through time and index-figures Qualitative data: data regarding the decisions behind the budget increase and personal insights on budget increase	Quantitative data: MIRT-reports; documents retrieved from the government trough http://zoek.officielebekendmakingen.nl ; CBS Qualitative data: Interviews; documents retrieved from the government trough http://zoek.officielebekendmakingen.nl ; articles; reports All files that mentioned the cases were downloaded and reviewed.

4.3 | Data sources

In order to gather the data necessary to take all the above mentioned the steps and gather a more in-depth insight to verify if the theory applies to the Dutch context include in-depth interviews, a paired interview, the MIRT data source and official government documents.

Interviews have been conducted with employees of RWS and MI&E to gain insight in the manner of working within the organizations that are concerned with road infrastructure projects (Rijkswaterstaat & the Ministry of Infrastructure & Environment). Furthermore, these interviews were used as orientation for the search process of further data and to use the expert opinions of the interviewees for verification of the methodology and results. The interviews were organized as semi-structured interviews guided by key questions and topics. *Table 7* shows an overview of the interview respondents.

Table 7: interview respondents

Respondent	Organization	Method and date of the interview
RWS employee	Rijkswaterstaat	Semi-structured interview 26/6/2015
Related to project	Rijkswaterstaat	Telephone interview 28/7/2015
Ministry employee	Ministry of Infrastructure & Environment	Semi-structured interview 11/8/2015
Ministry employee	Ministry of Infrastructure & Environment	Semi-structured interview 11/8/2015

5 | Cost overruns in reality: two case studies

In this chapter the two selected cases, 'A10 Tweede Coentunnel/A5 Westrandweg/N200 Halfweg' and 'N50-Ramspol', will be discussed. After a short introduction to the cases, a thorough analysis of the cost overruns and decisions that have led to these overruns will be given. At the end of the chapter the results will be summarized and some general findings will be presented

5.1 | A10 Coentunnel/A5 Westrandweg/N200 Halfweg

At the ToD the problem definition identifies the Coentunnel as a major accessibility bottleneck in the northern part of the Randstad metropolitan area. Furthermore, negative consequences to the quality of living in the area around the A10 highway that runs through the tunnel. Moreover, economic consequences resulting from reduced accessibility of the nearby harbour area and liveability and traffic safety issues in the same area due to a high traffic density are also included in the problem definition. The part of the A10 that the project has been concerned with is the part between junction Coenplein and the N200. Besides the A10, the A8 is an important feeding and discharge road for the tunnel, the part between junction Coenplein and junction Zaandam was also included in the project. The newly constructed part of the A5 Westrandweg runs between the southern exit of the Coentunnels and junction Raasdorp. The N200 runs between the A10 and the connection with the A200 at the village Halfweg. *Figure 5* shows where the project is located in the region as well as the country (MIRT reports, 2007-2014)



Figure 5: location project A10 Tweede Coentunnel/A5 Westrandweg/N200 Halfweg

As soon as in the year 1991 the necessity of an increase of capacity in the region was recognized. It was that year that the current track of the A5 Westrandweg was already recognized as the best solution. Building never started because procedures related to capacity increase of the Coentunnel were not finished. After that the project was cancelled because of lack of money (Tweede Kamer, 2002; RWS, 2005). When in 2000 because of the Randstad Accessibility Offensive budget was made available, the plans that were cancelled earlier were put back on the agenda. The region unanimously decided to work on the traffic problems from the perspective of an ecological friendly alternative as possible. The available budget, recognition of the problems and the consensus on solving this as ecological friendly as possible lead to the decision to build (Tweede Kamer, 2002).

5.1.1 | ToD, rToD and cost escalation over time

In the methodology the year 2007 was identified to be the ToD. Though it can easily be argued that at least in 2006 the real decision to build was taken. Even 2004 might be considered as rToD since in this year an agreement was signed about the financing and scope of the project and as mentioned before the track decisions were already earlier. Despite these facts 2006 is chosen since 2004 would

coincide with the starting decision. A two year period has been taken for the exploration phase. This is because the guidelines from that time say a year would be preferred (Ministerie V&W, 2004). For a project with such a long history of and proof of dedication of all parties to the project two year after the start decision seems to be a more than fair estimation.

At the rToD the measures consisted of expanding the capacity of the Coentunnel so that five driving lanes are available in the direction of the rush hour, adding one extra line to the feeding and discharge roads (A10 and A8) of the tunnel so that they connect with 5 lanes to the tunnel and the A5 Westrandweg would be built with 2x2 lanes. This then would also add to the accessibility of the Amsterdam harbour area and relieve the N200 through Halfweg. Several additional measures on this road would be taken as well in order to improve the landscape quality of the area and traffic safety (MIRT-report, 2006). At this point the budget of the project was 1196 million euros (2006 prices; 1170,1 in 2010 prices). At completion the project budget had risen to 2196 million euros (2014 prices; 1585,93 2010 prices). *Figure 6 and 7 show the cost overrun through time. The first not indexed and with BLD-contribution and VAT included which shows a rather disturbing first impression. The latter with the values properly handled so that the values correspond with the overrun as presented in table 5.*

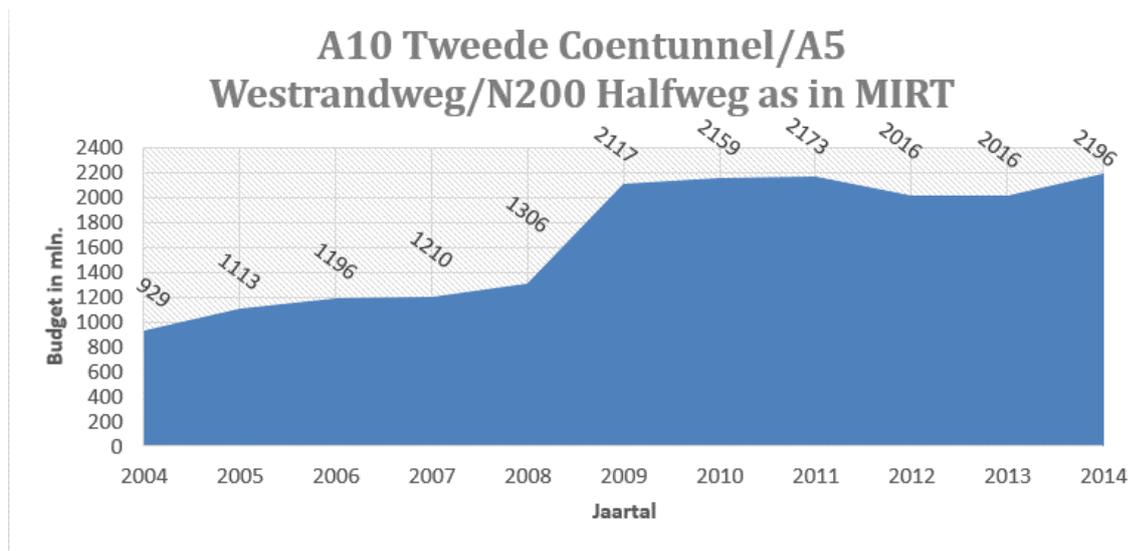


Figure 6: Costs over time as in MIRT A10 Tweede Coentunnel/ A5 Westrandweg/ N200 Halfweg

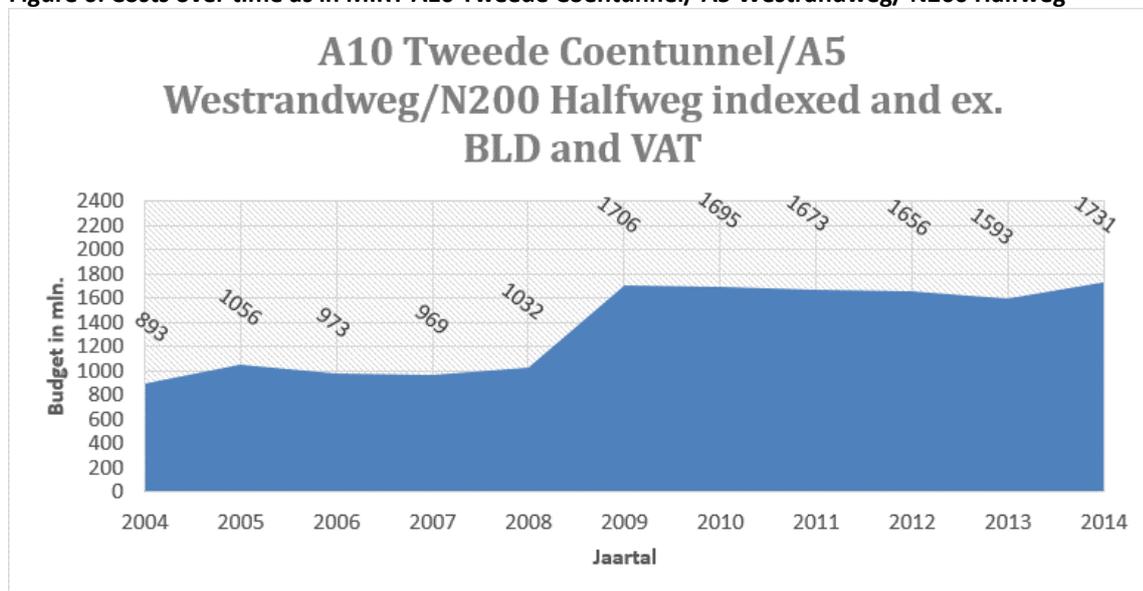


Figure 7: Costs over time indexed and ex BLD and VAT A10 Tweede Coentunnel/ A5 Westrandweg/ N200 Halfweg

Although *figure 7* shows a more nuanced image than *figure 6*, it still accounts for a cost overrun of 63%. The difference between the figures illustrates the necessity to examine cost overruns more closely because it is easy to get carried away with big numbers without considering changes in resource prices, inflation and more importantly the reason why certain budget increases were applied.

5.1.2 | Crucial moments regarding budget increase

Figure 7 is used to identify crucial moments in decision making regarding budget increase. Between the rToD and the completion of the project four of these moments can be identified: Between 2007-2008, 2008-2009, 2009-2010 and 2013-2014. These moments will be examined more closely. Because the budget increases are mentioned in the price of the year in which they are implemented, when a value is mentioned it refers to *figure 6*.

2007-2008: (1) Extra measures regarding air quality were needed. Approximately 80 mln was added to the budget for air installations and sound- and air screens at the side of the road (Tweede Kamer, 2007d; 2007e; Ministerie V&W, 2008; RWS employee, personal communication, 2015)

2008-2009: (2) 718 mln has been added because of a DBFM (design, build, finance and maintenance)-contract. (Tweede Kamer, 2007e; 2008b; 2008c; 2009c; RWS employee, personal communication, July 28 2015)

2013-2014: (3) Budget was added to cover risks until 2037, (4) additional costs for changes in road design and water drainage and (5) exogenous factors like compensation for a VAT change (RWS employee, personal communication, 2015). Furthermore, (6) 150 mln euros was divided among three tunnels that were constructed in this time period in order to improve tunnel safety. Since the Coentunnels are a part of this project, budget was also added to this project. (Tweede Kamer, 2009; 2011; MIRT-report, 2014; RWS employee, personal communication, July 28 2015). *Figure 8* illustrates how the phases described in *chapter 3* relate to the project budget. Moreover, it shows how the changes that contributed to the total cost overruns relate to both.

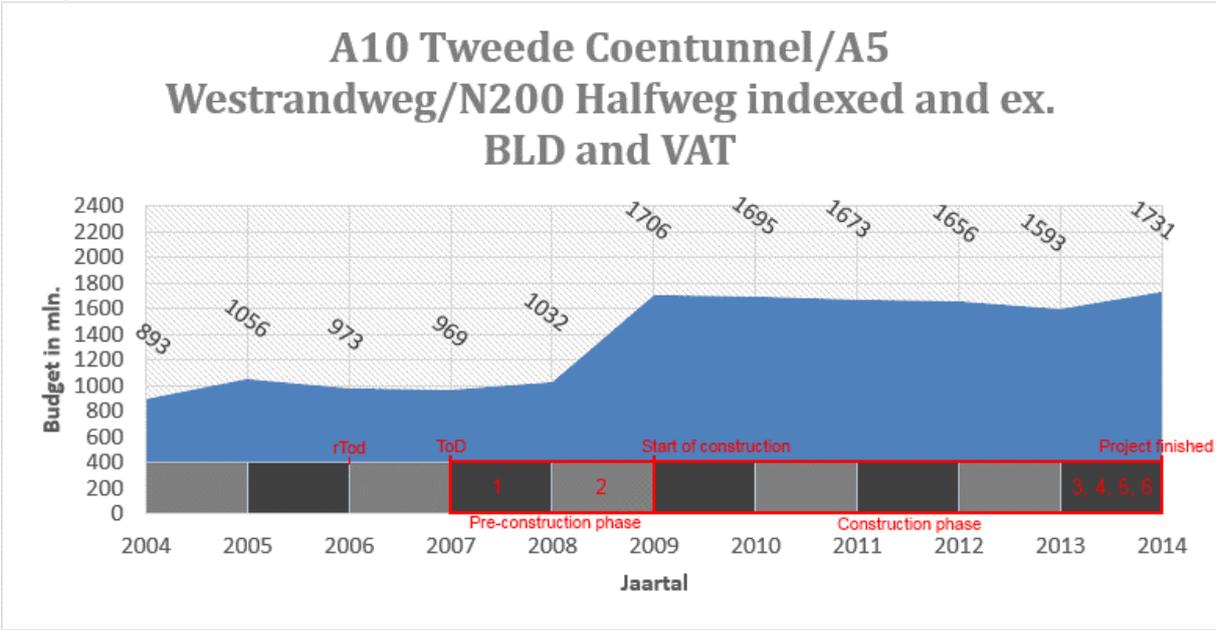


Figure 8: overview of the project costs, phases and changes A10 Tweede Coentunnel/ A5 Westrandweg/ N200 Halfweg

5.1.3 | Examining the changes up-close

(1) Changes regarding air quality and noise

What: Extra noise barriers and extra air pollution barriers were implemented. Also exhaust systems at the tunnel openings were added to the project (Ministerie Verkeer en Waterstaat, 2007; Ministerie Verkeer en Waterstaat, 2008; RWS employee, personal communication, 2015).

Identified reasons: Quality norms were not met (Ministerie Verkeer en Waterstaat, 2007)

Other relevant events: The track decision for A4 Burgeveen-Leiden had been nullified. Because of this a new method for meeting air quality standards had to be used (Ministerie Verkeer en Waterstaat, 2007; MIRT report, 2015).

(2) Changes regarding a DBFM- contract

What: a DBFM-contract with the Coentunnel Company resulted the largest increase in budget (Tweede Kamer, 2008; RWS employee, personal communication, 2015)

Identified reasons: the budget increase is the result of another transferring from another fund. It overall is a budget neutral operation. Normally these costs would not be included in the budget but because these costs are typically accounted for after a project has been completed from another budget (Tweede Kamer, 2008; 2009; RWS employee, personal communication, 2015)

Other relevant events: -

(3) Changes regarding risk coverage until 2037

What: budget was added to cover risk until 2037 (RWS employee, personal communication, 2015)

Identified reasons: related to the DBFM-contract (RWS employee, personal communication, 2015)

Other relevant events: -

(4) Changes road design and water drainage

What: Designs were adapted resulting in an increase of budget (RWS employee, personal communication, 2015)

Identified reasons: no further documentation on these changes could be obtained.

Other relevant events: -

(5) Changes regarding project exogenous factors

What: vaguely described changes that relate to project. It includes the adaptation of a traffic monitoring center (RWS employee, personal communication, 2015).

Identified reasons: no further documentation on these changes could be obtained.

Other relevant events:-

(6) Changes regarding improvement of tunnel safety

What: an improvement in tunnel safety measures had to be made resulting in extra budget being added (Tweede Kamer, 2011; RWS employee, personal communication, 2015).

Identified reasons: regulations regarding tunnel safety changed during the implementation phase of the project (Ministerie van Verkeer en waterstaat & RWS, 2010; Tweede Kamer, 2011)

Other relevant events: in 2010 the minister of infrastructure and environment launched the 'action plan road tunnels' in order to standardize tunnel safety norms, guarantee safety and speed up processes related to construction in these tunnels (Tweede Kamer, 2010c).

5.2 | N50 Ramspol - Ens

At the ToD the problem definition states that the core of the problem is that the Ramspol bridge is in a bad technical condition and that the part of the N50 motorway between Ramspol and Ens is significantly more dangerous than surrounding roads. The N50 motorway is the part between the city Emmeloord and junction Hattermerbroek of the national road 50 between the cities Emmeloord and Eindhoven and is also referred to as the connection road between the A28 highway, A50 highway and Emmeloord (RWS, 2009). *Figure 9* shows the area of that is concerned with this project as well as where it is located within country (MIRT-report, 2013)

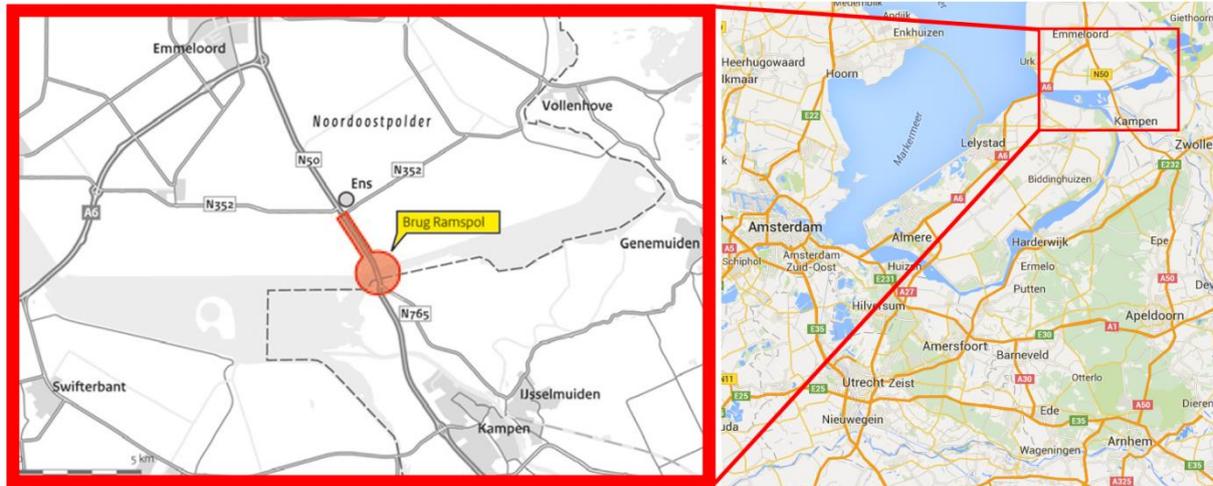


Figure 9: Location in the Netherlands and project area of project N50 Ramspol - Ens

Because this is the only part of the road that has not been upgraded yet, this part was considered as a 'weak link'. Moreover, traffic safety was compromised because of the physical state of the state of the road and bridge in terms of the number of lanes, the narrow bridge and road design. Besides that the technical state of the bridge was poor and the flow of traffic has been problematic. It was expected that in 2020 more cars will use the N50 than before. Reasons for this would include demographic and economic developments and the opening of the N50 around the city of Kampen. Without adaptations traffic problems would increase even more. More frequent openings of the bridge would also contribute to this. Ship traffic from and to the port of Meppel through the Ramsdiep had been increasing and for 3-layered container shipment a bridge with at least 7 meters passage height would be needed. The height of the old bridge was 5,6 meter. The route has also for a long time been a part of a frequently used sailing yacht route. The combination of the increase of both road and water traffic in combination with the poor conditions of the road and bridge and physical conditions of this part of road and bridge lead to the decision to build (MIRT-reports, 2001-2013; RWS, 2009).

5.2.1 | ToD, rToD and cost escalation over time

In the methodology the year 2009 was identified to be the ToD. Though it can easily be argued that at least in 2006 the real decision to build was taken. As early as 2005 it was reported that after an administrative consultation considering road infrastructure it was decided upon to "realize a future proof design" (Tweede Kamer 2005, p.30). Another illustrative example is that whenever the bridge part of the project is mentioned in all documents in 2006 it is not discussed whether the bridge should be build but merely if it should be 7 or 13 meters high (Tweede Kamer, 2006a; 2006b; 2006c; 2006d).

At the rToD the measures consist of a 2x1 road and a 7 meters high bridge (RWS, 2004; Tweede Kamer 2007e). At this point the budget of the project was 79 mln euros (2006 prices; 45,9 mln in 2010 prices). At completion the project in 2013 budget had risen to 134 mln euros (2013 prices, 98,7 mln in 2010 prices). *Figure 10* and *11* show the cost overrun through time. The first not indexed and with BLD-contribution and VAT included which shows a rather disturbing first impression. The latter

with the values properly handled so that the values correspond with the overrun as presented in *table 5*.

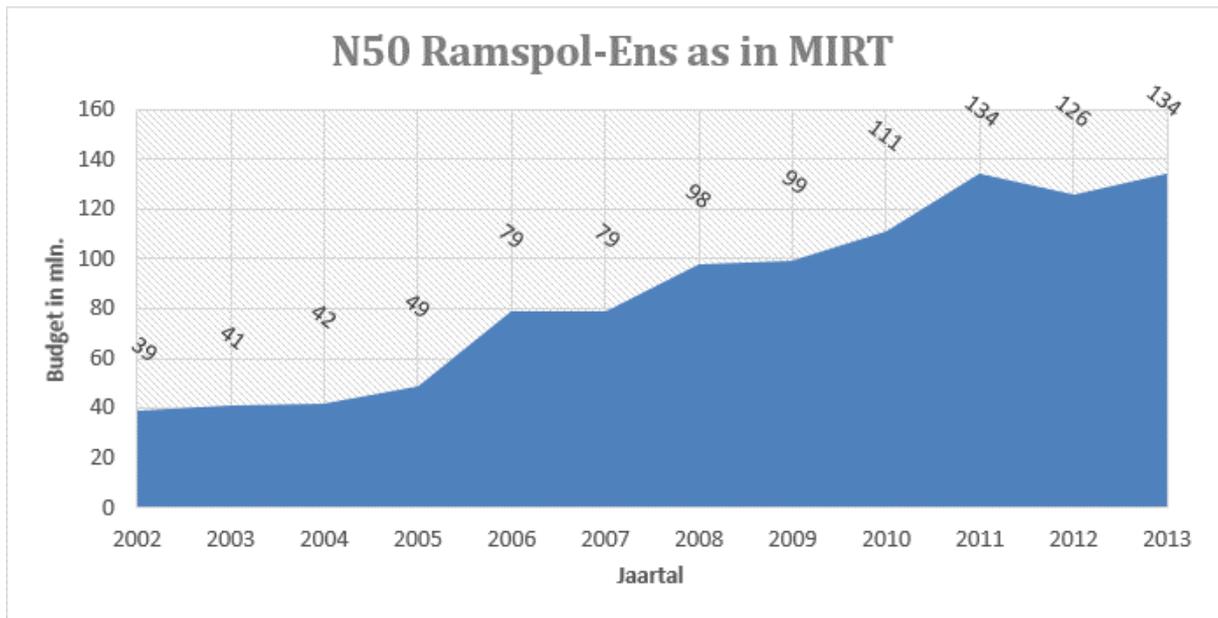


Figure 10: costs over time as in MIRT N50 Ramspol - Ens

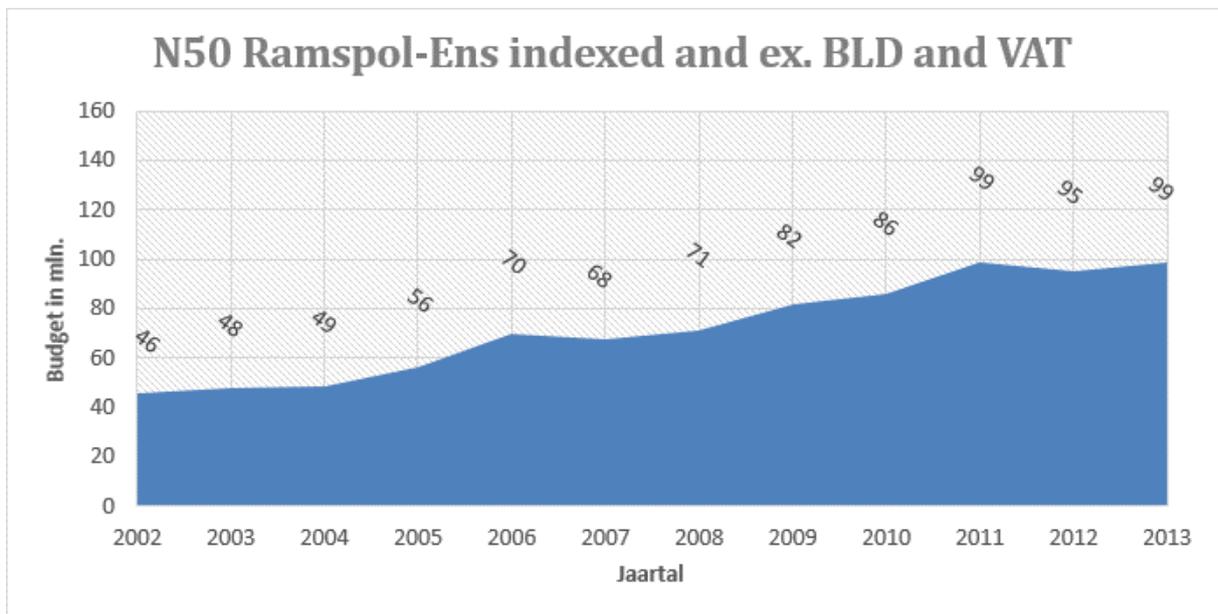


Figure 11: Costs over time indexed and ex BLD and VAT N50 Ramspol - Ens

Again the second figure shows a more nuanced image than first, but here also it still accounts for a cost overrun: 20,41% in this case. Thus it also contribute to the point made in the first case about the necessity to examine cost overruns more closely.

5.2.2 | Crucial moments regarding budget increase

Figure 11 can now be used to identify crucial moments in decision making regarding budget increase. Between the rToD and the completion of the project five of these moments can be identified: between 2007 and 2013, with the exception of 2011-2012, every year has increase in budget. These moments will be examined more closely. Because the budget increases are mentioned in the price of the year in which they are implemented, when a value is mentioned it refers to *figure 10*. The values will only be used to estimate the share in the total overrun.

2007-2008: (1) extra budget for the complete N50 motorway is realized. The project concerns a part of this motorway and the budget is increased. Approximately 18 mln is added to the budget (Tweede Kamer, 2006d; 2007b).

2008-2009: (2) the scope of the project is increased regarding the bridge. Approximately 8 mln is added to the budget (MIRT-report, 2009; Tweede Kamer, 2008d).

2009-2010: (3) the budget rises 12 mln and a shortage of 16 mln is mentioned (Tweede Kamer, 2009a).

2010-2011: (4) Adjustments to the plan are made so that the waterway can still be used during construction, (5) a bonus/malus agreement between the commissioning party and contractor and (6) the contractor made claims. For all of these budget was added (Tweede Kamer 2010a; 2010b; 2012a; 2012b)

2012-2013: (7) After project is finished 2,1 million will not be collected anymore. The budget rises back to the level of the year before (Tweede Kamer, 2013). *Figure 12* illustrates how the phases described in *chapter 3* relate to the project budget. Moreover, it shows how the changes that contributed to the total cost overruns relate to both.

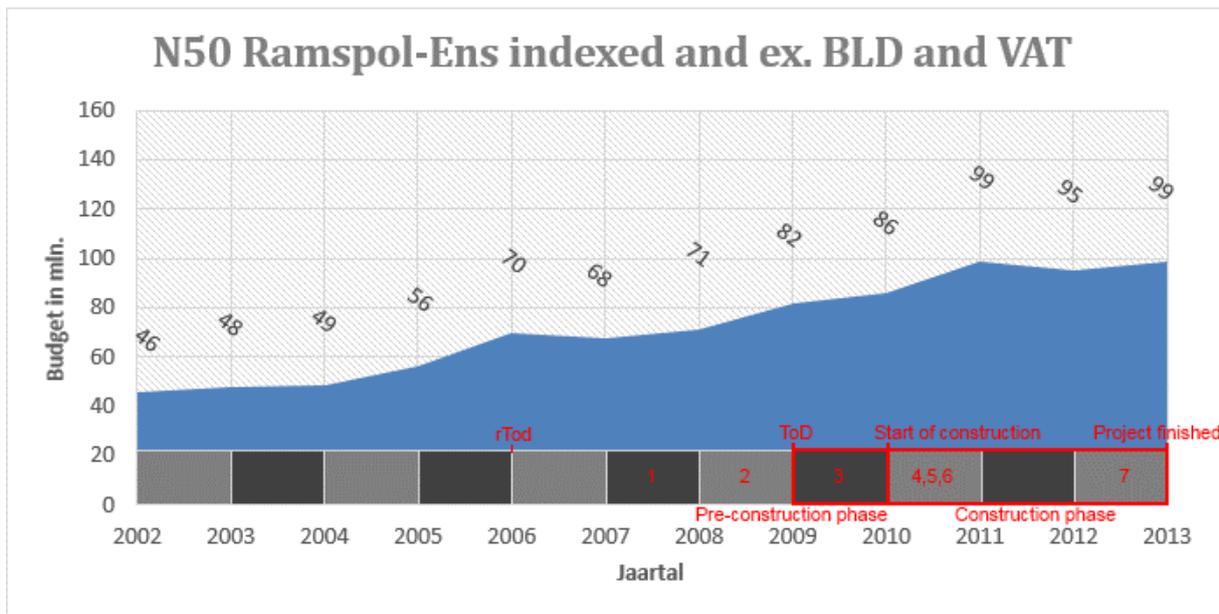


Figure 12: overview of the project costs, phases and changes N50 Ramspol - Ens

5.2.3 | Examining the changes up close

(1) Changes regarding extra budget for the complete N50 motorway

What: 18 mln euro has been added to the budget (Tweede Kamer 2007b; MIRT-report, 2008). Extra budget for the complete N50 motorway of which a part can be used for this project for investments in quality (Tweede Kamer, 2006d; 2007b).

Identified reasons: The Amendment Hijum/Hofstra passed in the Dutch Parliament. (Tweede Kamer 2006d; 2007b; MIRT-report, 2008)

Other relevant events: -

(2) Changes in the scope of the project regarding bridge height and number of driving lanes

What: The scope for the bridge is upgraded from 2x1 driving lanes and a 7 meter passing height to 2x2 driving lanes and 13m passing height (MIRT-report, 2009)

Identified reasons: Because of the fact that the Zuiderzee railway got cancelled, this money was made available for the regions. The region decided to use 26 mln for this project and moving the 18 mln to other projects resulting in the adding of 8 mln (MIRT-report, 2009; Tweede Kamer, 2008d). The extra budget will be used to change the scope to 2x2 driving lanes and a 13 meter high bridge as a result of an “societal discussion” (Tweede Kamer 2007a, p. 2). This discussion took place over a long period of time and resulted in the conclusion that the initial 2x1 driving lanes and 7 meters high bridge was deemed not sufficient and that now that the money was available societal benefits could be achieved (Tweede Kamer, 2006a; 2006b; 2006c; 2007a ;2007c; 2007e; 2008d).

Other relevant events: -

(3) The budget increased and a shortage of 16 mln

What: A blow-up weir and an oval roundabout have been added to the scope. A better estimation was made of the risk and real estate costs proved to be higher than accounted for (Tweede Kamer, 2009b)

Identified reasons: The scope increased after public participation at one of the participation moments (Tweede Kamer, 2009b). No further documentation on the other changes could be obtained.

Other relevant events: -

(4) Request to make plans suitable for ships to continue using the waterway

What: The plans had to be adjusted so that two yacht builders in the region would be able to continue their operations (Tweede Kamer 2010a; 2010b).

Identified reasons: Extra budget was added after a request in the House of Representatives although the yacht builders had not used their right of participation during the one of the participation moments (Tweede Kamer 2010a; 2010b).

Other relevant events: -

(5) Bonus/malus agreement

What: extra budget was because the bonus malus agreement was in favor of the contractor (Tweede Kamer, 2012a)

Identified reasons: no further documentation on these changes could be obtained.

Other relevant events: -

(6) Claims of contractor

What: the constructor claims extra money for adaptations (Tweede Kamer, 2012a; 2012b).

Identified reasons: adaptations had to be made due to a part of insufficient worked out design by Rijkswaterstaat (Tweede Kamer, 2012a; 2012b).

Other relevant events: -

(7) 2,1 mln will not be collected anymore

What: although the mentioned sum were scheduled merits, they will not be collected anymore. (Tweede Kamer, 2013).

Identified reasons: no further documentation on these changes could be obtained.

Other relevant events: -

5.3 | General findings for both cases

In the interviews with employees of RWS as well as of the Ministry of Infrastructure & Environment several useful findings about this sort of projects in general and thus also these cases were also done. All interviewees agreed upon the fact that the decision B2 and in some cases the track decision the scope should be set and changes should not be able anymore (RWS employee, personal communication, 2015; Ministry of Infrastructure & Environment employees, personal communication; 2015). Though, in some cases progressive insight gained from contextual knowledge and opportunities such as budget that was not available before could result in situations where chances should be seized. In a worst case scenario ignoring progressive insight might even result in the nullification of a track decision which on its turn can result in even more cost overruns than the initial investment (Ministry of Infrastructure & Environment employees, personal communication; 2015). Interviewees stressed that this does not mean that any 'investment' should be granted, on the contrary all stressed the importance of sticking to your plan. The interviewees see the report of the committee Elverding (2008) more as a message to politicians that should stick to their plans when they decide upon them (RWS employee, personal communication, 2015; Ministry of Infrastructure & Environment employees, personal communication; 2015)

6 | Interpretation of the results

Chapter 3 demonstrated that only changes regarding scope and law change provided ground for another, more positive explanation for cost overruns. Consequently, only the changes that relate to these categories have to be taken into account when discussing the possibility of a more positively charged explanation. The changes that do not relate to scope change or changes in laws or regulations are disregarded. Although it could be useful for other purposes, it is beyond the scope of this research to further examine these changes within the projects that contributed to the total cost overrun.

In the case of *A10 Tweede Coentunnel/ A5 Westrandweg/ N200 Halfweg* change 2,3,4 and 5 will be disregarded. Changes two and three because they simply should not be seen as a cost overrun. As pointed out above they are merely concerned with another manner of financing concerning a cost neutral transfer of funds. Although, they could still contribute to cost overruns over time they do not provide ground for reasoning they should be considered as another explanation for cost overruns. The fourth and fifth change strongly point to the error and omission category and/or externalities that influenced the project. Especially, since proved to be hard to get any documentation on these changes. It is not argued here that these changes were the result of mistakes or deception. They simply do not seem to be suitable for the goal of this research and are therefore not further examined. This leaves two possibilities for another explanation in the first case.

In the pre-construction phase extra measures had to be taken regarding air and noise pollution because norms were not met (Ministerie Verkeer en Waterstaat, 2007; Ministerie Verkeer en Waterstaat, 2008; RWS employee, personal communication, 2015). The MIRT-report (2009) makes an explicit connection to the nullification of the track decision for the project A4 Burgerveen – Leiden. The lawsuit that caused the nullification could be seen as a direct form of demanding more quality where it was apparently also possible to build with lower standards. This has had implications for this project: an investment in air quality and against noise pollution that else way probably would not have been done. In terms of being an investment in quality in terms of a more positively charged explanation for cost overruns it can be argued that this investment is not the result of *political/strategic* deception or manipulation since the events that caused the need for reexamining the norms was of an unpredictable nature. This can also be seen as an argument for disregarding the *psychological biases and lack of competence*. The latter is backed by the fact that the norms were sufficient before. *Bad luck* would only fly from a perspective of somebody that would want to construct a highway at any cost. Furthermore, the fact that the regulations had to be changed serves as both an argument for the legitimacy, since it could be seen as one of the mechanism that stakeholders can demand an investment. Also, the fact that a judge ruled in favor of the nullification and the fact that different norms were introduced could serve as an argument that the quantifiable effects are positive regarding to the new norm. In the construction phase tunnel safety became an issue because the current norms left room for interpretation. For this change the same arguments fly regarding *political/strategic deception or manipulation* and *psychological biases* as above mentioned. The fact that this change in norms occurred during the construction phase provides extra reason to examine if lack of competence might be the cause of the fact that it caused overruns. However, this norm change is also the result of an event of unpredictable nature. The ‘quick scan tunnel projects’ resulted in the need for new norms (Ministerie Verkeer en Waterstaat & RWS, 2010). The legitimacy and quantifiable effects seem to be safeguarded by this report and the fact that after this report the measures were implemented in several tunnels in throughout the Netherlands.

In the case of *N50 Ramspol - Ens* only changes 1, 2 and a part of the third provide ground for a positive explanation. A ‘better’ estimation of risk puts leaves little room for doubt that it should be categorized in the *error/omissions* category, as well as the 2.1 mln euros that would not be collected anymore. The higher real estate costs could be a result of external factors as well as the result of lack of competence and also point to the *error/omissions* category, the claims by the contractor were shown to be the result of mistakes and the adaptations regarding yacht builders also point to

errors/omissions as well and might even be the result of *deception or manipulation*. This leaves the bonus/malus agreement. Although such an agreement could save costs, the bonus budget should be included and not contribute to overrun in order to provide ground for reasoning that it could be explained more positively. This leaves three changes that could possibly be explained more positively.

All three changes occurred in the pre-construction phase (if the rToD is taken as starting point of the project) and have in common that they are the result of additional requirements regarding scope through several mechanisms. The first as the result of an amendment made by the House of Representatives. The second that builds on this amendment, the result of a long discussion between the central government and the region that ended in the scope upgrade when funds were available to the region as a result of the cancellation of the 'Zuiderzeelijn' railway project and the third through direct participation in the project. Although the first two could be explained as chances that were seized resulting in an investment in quality with a neutral cost-benefit ratio, *strategic/political deception or manipulation* cannot be ruled out. Furthermore, especially for the second change *planning fallacy* might be the explanation for the cost overruns. The scope changes imposed through direct participation is the only investment that might be explained more positively since stakeholders directly imposed the investment and were judged as being beneficial enough to include.

7 | Conclusion, limitations and areas for further research

Cost overrun is a widespread phenomenon that is present in a variety of contexts and can be seen as a problem that has persisted for at least the last 70 years in infrastructure that has also been observed in the Netherlands (Flyvbjerg, 2005; Cantarelli et al., 2012b). The suspicion of negative bias in explaining cost overruns lead to this research. The following main question was formulated in order to *shed light on the other side of cost overruns*:

Is a more positively charged explanation possible for changes in large road infrastructure projects that lead to cost overruns in in the Netherlands?

This research demonstrated the negative bias in literature concerning the explanations for cost overruns. By categorizing the explanations according to the main change element they relate to it can be concluded that the explanations for cost overruns present in literature can be summarized by the by *political/strategic manipulation, psychological bias, lack of competence* and *bad luck* (Brunes & Lind, 2014). After introducing the Dutch context to this research it was established that within the main elements regarding changes, scope changes and changes in laws and regulations provided ground for reasoning that another explanation could be possible. Within the pre-construction phase this becomes clear because of the necessity of a broad cost contingency (Love et al, 2013) combined with an observed integration of infrastructure planning and integration of infrastructure planning and spatial planning in the Netherlands (Struiksmā & Tillema, 2009). In the both phases changes regarding scope as the result of additional requirements and an investment in standards/quality through changes in regulations or laws provided room for reasoning that another explanation might be possible. The fact that several researches showed that some *'established'* explanations could not convincingly be demonstrated in reality also strengthens this (Eliasson & Fosgerau, 2013; Salling & Leleur, 2015).

The empirical part of this research studied two cases with cost overrun that were selected according to the methods of prominent researchers on the field of cost overruns (Flyvbjerg, 2007; Cantarelli, 2010). The case study *A10 Tweede Coentunnel/A5 Westrandweg/N200 Halfweg* showed two possible changes that contributed to the total cost overruns that could be explained a more positively charged manner. Both changes were the result of changes in regulations that could be explained as an investment in quality through several mechanisms imposed by society as a result of legitimate processes (Hendriks, 2002; Doesburg, 2011). Furthermore, three changes in the pre-construction phase in the *N50 Ramspol – Ens* case study showed potential for a more positive explanation. However, of both the amendment as well as the scope increase regarding the bridge disproving the possibility of *political/strategic deception or manipulation* and *psychological biases* was not possible within the scope of this research. Together with the scope changes that were the result of public participation these changes point towards an explanation that demonstrates that in the pre-construction phase opportunities may occur that should be seized and why a broad cost contingency should be taken in to account (Love et al., 2013). Also, these changes may be the result of what is called the integration of infrastructure planning and spatial planning in the Netherlands by Struiksmā & Tillema (2009). This is supported by the observation that contextual knowledge in some cases can lead to that chances are identified later on in the process but nevertheless should be seized (Ministry of Infrastructure & Environment employees, personal communication; 2015)

Absolute proof of the existence of a more positively charged explanation could not be provided by this research. However, it can be concluded that the presence of another, more positively charged, explanation for cost overruns in large road infrastructure projects in the Netherlands is plausible. There proves to be a ground for this explanation in theory and observations showed potential and even point in the direction of such an explanation.

This research has some limitations in scope as well as in depth of the case-studies. Firstly, it has a rather narrow focus on where these explanations might be found. Secondly, a broader scope might also provide a broader and more conclusive definition of what another explanation might look like

than given in this research. Lastly, more resources devoted to going more in-depth into the cases could have benefitted this research as well. It proves to be hard to obtain data about cases regarding cost overruns. Further research should focus on expanding the knowledge on budget increase, on the positive side as well as the negative. It could be possible that the positive side of budget increase is a relatively new phenomenon that is a result of the in chapter 2 described entanglement of infrastructure and spatial planning (Struiksmā & Tillema, 2009). Case studies like these should test if a more positively charged explanation could also be possible for other types of projects in and outside of the Netherlands.

The question on the cover page of this research will be answered by this research as well, in spite of the fact that it not listed among the main and sub-questions. It might even be considered to be a question in disguise since answering the question with 'no' would result in disregarding the term 'cost overrun'. Though in certain cases, as this research confirmed, the answer to the question (at least for parts of the budget increase) might be 'no'. At least in the context of large Dutch road infrastructure projects. This does not mean that the other explanations would be incorrect, incomplete or would not even exist. On the contrary: this research showed that the other explanations most likely are valid explanations as well for certain parts of budget increase in the projects. 'Budget increase' seems to be the more appropriate term now that the presence of a positive explanation is shown to be plausible. Budget increase might be a result of the mismatch between the simplification of project management and the complex nature of reality. This does not mean that all budget increases should be regarded too positive now since the same mechanisms that makes a positive explanation to budget increase possible is also the ones that made the term 'cost overruns' so popular.

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Appendix A:

Interview guide for semi-structured interview

- Determine expertise level
 - Please explain function and background
 - Any former experience with the subject?
- MIRT-projects
 - Who are responsible
 - What are the responsibilities
 - How does this relate to the budgets
- More in-depth questions about the methodology
 - Could you elaborate on the BLD-component?
 - Could you elaborate on FM components?
 - How do these constructions work?
- More project specific questions
 - How is the relation between central and regional governments regarding MIRT projects
 - How are the budgets constructed?
- Who are involved with this? MIRT-projects
 - Who are responsible
 - What are the responsibilities
 - How does this relate to the budgets
- Manner of working within organization
 - Could you elaborate on the subject of area-oriented development?
 - How does this relate to your organization?
 - How does this relate to scope changes?
 - How does this relate to the budgets?
- Professional opinion
 - Own professional opinion on cost overruns as a tool of measuring success of a project
 - Is it a tool for measuring success of a project?
 - Could in your professional opinion more positive explanations for cost overruns exist?
- Are there any subjects that you would like to elaborate on that have not been of subject yet?

Can you provide me with any documentation on the cases and subjects that we discussed