STRATEGIES FOR PUBLIC AUTHORITIES TO COLLABORATE IN ROAD TRAFFIC SYSTEMS

THEORETICAL AND EMPIRICAL EXPLORATION OF COLLABORATION IN A NETWORKED INFRASTRUCTURE SYSTEM BY THE COMBINED USE OF THE SYSTEM AND ACTOR PERSPECTIVES

Masters’ thesis Carla de Koning, 17 October 2013 - MSc Construction, Management and Engineering

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SUMMARY

Due to the recent budget cuts on a national level and the dismissed concept of road pricing, the possibilities to solve congestion by extending the road capacity or reducing the traffic demand are limited. The Dutch national government currently prefers to focus on making better use of the existing infrastructure. In the Netherlands, roads are managed decentrally by the road authorities on three levels: municipal, provincial and national. There is no public organization which has full grip on the performance of the road traffic system as a whole. However, the road user is only interested in the traffic circulation during his trip from its origin to his end destination, without considering the organizational boundaries that are passed. To optimize the traffic circulation across the organizational boundaries, collaboration between the road authorities is necessary to make optimal use of a coherent system.

Considering that public authorities in the field of traffic and transport are not familiar with collaborations up until a few years ago, it is presumed that some difficulties may challenge the process of setting up a collaboration in the road traffic system. The road authorities all have had an autonomous development and are not used to harmonizing their ways of working with each other. Each road authority has its own set of traffic control instruments, diverse organizational procedures and various traffic control scenarios to realize a set of self-reliant objectives. The large variety of interests, resources and objectives may challenge the set up of a collaboration. The research objective is therefore to explore the process of setting up a collaboration in the road traffic system by providing insight in the difficulties that occur in such a process and to propose strategies that can be used to effectively deal with these.

Considering that many individual road authorities at all governmental levels manage the roadways in the Netherlands, the road traffic system can be regarded as a networked infrastructure system. The research focuses on the following central question:

In what way can public authorities effectively deal with the difficulties that occur in the process of setting up a collaboration in a networked infrastructure system, specifically in the road traffic system at a regional level?

In line with the vision to improve the traffic circulation in a specific area where various road authorities control the road traffic system, the research focuses on a collaboration at a regional level. The process is examined from the intention to collaborate to a collective plan to organize the road traffic system together.
This research is performed for a two-folded purpose. On the one hand, the research is executed in order to support public authorities that intend to collaborate in a networked infrastructure system, specifically in the road traffic system. Gaining an understanding of the difficulties that occur in this process and the strategies that can be used is of main relevance to the practical-side of the research. On the other hand, the research is carried out for a scientific purpose. Considering that the road traffic system involves both complex technical systems and a network of interdependent road authorities, it is chosen to combine the system and the actor perspective to evaluate the process through a coherent research perspective. The scientific relevance of this research is therefore to explore the value of combining the system and actor perspectives in analyzing the process of setting up a collaboration in a complex sociotechnical system like the road traffic system.

By the use of case studies, it is tried to gain a profound and full insight in all the ins and outs of the process to set-up the collaboration between the road authorities. The cases that are studied are the PPA project in the Amsterdam area (Dutch: Praktijkproef Amsterdam), the collaboration VERDER in the Utrecht area and the collaboration BEREIK! in the area of The Hague/Rotterdam. Through the use of practical findings, it is defined what difficulties have to be overcome during the process, what approaches are used and what strategies are regarded as effective.

The defined difficulties include four system-related difficulties (1 – 4) and five actor-related difficulties (5 – 9). The system-related difficulties are observed by research elements derived from the system perspective, namely system dependencies, system functionalities, system behavior and the system performance. The system-related difficulties that need to be conquered for setting up a collaboration in the road traffic system are:

1. Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.
2. The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.
3. The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.
4. The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.

The difficulties that concern the interests of actors, actor behavior and decision-making are called actor-related difficulties. These research elements are derived from the actor perspective.
The actor-related difficulties that challenge the process are:

5. The individual interests of the road authorities may become inferior to the collective interest of the collaboration.
6. Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.
7. Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.
8. The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.
9. Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.

Difficulties that are evaluated as major difficulties have a higher level of consequences and are frequently mentioned in all cases, while minor difficulties have moderate consequences for the process and are not frequently mentioned. Each difficulty is recognized in each case, except the difficulty concerning continuous scope changes (difficulty 8). The evaluation is illustrated in the figure below. The implications of major difficulties are evaluated as vital consequences to the process of setting up a collaboration in the road traffic system.

**Gravity of consequences**

![Diagram showing the gravity of consequences for different difficulties.](image-url)
By evaluating the relative importance of these difficulties from top right to bottom left, it can be seen that the greatest part of the major difficulties are based on research elements that are derived from the actor perspective (difficulties 5 to 9). This implicates that the actor-related difficulties need specific attention to succeed in setting up the collaboration. In line with this evaluation, it is concluded that the consequences of incidents due to strategic behavior seem to be underestimated and that the importance of the extensive decision-making process seems by contrast overestimated.

These difficulties are explored with theory to create a better understanding of the empirical observations. From a system perspective, it is concluded that collaboration in the road traffic system increases both the system and the network complexity. Due to the new connections made between the separate parts of the road traffic system, additional system dependencies and an increasing amount of relations between the individual road authorities arise. Understanding the increasing system and network complexity is seen as a necessity to deal with the difficulties effectively and succeed in setting up a collaboration in the road traffic system.

The strategies listed below can be used to effectively deal with the defined difficulties. Strategies that fit to the system perspective are concerned with optimizing effects of decision, focus on behavior of a rational actor who would reach a decision within a situation of being fully informed and policy processes that proceed in stages. On the contrary, the strategies that fit to the actor perspective assume that public policy making takes place in networks, including interdependent parties with often conflicting rationalities, interests and strategies and interaction processes in which actors exchange information.

The added value of the strategies printed in bold is that collective use of these strategies creates a learning process. Each strategy aims to realize a specific outcome, but it is presumed that the way towards this outcome may be even more valuable. Experiencing these learning processes together creates a shared understanding among the coalition partners. It is presumed that in this way the increasing system and network complexity is understood in the course of time.

<table>
<thead>
<tr>
<th>Strategies from system perspective</th>
<th>Strategies from actor perspective</th>
</tr>
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<tbody>
<tr>
<td>▪ S1. Outline an objective assessment framework</td>
<td>▪ S2. Compose a mixed package of measurements</td>
</tr>
<tr>
<td>▪ S4. Follow successive phases during decision-making</td>
<td>▪ S3. Move potential incidents up to a higher level</td>
</tr>
<tr>
<td>▪ <strong>S6. Design a joint control strategy</strong></td>
<td>▪ S5. Allow shifts in the proposed plan on the administrative decision-making table</td>
</tr>
<tr>
<td>▪ S9. Quantify the expected gains and losses of collaborative measurements</td>
<td>▪ S7. Translate the technical control strategy to interests of the road authorities</td>
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<td></td>
<td>▪ S8. Accommodate conflicting functionalities to separate collaborations</td>
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Coming back to the research question, it can be concluded that several strategies can be used to overcome the difficulties to set up a collaboration in a networked infrastructure system. The table below shows what strategies are applicable to the difficulties. Striking is that there are no effective strategies found to deal with two major difficulties, namely difficulty 1 and 6. Two main advantages are given to clarify the added value to analyze the process of setting up a collaboration in the road traffic network with the combined use of the system and the actor perspectives. First, the difficulties that are defined from both perspectives differ strongly. This implies that a more coherent understanding is gained than when difficulties are assigned from one of the perspectives. The second advantage is the use of cross-application. Seeing that strategies from the system perspective can be used to overcome actor-related difficulties and the other way around, it is presumed that cross-application of strategies is common and useful. Cross-application implies that strategies from one of the perspectives can be used to deal with the difficulties from the contrasting perspective. This implicates that strategies from a system perspective can help to structure complex decision-making processes and create an objective overview of the variety of interests. Although this way of cross-application can be useful, it must be used with care since it creates little freedom of action for the actors.

### Cross-application of strategies

<table>
<thead>
<tr>
<th>Difficulties</th>
<th>Strategies from system perspective (rational actor approach)</th>
<th>Strategies from actor perspective (network approach)</th>
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<tr>
<td></td>
<td>S1</td>
<td>S4</td>
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<tr>
<td>System-related difficulties</td>
<td>Difficulty 1</td>
<td>X</td>
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<td>Difficulty 2</td>
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<td>Actor-related difficulties</td>
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<td>Difficulty 7</td>
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<td></td>
<td>Difficulty 9</td>
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</tbody>
</table>

Despite the fact that the difficulties are often recognized in the water sector, it would be a bit presumptuous here to conclude that the research results are applicable to all other networked infrastructure systems. It is found that the usefulness of the strategies is limited for setting up a collaboration in the water infrastructure system since the sector is more centrally organized than management in the road traffic system. It is recommended to apply this research methodology to other networked infrastructure systems to examine which difficulties overlap.
While the importance of learning to create an understanding of complexity is one of the main conclusions in this research, writing this report has been a learning experience in itself as well for me. I had to become familiar with terms and definitions in road management, to acquire knowledge about complex sociotechnical systems and to create a vision on collaboration between public authorities in the Netherlands. This Masters’ thesis is the final result of my process to successfully complete the MSc program Construction, Management and Engineering at the TU Delft.

Despite the fact that I had to conduct this research independently, some people supported me in completing the research and writing up this report. I want to thank my graduation committee for the supervision during my research project. Hans de Bruijn, for taking place in the committee as chairman and sharing your knowledge on complex decision-making processes in the public sector. Rob Schoenmaker, thank you for helping me to familiarize myself with the road traffic system and for giving advice during my research project. Bauke Steenhuisen, you helped me to put my thoughts down in writing.

Many thanks to Pau Lian Staal-Ong and Jan-Floor Troost-Oppelaar, who gave me a welcome start at AT Osborne. Thank you for helping me to move the scope of this research project in the right direction, giving me feedback at any desired moment and having informal chats about my future plans. I really appreciated working with you.

Carla de Koning
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1. INTRODUCTION

Road management is organized decentrally in the Netherlands. The roads are managed by the road authorities which are municipalities, provinces and the national government. The belonging tasks are to build, control and maintain the infrastructure and to perform traffic management of their roadways. At this moment, the main goal of the national government is to make better use of the current infrastructure. The underlying reasons for this aim are the estimated economic damage between approximately 750 million and 1 billion euro in 2012 as result of waiting times due to congestion (Zanten & Veth, 2012), the recent budget cuts at national level which limit the possibilities of expanding the road capacity in the short term and the concept of road pricing that has been dismissed since the new government plans of 2012. For these and many more reasons, it is neither possible to fight the congestion problems by extending the road capacity, nor by reducing the traffic demand. This implies the necessity of organizing road management together to reduce congestion without large investments and thereby optimizing the traffic circulation.

1.1. RELEVANCE OF THE RESEARCH PROJECT

Collaboration between the road authorities is necessary to realize road management across the organizational boundaries to make better use of the current infrastructure. Rijkswaterstaat (2004) developed a business plan to set course for this new direction. The aim is to transform the organization from an individual road authority to a network manager. This implicates the focus on the road user by making use of a coherent system through collaboration between decentralized authorities and cut across internal boundaries. The collective interest of the road authorities is to improve the traffic circulation on the roadways for the road user. The road user is only interested in the traffic circulation during the trip between its origin and destination, without considering the organizational boundaries that are passed. By making the decision on which route to follow, the road user does not take in account whose roads these are. For this reason, some synchronization between the road authorities is necessary to organize their tasks and activities across the boundaries between their individual organizations. In this research project, the process of setting up a collaboration in the road traffic system is the research object.

According to a survey research by Pröpper, Kessens, and Weststeijn (2005), the common fields for such collaborations between public authorities are currently ‘nature, environment and waste processing’, ‘social affairs’ and ‘general affairs’. The public authorities in the field of traffic and transport were not familiar with such collaborations up till a few years ago. It is presumed by the researcher that many difficulties may challenge the process of setting up a collaboration. The
road authorities all have had an autonomous development and are not used to harmonize their ways of working with each other. Each road authority has its own set of traffic system instruments, diverse organizational procedures and various traffic control scenarios to realize a set of self-reliant objectives. The large variety of interests, resources and objectives challenge the formation of a collaboration.

A collaboration between the road authorities implies an increasing number of relations between the organizations and their separate parts of the road traffic system, which is illustrated in Figure 1-1 and Figure 1-2. The road traffic system includes the roadway infrastructure, the traffic control instruments such as VRI’s, DRIP’s and TDI’s and the belonging data measurement system.

Every road authority has the responsibility for a certain part of the system, which can be managed to its individual interest. However, these systems of the road authorities are dependent of each other considering that the performance of the separate systems determines the overall system performance. This setting is illustrated in Figure 1-1. For instance, an optimal traffic circulation in municipality X may cause heavy traffic in municipality Y as result of alternative routes suggested to the road users by municipality X.
Furthermore, there is no organization which has full grip on the functionality or performance of one particular system element, let alone the control over the whole system. As illustrated in Figure 1-2, a collaboration implies that the separate systems are controlled together by the coalition partners. This brings in the difficulty that the control now exceeds the boundaries between the system parts instead of system control as intended by the road authority itself. A collaboration in the region may involve various road authorities with, for example, other traffic control scenarios pursuing divergent objectives or other procedures to subcontract particular activities. These differing procedures and control policies may conflict with one another.

Other examples that may challenge the process of setting up a collaboration between the road authorities are:

- Joint decision-making, since the individual interests of the road authorities may be conflicting with the collective interest. For instance, the aldermen of municipality X must give approval to buffer extra traffic at the municipal roadways to stimulate a high traffic circulation on the national roadways.

- Indicating the effects of collaboration despite the complexity due to the increasing relations between the separate parts of the road traffic system. For instance, predicting the effect on the provincial roadways through admitting a limited amount of cars to the national roadways as control mechanism for the traffic inflow.

- Collectively managing conflicting system functionalities within the road traffic system. For instance, organizing traffic management in the most optimal way by the network of road authorities while maintaining the infrastructure system limits the road capacity.

All those diverse barriers are to be conquered to reach consensus among the road authorities to organize the road traffic system together. The research objective is to explore the process of setting up a collaboration in the road traffic system by providing insight in the difficulties that occur in such a process and the strategies that can be used to effectively deal with these.

Figure 1-3 The examined process from the first intention to a collective plan to collaborate
1.2. Refinement of the Research Context

During the process of setting up a collaboration, a shift must be made from isolated road authorities to a collective plan to manage the road traffic system in the area concerned. The start and end of this process is roughly illustrated in Figure 1-3. It is assumed that the difficulties are conquered as such a collective plan is approved. The process is therefore explored from the first intention to collaborate to a collectively designed and approved plan to organize the road traffic system together.

It is chosen in this research to focus on collaborations regarding the operation, maintenance and control activities, excluding the physical development of the network. The delineation of road management is illustrated in Figure 1-4. Activities that aim to change the capacity of the road, such as widening or reconstructing the roads do not belong to road management, but are defined as investments. These infrastructure investments, including the procurement of traffic control instruments, are not part of road management and thereby not part of the research scope. This illustrated distinction of road management disciplines is based on analyses performed by the Rijkswaterstaat (RWS), which is the engineering department of the national government. While no explicit difference is indicated by RWS, it is thought that ‘construction’ implies the development of new roadways while ‘realization’ covers the activities of widening the existing roadways. The road traffic system includes the disciplines of ‘infraproviding’ and traffic management, excluding the control of bridges and tunnels. Those bridges and tunnels form important interfaces, but also bring in other network relations and system functionalities. This would increase the complexity of the research project to a high extent, while it would have insignificant added value to obtain the research objective.

![Figure 1-4 Delineation of the road management disciplines (Rijkswaterstaat, 2007a, 2007b)](image-url)
1.3. Research Question
Considering that many individual road authorities at all governmental levels manage the roadways in the Netherlands, the road traffic system can be regarded as a networked infrastructure system. Lukszo, Weijnen, Negenborn, De Schutter, and Ilić (2006) refer to networked infrastructure systems as complex sociotechnical systems operated by a multitude of actors in a setting of decentralized decision-making. Another networked infrastructure system is for example the water infrastructure system in the Netherlands. Since the research findings may be interesting to this field of practice as well, the applicability of research findings in other sectors is also evaluated in this research.

The research focuses on the following central question:

In what way can public authorities effectively deal with the difficulties that occur in the process of setting up a collaboration in a networked infrastructure system, specifically in the road traffic system at a regional level?

In line with the vision to improve the traffic circulation in a specific area where various road authorities control the road traffic system, the research focuses on a collaboration at a regional level. The research starts with describing the difficulties that occur during the process of setting up a collaboration based on three case studies. This provides knowledge that is required to explore why those difficulties occur. At last, strategies are defined that may be used to effectively overcome the difficulties along the process.

The sub research questions related to previous described steps are:

1. What difficulties challenge the process of setting up a regional collaboration in a network of public authorities on the road traffic system?
2. How do these difficulties come about?
3. What strategies can be used to effectively deal with the difficulties of setting up a regional collaboration?

These research questions provide joint input to answer the central research question.

This research is performed for a two-folded purpose. On the one hand, the research is executed in order to support public authorities that intend to collaborate in a networked infrastructure system, specifically in the road traffic system. Gaining an understanding of the difficulties that occur in this process and the strategies that can be used is of main relevance to the practical-side of the research. The research project is thereby carried out under the authority of the management and consulting firm AT Osborne. AT Osborne is an independent multidisciplinary firm that solves spatial issues by providing managerial and consultancy activities in the public
sector. Supporting public authorities to set up such a collaboration can be a service provided by the consultants and managers of AT Osborne.

On the other hand, the research is also carried out for a scientific purpose. The definition of the difficulties and the strategies is approached through a coherent research perspective. Presuming that difficulties may occur due to the complexity of the multi-actor network of road authorities and the complexity in the road traffic system, it is chosen to combine the system and the actor perspective to evaluate the process. The system perspective, as used in this research, is regarded as the hard systems thinking discipline which is rooted in the engineering sciences. While the actor perspective is rooted in the social sciences. De Bruijn and Herder (2009) emphasize that the actor perspective and the system perspective are ‘competing’ perspectives which must be used alongside each other. Full integration will erode this competing character, rendering both perspectives of lesser value. The scientific relevance of this research is therefore to explore the value of combining the system and actor perspectives in analyzing the process of setting up a collaboration in a complex sociotechnical system like the road traffic system.

While a set up collaboration is evaluated as the ultimate goal in this research project, some necessary differentiations shall be made in the end. Evaluating the research findings from a multi-actor perspective, the meaning of specific difficulties and strategies may differ for the individual road authorities. An example is given to explain the use of a multi-actor perspective. Since the interests of individual road authorities may conflict, a particular difficulty or strategy can be beneficial to municipality X while the national government is put at a disadvantage for example. Nonetheless, it is aimed that all road authorities benefit from the set up collaboration in the end. A well-managed process resulting in a collective plan which satisfies all coalition partners in some way is presumed to be a successful result. On the contrary, it is thought that many unsatisfied road authorities could lead to a premature ending of the collaboration. A long-termed collaboration between satisfied road authorities is regarded as most valuable as it then can result in structural improvements for the road traffic system while making use of the existing infrastructure.

1.4. LINE OF REASONING
This research concerns a diagnostic research, related to the aim to explore the occurrence of difficulties in the process of setting up a collaboration and the strategies to deal with these. Chapter 2 elaborates on the theoretical framework that was created to provide a holistic viewpoint to analyze the research topic by combining the system and actor perspective. Additionally, the research methodology is described in Chapter 3 to explain the choice for a comparative case study research. An elaborate description of the three cases studied is given in Chapter 4. This chapter provides the empirical observations that serve as input for the further
research phases, such as the defined and evaluated difficulties in Chapter 5 and the theoretical exploration of the difficulties in Chapter 6. The strategies defined are also based on empirical observations whilst studying the cases. In Chapter 7, strategies are extensively described, including the belonging advantages and disadvantages, the conditions for effective use and relations between strategies for combined use. Chapter 8 elaborates on the validity and the broader applicability of the research findings. The final conclusions and the recommendations for further research are given in Chapter 9. The report ends with Chapter 10, which provides a critical reflection on the research project.
2. THE THEORETICAL PERSPECTIVE

A theoretical framework is created to provide a holistic viewpoint to analyze the research object by combining the system and actor perspectives. Both theoretical perspectives are used to define the difficulties that may occur during the process of setting up a collaboration and to define what strategies can be used to effectively deal with these. To provide a starting point for the analyzes, some aspects are selected and described in section 2.1. These aspects are evaluated from both perspectives to determine the research elements. In section 2.2., both perspectives are independently and combined described. Subsequent to this, it is viewed in what way the separate perspectives perceive the selected aspects to determine the research elements that are to be observed. Those research elements are stated in section 2.3. Besides that, the use of strategies is interpreted by the use of theory as well to evaluate the underlying principles of these strategies. The used theoretical approaches fit to both the actor and system perspectives as described in section 2.4. The complete theoretical framework is illustrated in section 2.5. to visualize the specified research perspective.

2.1. SELECTION OF IMPORTANT ASPECTS AS STARTING POINT

An empirical and theoretical analysis to define and explore process-related difficulties needs a starting point. Many elements can be examined due to the broad meaning of processes. Difficulties occur in all kinds of forms during such a process, especially in complex systems that are managed by a complex network of public organizations on all governmental levels. For this reason, four aspects have been selected as a starting point for the analysis that can be examined from both the system and the actor perspective.

Related to this selection, a few considerations are taken in account. First, it is considered that the aspects covered a broad range of process-related topics to create a well-balanced picture of the process from beginning to end. Second, it is tried to prevent overlap of the aspects as much as possible, although the aspects are not completely independent of each other. It is thought that complete independent aspects cannot be found since these are particular parts of a coherent whole. Third, the theoretical perspectives chosen must relate to the aspects in some way to define the research elements that are used to evaluate the process. For this reason, the selection is based on a literature review of both perspectives and process management theories. The four selected aspects are 1) the dependencies, 2) the objectives, 3) the behavior and 4) the result.
2.2. **COMBINED USE OF THE SYSTEM PERSPECTIVE AND ACTOR PERSPECTIVE**

This section elaborates on the system perspective in paragraph 2.2.1 and the actor perspective in paragraph 2.2.2. The section is ended by explaining the added value for the combined use of the perspectives related to complex sociotechnical systems.

### 2.2.1. **SYSTEMS PERSPECTIVE**

In the system perspective, problems are valued as structured and hard, assuming that the reality can be known objectively. This section elaborates on the system perspective by describing what systems thinking implies, the corresponding assumptions and the limitations of the system perspective are given.

**Systems thinking**

The system perspective has to be perceived as a way of thinking. It is a technical-rational perspective of complex systems. The system perspective developed as the idea took hold that the engineering disciplines could be extended to tackle systems made up of the interaction of many components, as illustrated in Figure 2-1.

![Figure 2-1 Interaction of the system components, sub-systems and the overall systems](image)

Systems thinkers use systems ideas to develop methodologies for problem solving in real-world problem situations. Several approaches fit to the systems perspective, as illustrated in Figure 2-1. Checkland (1985) included systems engineering and systems analysis in the category of hard systems thinking. According to Jackson (1991), other approaches such as operational research can be added to this list. Two main similarities between these approaches can be given. First, the underlying disciplines apply a phased and structured approach of problem solving. A fundamental concept of systems engineering is that all systems are associated with lifecycles. Second, all these approaches share the basic orientation, identified by Checkland (1985), as “the assumption that the problem task they tackle is to select an efficient means of achieving a known and defined end”.

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Checkland (1985) extensively explains the development of systems thinking as a transition from optimizing to learning. Ideas about system control were generalized across disciplines in cybernetics, the study of the underlying logic of the control of systems of any kind. In the language of this paper, the framework F as illustrated in Figure 2-2 now contained the notion of optimizing the structure and behavior of systems and maintaining them in that state. But if this notion is to be applied to 'human systems', then some concept of the nature of the latter is needed: a view has to be taken on what it is in 'human systems' that can be 'engineered'.

Figure 2-2 The organized used of rational thought (Checkland, 1985).

The answer adopted in the 1950s and 1960s was: goal seeking. It was assumed that any human activity could be regarded as a goal-seeking system, and the thinking which constituted the framework F and methodology M could be condensed into:

- defining the system of concern;
- defining the system's objectives;
- engineering the system to meet those objectives.

This has been a coherent and powerful way of thinking: it is the 'hard' paradigm of systems thinking. This paradigm is succinctly expressed in Ackoff's assertion written in 1957:

"All problems ultimately reduce to the evaluation of the efficiency of alternative means for a designated set of objectives".

That is the belief which drives work within the 'hard' tradition. According to Jackson (1991), the purpose of systems engineering, as one of the disciplines in hard systems thinking, is to understand the status quo better with a view to facilitating prediction and control of the system of concern. The systems engineering methodology aims through empirical investigation to build up a systematic account of a real-world problem situation and the interactions that determine its nature.
Assumptions in systems thinking
Adapting another of Checkland's formulations, the hard systems approach presupposes that real-world problems can be addressed on the basis of the following four assumptions:

1. There is a desired state of the system, S1, which is known
2. There is a present state of the system, S0
3. There are alternative ways of getting from S0 to S1
4. It is the role of the systems person to find the best means of getting from S0 to S1

The job of the systems analyst is to find an optimum how, the most effective and efficient means to realize predefined objectives (Jackson, 1991). According to Checkland, a systems thinker will identify some entities which are coherent wholes, perceive some principles of coherence to draw a boundary and identify some mechanism of control by which the whole retains its identity. The rational modeler may base their work entirely on hard facts and incontestable data. Such an approach assumes that problems can be identified and the information required to model and understand the system is available. It presupposes the existence of a globally optimal solution (De Bruijn & Herder, 2009).

Limitations of systems thinking
Hard systems thinking methodologies originally seek to assist with the prediction and control of those subsystems of organizations and society concerned with the development of the technical aspects of transformation processes (Jackson, 1991). However, the control of the system under surveillance is subject to several road authorities with decentralized power and authority. By applying the system perspective in this research, the hard systems thinking methodologies are used on a sociotechnical system.

Jenkins already stated that the same systems thinking which can be applied to the design of hardware systems, can also be applied to parts of firms, or whole firms, or local government. Jackson (1991) discusses the use of hard systems thinking extended to social systems. Hard systems methodologies assume that it is possible to arrive at a clear statement of the objectives of a system from outside the system concerned. But objectives originate from within social systems and different individuals and groups often vary considerably concerning the goals they wish to see pursued. Hard approaches have no means of engineering a consensus or accommodation between the representatives of different interests. In these circumstances hard methodologies might be expected to fail because they are unable to achieve better prediction and control.

Checkland (1985) emphasizes that although the concept of optimizing is wisely dropped in relation to human affairs, the core idea underlying the search for heuristics for real-world
problem solving is that of goal seeking as a model of human behavior. On the contrary, Jackson (1991) admits that hard methodologies do often seem to ‘work’ when applied to social systems. Subsequent to this, he states that this success must logically depend on there being either widespread agreement over objectives among the human being who make up the system (which is likely to be quite rare) or an autocratic decision-maker who can decide on the objectives of the system. In line with this reasoning, it is stated that hard methodologies can be legitimately employed to social systems when there is agreement over ends and means among the human beings who make up the system.

2.2.2. ACTOR PERSPECTIVE
This section elaborates on the theoretical concepts of thinking in networks which is central to this point of view and the assumptions in network thinking. Since the system perspective does not completely fit to real-world problems, the combined use with the actor perspective is vital. The actor perspective is rooted in social sciences. As where the system perspectives focuses on the multiple, perhaps conflicting, functionalities between decomposed sub-systems, the actor perspective mainly focuses on the interests present in the network. The behavior by actors depends on their interests, standpoints and perceptions regarding ‘reality’. These may conflict through the variety in the network.

Assumptions in network thinking
The actor perspective treats its subjects as reflective actors. In comparison to the rational behavior that is shown by subsystems, it is assumed that the actors adopt strategic behavior and they learn. This implies that no optimality can be found based on the actor perspective. The main difference is that, in a black-and-white world, the system perspective treats its subjects as ‘mechanical’ beings, while the actor perspective treats it subjects as reflective actors. Reflectivity means that the actors have the ability to learn, which has three significant implications (De Bruijn & Herder, 2009).

1. Actors display strategic behavior,
2. Actors learn how to neutralize the interventions of others,
3. An understanding of the process of interaction that will eventually lead to a decision is crucial.

Those implications refer to the behavior of actors as they participate in the process of becoming part of a coalition. One of the main principles of these implications is the assumption that the main motives of the actors are to serve their own interests and realize their own objectives. Strategic behavior refers to all those actions that help the actors to do so. Another assumption is that the actors learn the strategies and interventions used by other actors and in time will often
develop means to sidestep these strategies and interventions. In this way, every strategy is of only temporary effectiveness because other actors learn how to neutralize its effects (De Bruijn, 2006).

2.2.3. Combining both perspectives

The road traffic system is regarded as a complex sociotechnical system. Those sociotechnical systems are systems that involve both complex physical-technical systems and networks of interdependent actors. According to De Bruijn and Herder (2009), the merging Systems-of-Systems discipline generally calls for an integration of both the actor and system perspectives in order to model and design complex sociotechnical system, but it is argued and shown that full integration is not the preferred way to go. In this particular article, both perspectives are compared as shown in Table 2-1. The theoretical framework is mainly based on this comparison of the perspectives.

Table 2-1 Perspectives compared by De Bruijn and Herder (2009)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>System perspective</th>
<th>Actor perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>Subsystems, dependencies, multiple conflicting objectives (functionalities)</td>
<td>Actors, different types of interdependency, conflicting interests</td>
</tr>
<tr>
<td>Unit rationality</td>
<td>Subsystems show rational behavior</td>
<td>Actors are reflective, no optimality</td>
</tr>
<tr>
<td>Constellation of units</td>
<td>Complex systems: systems no longer recognizable or impossible to model rigorously</td>
<td>Overall set of dependencies is not recognizable: information is frequently contested, problems are ‘wicked’</td>
</tr>
<tr>
<td>Unit aggregation and segregation</td>
<td>System decomposition</td>
<td>Networks of networks</td>
</tr>
<tr>
<td>Dynamic behavior</td>
<td>Dynamics in subsystems and in the topology of a system</td>
<td>Dynamics in the constellation of actors and in the topology of the network</td>
</tr>
<tr>
<td>Design approach</td>
<td>Technical-rational, successive, phased approach is useful</td>
<td>Network and contested information frustrate rational, successive decision-making processes</td>
</tr>
<tr>
<td>Design results</td>
<td>Result / performance is key</td>
<td>Decision-making is the result of the interaction: knowledge of this process is crucial</td>
</tr>
</tbody>
</table>

2.3. Research elements derived from both perspectives

The aim of this section is to clarify the research elements that are observed to define difficulties that occur during the process of setting up a collaboration between the road authorities. To identify those research elements, it is chosen to focus on four selected aspects as described in
section 2.1. Those aspects are 1) dependencies, 2) objectives, 3) behaviour and 4) the results of the process. Both the system perspective and the actor perspective are used to identify difficulties that arise related to these aspects. This implies that both perspectives focus on different types of dependencies, the objectives, the behavior and the result. These different research elements are defined in Table 2-2. The definitions for those research elements are given in Appendix A, which includes a list of definitions.

Table 2-2 Aspects explored from both the system and the actor perspective

<table>
<thead>
<tr>
<th>Aspects</th>
<th>...from a system perspective</th>
<th>...from an actor perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependencies</td>
<td>System dependencies</td>
<td>Actor dependencies</td>
</tr>
<tr>
<td>Objectives</td>
<td>System functionalities</td>
<td>Actor interests</td>
</tr>
<tr>
<td>Behavior</td>
<td>System behavior</td>
<td>Actor behavior</td>
</tr>
<tr>
<td>Results</td>
<td>System performance</td>
<td>Decision-making</td>
</tr>
</tbody>
</table>

2.4. THEORETICAL APPROACHES TO INTERPRET THE USE OF STRATEGIES
The strategies are also explored via the system and the actor perspectives. Those perspectives although do not explicitly state specific strategies. For this reason, theoretical approaches are described that can found a basis to interpret the use of strategies. Those approaches are selected in such a way, that a clear similarity can be seen with the perspectives. The foundation for the choice of those approaches lies with the book ‘Managing complex network: strategies for the public sector’ by Kickert, Klijn, and Koppenjan (1997). The rational actor approach represents the theoretical basis for the strategies related to the system perspective as described in paragraph 2.4.1. Respectively, paragraph 2.4.2. describes the network approach which represents the basis for the strategies related to the actor perspective.

2.4.1. THE RATIONAL ACTOR APPROACH
Policy science grew out of ‘decision theory’ which was concerned with optimizing the effects of decision and calculating the costs and benefits connected with those decisions. (Kickert et al., 1997). The rational actor approach is originated from economics. According to Braybrooke and Lindblom (1963), policy science focused on the behavior of a rational actor who would reach a decision within a situation of being fully informed and of complete and clear preference ranking. (...). In the rational actor approach, the decision maker aims at ‘a systematic canvassing of all possible politics, for a similar systematics analysis of the consequences of each possible alternative and for a policy choice to serve goals or objectives somehow separately established’. The rational actor model assumes that policy processes proceed in stages (policy formulation, decision and implementation) based on a view in which the decision maker first analyses the problem and the alternatives and then makes a rational decision about which option he or she should choose (Kickert et al., 1997).
2.4.2. **The Network Approach**

It is considered that the network approach fits to the actor perspective. This approach provides the theoretical basis for the strategies that can be used to overcome the difficulties. According to Kickert et al. (1997), the network approach considers public policy making and governance to take place in networks consisting of various actors none of which possess the power to determine the strategies of the other actors. (...) Public policy making within networks is about cooperation or non-cooperation between interdependent parties with different and often conflicting rationalities, interests and strategies. Policy processes are not viewed as the implementation of ex ante formulated goals, but as an interaction process in which actors exchange information about problems, preferences and means and trade-off of goals and resources.

2.5. **Theoretical Framework**

Figure 2-3 is designed to visualize and schematize the theoretical framework that is composed to create a viewpoint to analyse the process of setting up a collaboration in the road traffic system. The research elements provide a starting point to analyze what kind of difficulties occur by the combined use the system and actor perspective. The rational actor approach and the network approach are chosen to interpret the use of strategies corresponding to the assumptions of the system and the actor perspective.

![Theoretical framework diagram](image)

Figure 2-3 Theoretical framework
Difficulties that are defined on the research elements derived from a system perspective concern challenges regarding system dependencies, system functionalities, system behavior and the system performance of the road traffic system. These are called system-related difficulties. Additionally, the actor-related difficulties are defined on the research elements derived from an actor perspective. These concern challenges regarding actor dependencies, actor interests, actor behavior and decision-making. Furthermore, the used strategies are also split up in strategies fitting the system or actor perspective by relating the underlying principles of the strategies to the assumptions of the rational actor approach and the network approach.

The purpose of the theoretical framework is to provide structure to the analysis, to create a better understanding of the empirical observations and to enable the interpretation of the research findings. By making this distinction between system-related and actor-related difficulties and strategies, it can be examined whether it is of added value to use both perspectives in a combined manner. In this way, it can be analyzed to what extent strategies from the system perspective can be used to overcome actor-related difficulties and the other way around. Amongst other things, this contributes to the stated scientific purpose of this research: to examine the added value of using the system and actor perspectives in combination to analyze the process of setting up a collaboration in a networked infrastructure system such as the road traffic system.
3. Research Methodology

The research strategy is the approach taken to carry out this research project, which includes the coherent body of decisions to gather relevant material and processing this material into valid answers to the central research questions. This chapter gives the justification of the research methodology chosen in section 3.1., elaborates on the criteria to conduct case studies in section 3.2., describes the screening and selection of cases in section 3.3. and closes with the approach to gather and analyze data in section 3.4.

3.1. Why the use of cases?
A case study research implies both the collection and analysis of empirical data. It is of great importance to reveal, in great detail, all the ins and outs of the processes that form the collaboration between road authorities. By the use of case studies, it is tried to gain a profound and full insight to answer the research questions (Verschuren, Doorewaard, & Mellion, 2010).

Case studies have been defined as ‘research situations where the number of variables of interest far outstrips the number of data points’ (Yin, 2002). While case studies may, and often do, use quantitative data, a key difference with other research methods is that case studies seek to study phenomena in their contexts, rather than independent of context (Gibbert, Ruigrok, & Wicki, 2008). Case studies are characterized by Verschuren et al. (2010) as follows;

A small domain, consisting of a small number of research units, intensive data generation, more depth than breadth, a selective sample, an assertion concerning the object as a whole, an open observation on site and qualitative research methods are frequently used.

A case study analysis fits this research, because the process of setting up a collaboration cannot be isolated from its environment. In contrast with a survey or experiment, a case study attempts to analyze the interwoven relations between the complex relations and interactions between the actors and the underlying system. In-depth understanding is required to identify the dominant strategies that are used to form a certain collaboration. Through the use of findings in practice, it is tried to define what difficulties has to be overcome in the process of setting up a collaboration, in what way the interview respondents handled the situation and what approaches are seen as effective or ineffective. Asking open questions creates an understanding to gain an insight in the reasons for these motivations. A survey study would have used more interviews by written polls with closed questions than the intensive and open face-to-face interviews as carried out in the case studies used for this research.
Considering that the information gathered by case studies is qualitative data, it is impossible to analyze the data with quantitative research methods. This means that the emphasis is more on comparing and interpreting the results instead. Chapter 4 compares the empirical findings of three selected cases. More specific, the research strategy is called a comparative case study where several interrelated cases are compared. It is a hierarchic method which means that the research project is carried out in two stages.

i. In the initial stage, the separate cases are examined as if they belong to a series of single case studies. An established pattern to analyze the cases and describe the results is essential to study the cases independently from each other. For this reason, extensive, independent case descriptions are given in Chapter 4 on the basis of the research elements defined in Chapter 2. Those descriptions mainly consist of only empirical observations.

ii. The second stage concerns the comparison of the cases that are involved in the research. In this way, the first stage serves as input for the comparative analysis of the second stage. This strategy facilitates the process of finding explanations for the similarities and differences between the various cases that have emerged from the first stage (Verschuren et al., 2010).

It must be noted that conducting research with case studies is very time-consuming, especially when most of the data is still to be gathered as is in this research project. The number of cases is therefore relatively small. A disadvantage of the relative small number of cases can be that the external validity of the results is often under pressure (Verschuren et al., 2010).

### 3.2. Criteria to Conduct Case Studies

In the positivist tradition, four criteria are commonly used to assess the rigor of field research: internal validity, construct validity, external validity, and reliability. These criteria have been adapted for use in case studies by Yin (2002), and others (Eisenhardt, 1989). Conducting case studies in a way that provides reliable and valid research findings therefore requires the research to meet the following criteria. Additionally, it is described in what way this research project fulfills those criteria.

**Internal validity**

'Internal validity' is also called 'logical validity' (Yin, 2002) and refers to the causal relationships between variables and results (Gibbert et al., 2008). Internal validity reflects the extent to which a causal conclusion based on a study is warranted. It examines the extent to which a research finding (e.g. A leads to B) is valid (Verschuren et al., 2010). So, the internal validity is mostly relevant in the diagnostic research phase that tries to establish causal relationships. The key
question in internal validity is whether observed changes can be attributed to the intended cause and not to other possible causes which are alternative explanations for the outcome. In this research project, the internal validity is taken into consideration by triangulation of research methods and sources. For each case, three or four different interview respondents are consulted as can be seen in Appendix B and a content analysis of textual material is executed as described in Section 3.4

**Construct validity**

According to Gibbert et al. (2008), the ‘construct validity’ of a procedure refers to the quality of the conceptualization or operationalization of the relevant concept. Construct validity needs to be considered during the data collection phase. As such, construct validity refers to the extent to which a study investigates what it claims to investigate, that is, to the extent to which a procedure leads to an accurate observation of reality (Denzin & Lincoln, 2005). Therefore, researchers have sought to triangulate, that is, adopt different angles from which to look at the same phenomenon, by using different data collection strategies and different data sources (Denzin & Lincoln, 2005; Yin, 2002). In this research project, the construct validity is taken into consideration by the extensive approach illustrated in Section 2.5. First, four aspects are selected on the basis of a literature review. Second, eight research elements are derived by evaluating the four selected aspects with both the system and the actor perspectives. The definitions of the research elements are given in Appendix A. Those research elements provided the basis for the interviews.

**Reliability**

The reliability of the research method is ensured by an extensive description of the research steps, a precise format for each interview and the reports for the interviews afterwards. It promotes good and strict interpretation of the research approach and enables control of the steps to be followed (Baarda, De Goede, & Teunissen, 2005). In this research project, the eight research elements are used to structure the interviews in the same way. As further discussed in section 3.4, a checklist is used during all interviews to check whether all research elements are discussed. This interview checklist is added in Appendix C. Afterwards, extensive interview reports are written which are verified by the interview respondents. During the analysis phase, some ambiguities are additionally checked with some interviews respondents by mail or phone conversations. It must furthermore be noted that a certain degree of twisting in the research observations cannot completely be prevented due to the individual preferences and views of the researcher.
External validity

This criteria concerns the scope's quality of the research conclusions. One of the assumptions in case studies is that the results can be generalized to other comparable situations and a general theoretical concept. The scope of the research conclusions is limited to the relevant conditions under which the findings are realized (Verschuren et al., 2010). In the end, it may be more difficult to apply the results to a broader population of interest or to similar cases. It is therefore important to select a strategic sample rather than a random sample. The selection of cases is discussed in the upcoming section 3.3. At the end of the research project, the research findings are discussed in an expert meeting. The experts involved are listed in appendix D, which also includes the presentation that is given as input for discussion. In Chapter 7, the feedback and the remarks originating from this expert meeting are described and related to the validity and the applicability of the research findings to other fields of practice.

3.3. SCREENING AND SELECTION OF CASES

It is chosen to select three cases to conduct this research with a certain variety that enables generalization of some of the research conclusions to a broader domain despite the limited time available for this research. This screening is based on a broad variety of cases with regard to collaborations in the field of transport and traffic industry in the Netherlands. All the cases taken into consideration are listed in Appendix A. As it is essential to compare the cases, the achieved domain has to dispose a certain homogeneity. This is ensured by a set of screening criteria that is used to select the relevant cases that fit to the aimed domain.

The general preconditions in the screening are;

- The collaboration concerns road management tasks,
- The collaboration has a transgressing, regional character,
- The collaboration involves more than two road authorities,
- The collaboration has a sustainable intention for the long term,
- The collaboration already exists for at least three years,
- The collaboration concerns only public authorities,

Those screening preconditions are chosen in consultation with the company AT Osborne. Related to both the theoretical and practical research objectives, the focus is laid with collaborations between governmental organizations that are together to form a collaboration in the road traffic system. To create the opportunity of analyzing a process afterwards, the collaboration had to exist for some years to gather data related to this process. Thereby, it is chosen to select cases with more than two road authorities to prevent bilateral discussions and focus on multi-actor networks. The preconditions determine the homogeneity of the case
studies. The screening that is performed is added in appendix E. More pragmatic criteria that are also taken into consideration are the availability of empirical material such as evaluation and audit reports and the accessibility of key players in the collaboration.

3.4. DATA GATHERING
Valid and reliable research findings can be realized by triangulation of research methods and sources. It is an effective instrument for gaining the overall picture of the process to set up a collaboration in the road traffic system. It is therefore important to make sure that data is gathered in several ways. It is chosen to do this by;

- Individual interviews with a sample of people. This strategic sample includes participants of several public authorities involved in the collaboration. A list of interview respondents is given in Appendix B.
- Extensive content analysis of textual material such as declarations of intent, plans of action, progress reports, evaluation reports and audit reports.
- An additional workshop with consultants from AT Osborne provided input with regard to the discussion whether the research findings might be generalized to other sectors.

3.5. DATA ANALYSES
Both the difficulties in setting up the collaboration and the strategies to deal with these are based on empirical observations derived from three case studies. The case descriptions are given in Chapter 4. The difficulties are defined by comparing the experienced challenges in these three cases. The research elements derived from the system and actor perspectives served as the starting points for observing these challenges. Chapter 5 elaborates on the defined difficulties. On the basis of the cases, the difficulties have been ranked in terms of importance: from major to minor. For this reason, each case description concludes with a top-3-ranking difficulties.

The strategies are defined on the basis of effective approaches that are used in one or more cases to deal with the difficulties. In this way, the defined difficulties were the starting point for analyzing and defining the strategies that can be used to succeed. Considering that the strategies need to be used under specific conditions, the strategies are examined by exploring the design principles from a theoretical perspective. In this way, it is analyzed from an empirical and theoretical way in what way the public authorities can succeed in the process of setting up a collaboration in the road traffic system.
4. CASE DESCRIPTIONS
This chapter elaborates on three cases that are studied, namely the PPA project, VERDER and BEREIK! In each case, a collaboration is formed aiming to optimize the overall performance of the road traffic system in a particular region by working together with the road authorities in that area. The development of the process, the challenges that are experienced and the approaches that are used trying to solve these challenges are extensively described. Each case description concludes with some case-specific findings that are used in the further research steps. The experienced challenges and used approaches are the empirical foundation for the defined difficulties and strategies in the upcoming chapters. The cases are observed by the means of the research elements that are derived from the system and the actor perspectives. These are mentioned in the side-line to provide a structure while reading.

4.1. PPA PROJECT
The formal start of the PPA project was the decision to set up a large-scale pilot project Integrated Traffic management, which is initiated by RWS in 2004. This pilot project included the innovative measurements considered in the vision document ‘Strategy 2020’ which was formulated by RWS to develop an user-oriented network vision of traffic management. It was decided to set up this pilot project in the Amsterdam area wherefore the project is called ‘Praktijkproef Amsterdam’ (PPA project). The geographical range of the project is illustrated in Figure 4-1.

The coalition of the PPA project consists of four partners at all governmental levels; the national government, the province Noord Holland, the city region Amsterdam (Dutch: Stadsregio Amsterdam) and the municipality of Amsterdam. The national government has commissioned the PPA project what makes the Ministry of Infrastructure and Environment the formal client, whereby Rijkswaterstaat Noord Holland is the delegate client and partner in the coalition. Besides that, the ‘Dienst Infrastructuur Verkeer en Vervoer’ (DIVV) represents the city districts located in the municipality of Amsterdam since the city districts

Figure 4-1 Geographical range of the PPA project (RWS, 2012)
which are the legal road authorities warranted DIVV to be in charge of the municipal network. The involvement of the business organizations is left aside regarding the scope of the research.

4.1.1. Observed Challenges in the Road Traffic System of the PPA Project

During the start of the PPA project, it is discovered that the regular processes of some road authorities took care of the traffic control instruments in an insufficient way. According to the respondent of the province, 40 to 60 per cent of the provincial traffic control instruments (such as TDI’s, DRIP’s and VRI’s) are out of order (interview PPA/AR). This closes the door to traffic management since the instruments are necessary to control the traffic flows as illustrated in Figure 4-2. The project manager of the PPA project explained that it was a risk for the pilot project (interview PPA/RA):

“These instruments were necessary for the PPA project, but not all instruments were functioning well. We needed to solve this problem as the pilot project was otherwise not conceivable”.

Finding a solution to this problem was not straightforward. According to the respondent of the province, it is difficult to sort out the chaos as the chain of maintenance is disintegrated. This originates from that fact that purchases in the traffic management discipline need to be outsourced separately. An example is given to explain this. For instance, it is decided to purchase a new DRIP as it is demanded by the traffic management discipline. This discipline organizes the procurement and the realization of the DRIP and puts it under municipal control. The municipality receives a budget and subsequently outsources the maintenance of the DRIP to a contractor. Two months later, three TDI’s are purchased as well. However, these need to be outsourced once again since it is not allowed to place these under the existing contract of the DRIP due to the procedures according to the framework agreements (Dutch: raamcontract). This framework is determined to anticipate on ‘truck systems’ (Dutch: winkelnering) which

Figure 4-2 Use of traffic control instruments for traffic management (Hoogendoorn, Kooten, Landman, & Schreuder, 2012)
may provide absolute power to one contractor. For this reason, the new TDI’s are placed under a new contract. Bearing in mind that the province has 500 traffic control instruments, this creates an enormous amount of contracts with diverse contractors, under differing agreements and for other time spans.

Many road authorities lack the overview which may be one of the reasons that traffic control instruments are insufficiently maintained. To deal with this situation, the project organization ‘took’ the necessary instruments under own control for the time span of the project. This had to be done in consultation with the formal road authorities. According to the respondent of the province, some facts were helpful to convince the road authorities to cooperate with this approach. RWS had a powerful position in the collaboration since they were the main financer of the project, there was political engagement to the project which probably helped to contribute towards the pilot and some road authorities were even in ignorance of their possessions (interview PPA/AR). These facts gave the project organization a powerful position to ‘claim’ the authority over these traffic control instruments to update them in the interest of the project.

A field of tension is felt between the two functionalities of traffic management and ‘infraproducing’. Traffic management is mainly concerned with the use of the roadways while the department ‘infrastructure’ is responsible for the conditions of the roadways. The respondent of the province, who is mainly concerned with traffic management, explains this as follows (interview PPA/AR):

“Actually, I lay it on thick, we get in each other’s ways all the time. We want the roadways to be open to control the traffic flows as best as possible, but they want the roadways to be accessible for maintenance activities”.

Both respondents of the province and the municipality explain that the roles corresponding to both disciplines are laid down with other departments in the organizations since the functionalities of both disciplines are conflicting. Both stated the importance of having an own role to operate. In both the municipality and the province, traffic management had become a full department next to instead of under the maintenance department in both public authorities (interview PPA/DM and PPA/AR). A third department higher in ranking makes the trade-off between the objectives that are strived by the separate systems.

The road authorities are dependent of each other in controlling the road traffic system in the Amsterdam area. The traffic is managed by three traffic control centers, namely those of the province, municipality and RWS. It is not likely to merge the three traffic control centers into one collective traffic control center as relinquishing control over the own set of instruments is a
sensitive topic. The respondent of DIVV indicated that it is important who sits at the controls (interview PPA/DM).

Before the PPA project started, a joint control strategy was already developed in the context of the project ‘Verbeterde Doorstroming Ring A10’ (‘VDA10’). This control strategy is designed together with the same coalition partners namely the municipality Amsterdam, the City Region Amsterdam, the Province Noord Holland and RWS. The control strategy implies that priorities are given to the roadways to determine where the accessibility on the roadways is aimed to improve and on what roadways the traffic flows can be buffered. In this way, the traffic is spread over the road traffic system as a whole. While aiming to improve the accessibility on the Amsterdam beltway, buffer agreements had to be made between the road authorities to prevent that the side-effects get out of control. Making the connection between the separated system parts has been a challenge in the PPA project. The respondent of DIVV explained the approach during this phase as a growth model. The necessary parts were connected step by step instead of everything outright. As RWS requires the assistance of the municipal roadways, the traffic controller of the municipality is informed. The traffic controller still decides whether the request is accepted and which scenarios are used at the municipal roadways (interview PPA/DM). Without relinquishing control, interaction between the traffic control centers is enabled in this way.

The VDA10 strategy formed a basis for the control strategy in the PPA project, although the PPA project is innovative in developing a proactive traffic management approach which is in contrast to the reactive character in the VDA 10 project. The innovative nature of the PPA project partly demonstrates the high complexity present in the collaboration (interviews PPA/DM and PPA/RA). Up to now, traffic management has always had a reactive character and not a predictive character. At this moment, the algorithm is written by the Delft University of Technology. The outcomes are not yet tested and the precise effects are therefore still not clear. This challenged the collaboration as the control strategy had to be approved by the city districts of Amsterdam who are formally responsible for traffic management. The city districts were not familiar with the network oriented control vision. Organizing traffic management across the boundaries of the road authorities was very new to them. The respondent of DIVV (interview PPA/DM) confirmed the hindering effect of this lack of understanding. DIVV dealt with this situation by ‘retranslating’ the system effects to the interests of the road authorities. To the opinion of DIVV, simulation models can support this process. These models may clarify the different kind of effects by showing the general effects in the region while also zooming in on more local parts of the system.
4.1.2. **Observed Challenges in the Multi-Actor Network of the PPA Project**

RWS is the initiator of the PPA project, but the project manager explains that the organization was aware that this project couldn't be executed without the participation of regional partners (interview PPA/RA). A collaboration had to be formed to involve the road authorities in the Amsterdam area. The project manager explains this situation as follows (interview PPA/RA):

“When it comes to the crunch, RWS is not allowed and able to pull the strings in the municipal part of the system. (...) In this way, RWS is dependent of the municipality of Amsterdam.”

The partners of the PPA project were already collaborating in the so-called “Regieteam”, which provided a foundation for the collaboration. According to the project manager of the PPA project (interview PPA/RA), the previous history between the coalition partners contributed towards the forming of the PPA collaboration. The existing organizational structure is partly used to build the collaboration on, which is illustrated in Figure 4-3. In the Amsterdam area, the Regieteam is placed under the consultative body ‘DOMA’ and the administrative platform ‘PBMA’ which respectively consist of the directors and the administrators of the four coalition partners. The formal mandate of the Regieteam is unknown, but it is explained as a coordinating platform for several collaborations amongst which the PPA project (interview PPA/AR).

The participation of the coalition partners DIVV and the Amsterdam city region can be seen as representatives for groups of road authorities. The Amsterdam city region represents sixteen municipalities in the Amsterdam area. The composed coalition is illustrated in Figure 4-4. DIVV is thereby no legal road authority as well and depends on the commitment from the city districts. The respondent of DIVV (interview PPA/DM) explained that he focused to continuously involve the city districts from the start of the process as their commitment was of main importance.

*Figure 4-3 Overview of collaborations in the road traffic system of the Amsterdam area including the PPA project*
According to the respondent of DIVV, the complexity of the collaboration is mainly caused by the many public authorities and diverse interests incorporated. The complexity of the collaboration is explained as follows (interview PPA/DM):

“The involvement of the diverse coalition partners is necessary, but brought in the participation of many actors and the corresponding interests which were all to be taken in account”.

While the involvement of all public authorities was necessary, it also brought all kinds of interests into the process. The project manager (interview PPA/RA) stated that an interest which should not be underestimated is the provided budget by RWS that is used to realize the PPA project. RWS is the main financer of the project, while the other coalition partners contribute by showing effort, providing labor force and representing the road authorities in the project organization. Nonetheless, the coalition partners may individually benefit from this collective budget as well. As explained by the project manager (interview PPA/RA), the other coalition partners tried to incorporate some investments in the context of the collaboration while their individual interest was served as well. For instance, additional inductive loops in the Amsterdam road traffic system were financed by this budget. This created a willingness to participate with an eye to the budget made available by RWS.

Furthermore, some skepticism of the city districts was felt regarding the collaboration (interview PPA/DM). As previously described, DIVV was dealing with the commitment of the city districts who are the legal road authorities in Amsterdam. The respondent of DIVV explained that DIVV conquered this skepticism by clarifying the expected effects of the collaboration in relation to the individual interests of the city districts. For example, explaining the possible positive effects to some bottlenecks in their part of the road traffic system helped to convince them of the added value of the collaboration.

Figure 4-4 Coalition of the collaboration in the PPA project
The PPA project has had an extensive decision-making process starting in 2004. In the beginning of the process, RWS was discussing the scope, the funding and the timing of the project in the internal organization (interview PPA/DM). The project manager mentioned an administrative impasse around 2008/2009 since the politicians and administrators were not on the same wavelength with each other at that time. This was a period of doubts within RWS as it was indecisive about continuing the project (interview PPA/RA). The decision-making process is babbled on for some years without the occurrence of any remarkable events.

A breakthrough was realized with the formulation of a plan to completely start the project up again (Dutch: 'doorstartplan'). This plan is drawn up together with the regional partners. To the project manager's way of thinking (interview PPA/RA), it was crucial to make the plans as concrete as possible as incentive to go through the process closely together. In developing the 'doorstartplan' together, the partners had to discuss the difficulties in detail as those really occurred on the roadways. This plan is no formal governance agreement, but underlies administrative decision-making by the coalition of partners. The respondent of DIVV further emphasized the importance of such administrative decisions as it is a foundation to fall back on with the coalition (interview PPA/DM). After reaching agreement with the coalition in September 2011, this plan accelerated the speed of the process (interview PPA/RA).

During the process of decision-making, some situations occurred that challenged the relation between the coalition partners. One of these examples is given by DIVV. The municipality of Amsterdam felt once sidelined by RWS. A decision was made without consulting the DIVV. It appeared that RWS had 'another agenda' at that time. This situation is eventually discussed in a clear transparent way. The respondent of DIVV explained that this improved the relationship, which was harmed by the incident, after all. Besides assigning the occurrence of strategic behavior in such a process, the respondents emphasized the need for trust and transparency in a collaboration (interview PPA/RA and PPA/DM). A strategic game may be played, but incidents that harm the relation severely need to be avoided.

**4.1.3. CONCLUDING FINDINGS PPA PROJECT**

Realizing the PPA project is of main importance to RWS. Although the other coalition partners did not financially contribute, their interests need to be incorporated as well since the collaboration depends on the commitment of these road authorities. Seeing the challenges faced during the PPA project, a few topics are considered as important. Looking to the frequency in which the research elements are discussed, a top 3 of most mentioned challenges in the PPA project are ranked.
1. **System dependencies;** traffic control instruments are maintained in an insufficient way which closes the door to collective traffic management.

2. **Actor interests;** Individual interests of the road authorities that may be harmed can challenge the collaboration as their commitment is needed.

3. **Decision-making;** Long decision-making processes are introduced since consensus had to be reached at the administrative level of the coalition partners.

First, overdue maintenance of some road authorities hampered the collaboration to organize traffic management. While they were the only one hampered as the road authorities were operating isolation, other road authorities in the coalition are hampered in the case of a collaboration. Road authorities like the province of Noord Holland benefitted from the budget provided by RWS to update the insufficiently maintained traffic control instruments. The budget of the collaboration is used for these necessary adaptations since it is in the collective interest that the instruments are updated. Otherwise, the PPA project could not be realized.

Second, the umbrella organizations like DIVV depend on the commitment of the seven city districts since these are the legal road authorities. An understanding had to be created to provide an insight in the effects of collaboration in the road traffic system. To create this commitment, DIVV tried to establish this understanding by coupling the system effects to the problematic bottlenecks of the city districts. In this way, it is tried to show that the collaboration is in the individual interest of the city districts as well.

Third, the decision-making process muddled on for a few years since the administrators were not on the same wavelength with each other. A breakthrough is realized by together designing a specific plan regarding collaboration in the road traffic system. Developing this plan was of added value to create the necessary breakthrough as it forced the coalition partners to discuss the details together.

Remarkable is the powerful position of RWS in this coalition, which is the initiator and financer of the PPA project. Considering the fact that 'the one who pays the piper calls the tunes', this unequal power balance is perhaps created with the unequal financing structure. RWS used the collective budget provided by them to gain the commitment of the other coalition partners.
4.2. VERDER

The collaboration VERDER is focused on multiple disciplines such as public transport, infrastructure measurements and traffic management. Traffic management has an integrated program within the collaboration. By signing the covenant in 2006, VERDER is started under the name of 'pakketstudies Utrecht'. From that moment on, the coalition partners tried to work out in which way the accessibility of the road traffic system could be improved in the Utrecht area. A network analysis executed in the context of the national program ‘Nota Mobilitéit’ pointed out several bottlenecks, such as the interchange Hoevelaken. This network analysis indicated the bottlenecks at national, provincial and municipal levels for the upcoming twenty years. A collaboration between the road authorities was necessary since no one was fully in charge to solve these bottlenecks alone. The result of this process is a collaborative plan of action, including a mixed package of measurements approved on an administrative level in 2010 and a collective traffic control vision. Along the way, some challenges had to be overcome to succeed.

4.2.1. OBSERVED CHALLENGES IN THE ROAD TRAFFIC SYSTEM OF VERDER

VERDER is a collaboration that concerns the road traffic system in the Utrecht area. The sub-program traffic management focuses on effective use of the road traffic system aiming to improve the accessibility in Utrecht. However, the traffic control instruments were not always well-maintained and well-controlled (interview VERDER/JJD). Some traffic control instruments (DRIP’s, VRI’s and TDI’s) had to be bought or adapted to provide the traffic control centers with the necessary equipment to perform traffic management. These adaptations and investments are financed with the collaborative budget of VERDER.

The road traffic system of Utrecht includes several traffic control centers. VERDER aims to manage these with a region-oriented coordinating control center to organize traffic management across the organizational boundaries of the separate traffic control centers. However, the traffic control centers have autonomously developed traffic management measurements and control scenarios which are inconsistent with each other. The inconsistency implies that the measurements and traffic control scenarios cannot be used together. Besides that, a joint vision is lacking which risks the effectiveness of traffic management. For this reason, a control vision (Dutch: sturingsvisie) is designed together with the coalition partners. The respondent of the traffic management team explains that the control vision is a framework of agreements concerning the way in which the traffic flows are managed.

These agreements are starting points to control, steer and inform the traffic flows on the road traffic system in the area. Questions arise such as: ‘What are the consequences on the roadways?’ and ‘What is the delay for the road users as the result of buffering the traffic flows on some roadways?’ The control vision is designed by categorizing the roadways, which is an important
starting point of traffic management (interview VERDER/JJD). By separating the traffic flows for origin and destination, the main bottlenecks can be assigned in the area. The main question with this approach is; ‘Does the road traffic system fulfill the demand according to the traffic flows?’ In this way, it can be concluded which routes lack capacity. Besides that, it is considered to buffer the traffic flows on the municipal and provincial roadways and ‘take’ these traffic flows off the national roadways. These buffer agreements are based on the priorities determined for the roadways as illustrated in Figure 4-5.

Subsequent to the design, such a control vision had to be approved on an administrative level. Before the collaboration VERDER was formed, the road authorities in the area were not yet succeeded in designing such a framework including their diverse policy objectives. One of the program managers emphasized the difficulty to explain the effects of traffic management to the administrators (interview VERDER/ED).

“Traffic management sometimes entails that the traffic in a village is at a standstill on a municipal road way to enable other traffic flows to circulate”.

Keeping in mind that most administrators are not familiar with the effects of traffic management, the interview respondent of the traffic management program emphasized the need for gaining an understanding of the administrators. In the end, the administrators had to approve the designed control vision to receive permission for this approach of collective traffic management. In his opinion, it was necessary to transform the traffic control vision to an administrative line of reasoning by linking the system effects to the interests of the road authorities. The individual interests that can be harmed to enable collective control of the road traffic system are further discussed in the next actor-related paragraph.

Besides the challenge to collectively control the road traffic system in the Utrecht area, the effects that are exactly obtained through collaboration are hard to indicate beforehand. Such a
clarification was necessary to convince the administrators of the positive effects that traffic management can have (interview VERDER/JJD). A cost benefit analysis is used to show that the effects of traffic management are worth the investments.

Effective traffic management was also challenged as road work activities severely reduced the capacity. RWS had planned a number of infrastructure projects to extend the road traffic system in the Utrecht area. Examples are the realization of the roadway A12 and extension of the national roadway A2. Besides that, some maintenance activities are regularly performed on the roadways. Other organizations than VERDER geared all road work activities to one another at tactical and strategic level through coordination by the regional tactic team (Dutch: Regionaal Tactisch Team, RTT).

4.2.2. OBSERVED CHALLENGES IN THE MULTI-ACTOR NETWORK OF VERDER

Several interview respondents in VERDER stated that the mutual dependencies ‘force’ the road authorities to solve the assigned bottlenecks in the area through collaboration. It could not be solved with a single organization (interview VERDER/ED). This is explained as follows (interview VERDER/JJD):

"You need each other to solve the problem. Everyone organization has its own policy and wants to get something done. However, you are not the only one who is in charge".

The organizations in the region were not used to collaborate. The Utrecht area was a 'blank' area with regard to collaboration. The program manager presumed that the public authorities do not work obviously together due to the political character of the organizations (interview VERDER/ED). There are very contradicting political perspectives in the area since the city of Utrecht has normally a more left character than the provincial Executive, which is currently more right-leaning. The administrators were flatly opposed to each other and had contradicting perceptions.

Seeing the enormous amount of road authorities involved in this wide-spanning collaboration, an attempt is made to reduce the number of coalition partners. According to the program manager (VERDER/ED), the choice to incorporate umbrella organizations helped to reduce the single agreements with the individual road authorities. The composed coalition of partners is illustrated in Figure 4-6.
Considering that the participation of all road authorities is necessary in the collaboration, it was required to bring all diverse interests together in one collective program. The program manager emphasized that those interests conflicted sometimes, like the frequent struggles between the proponents for ‘concrete’ measurements and for ‘public transport’ measurements. Most organizations around the city Utrecht preferred public transport measurements since they were dealing with heavy air pollution (interview VERDER/JL). Furthermore, there was a strong left-leaning political opposition in the area that prefers ‘public transport’ measurements above ‘concrete’ measurements (interview VERDER/BJ). On the contrary, the national government and the municipality of Amersfoort were proponents for infrastructure measurements. One of the program managers emphasized the importance to keep an eye on the collective interest, but on the individual interests as well to keep the crucial organizations involved in the collaboration (interview VERDER/ED).

Extraordinary was the early confirmation of an immense budget. In 2006, the covenant was signed including the promises to provide a 3.1 billion budget of which 2.6 billion national budget and 0.5 billion regional budget. This budget is based on a rough calculation to design a complete package of measurements to solve the bottlenecks in the area. According to the program manager (interview VERDER/ED), this was an extraordinary starting point as the solutions were not yet considered and not yet designed. The 0.5 billion regional budget is provided with differing contributions by regional organizations. This distribution is illustrated in Figure 4-7. The City Region Utrecht (BRU) that administered the BdU subsidies of the area decided to ‘freeze’ the budget for the coming ten years in favor of VERDER as the collaboration provided a comparative framework to finance measurements in the region. This made it attractive to provide the BdU budget to VERDER.
So, the program had a 3.1 billion budget at one’s disposal, which had to be used according to a well-considered plan. It was decided that a mixed package of measurements had to be made. One of the main difficulties to reach consensus is already briefly mentioned. In case a measurement is taken to improve the traffic circulation by buffering certain traffic flows on the municipal roadways, the aggrieved aldermen must also give its approval while the proposed measurement is not in the interest of the municipality. An example is given to illustrate this. The aldermen of Soest was in the belief that Soest had to be appointed as economic central area (Dutch: economisch kerngebied) to get measurements in the interest of Soest. However, Soest was not appointed as economic central area and the alderman was concerned to become the drain in the area with heavy cut-through traffic. To reach an agreement about the total package of measurements, understanding had to be gained that a traffic management measurement in Amersfoort could lead to positive effects in the overall road traffic system, including the area of Soest as it reduced the amount of cut-through traffic.

The mixed package of measurements is composed in three phases. Composing the package deal started with the ‘no regret’ measurements to speed up the process from the beginning. No heavy discussions were expected regarding these measurements since these were in the interest of all coalition partners. The main discussions occurred as decisions had to be made about the complementary measurements which were expensive and concerned more far-reaching effects. To support this complex process of designing the mixed package of measurements, an objective assessment framework is designed to propose a right distribution of the collective budget. The respondent of the traffic management team stated that the assessment framework incorporated the objectives ‘we wanted to achieve’ (interview VERDER/JJD). The framework was used to

![Figure 4-7 Financial contributions of the coalition partners in VERDER (VERDER, 2010)](image-url)
assess the proposed measurements against collectively determined criteria and objectives. In this way, all proposed measurements are assessed by answering questions as 'What is the effect?', 'What are the consequences?' and 'What are the side-effects in combination with other measurements?'. The final assessment resulted in a proposed set of measurements which had to be brought to the decision-making table on an administrative level.

A decision on the mixed package of measurements on an administrative level had to be the result of the process to form the VERDER collaboration. It is chosen to incorporate umbrella organizations to minimize the organizations involved in the decision-making process (interview VERDER/JJD). Nevertheless, many public authorities were still involved. Consensus on an administrative level had to be reached in the administrative platform called the UVVB. All coalition partners were sitting around this table. But after reaching consensus, many decisions had to be brought back to the rank and file of each road authority. This delayed the process of decision-making. The program manager stated this as follows (interview VERDER/ED):

"An administrator could say, 'I'm here to make a decision, but I have no authority to do this. I have to consult my rank and file'. This sometimes resulted in the collaboration getting hostage".

An example is given to illustrate such a setting. The odd one in the coalition was the municipality of Hilversum, which created a field of tension with the province Noord Holland. It was logic to involve Hilversum in the collaboration concerning its geographical location in the road traffic system, but the budget provided by the City Region ‘Gooi en Vechtstreek’ originated from the BdU of the province Noord Holland. For this reason, the province Noord Holland wanted to be involved in making decisions. The program manager emphasized that the relations with the administrators in Noord Holland were good and coupling the issues to the objectives of both parties worked in his opinion, but it challenged the decision-making sometimes.

As explained by the program manager (interview VERDER/JL), two important instruments are approved on an administrative level beforehand to manage the process of decision-making. Those are a milestone-planning and the objective assessment framework. The program manager emphasized the function of those instruments to provide structure (interview VERDER/JL):

"The milestone-planning and the objective assessment framework provided structure during the process to focus on making progress while keeping an eye on the content".

Using these instruments, a proposal was first made to show what measurements objectively fit. But besides indicating the potential successful effects of measurements, the program manager also emphasized the importance to examine whether the measurements were also feasible regarding the political character in decision-making. The package deal is therefore finally
composed with an ‘administrative puzzle’. This approach implied a shifting in the proposed measurement package of approximately 10 percent. In this way, a final package could be made which enabled each administrator to explain the decision to their rank and file. Taking in account that each coalition partners needed something ‘to go home with’, some ‘change’ is necessary to reach consensus about a final package of measurements.

Considering that all coalition partners provided a financial contribution to the collaboration, it must be kept in mind that each one also tried to make the most of it in own interest (interview VERDER/ED). An example is given to illustrate the influence of such behavior. In relation to the immense financial budget, the respondent of the traffic management program is upset with the attitude of RWS in the collaboration (interview VERDER/JJD).

“The national government wanted to have an influence on the way the budget was spent since they were the main investor in the collaboration. In my perception, such an attitude is against the notion of collaborating”.

The same respondent emphasized the pleasant collaboration with the regional partners of RWS and the traffic control centers, but to the respondent’s opinion the national layer was focused to leave one’s mark on the collaboration.

Another potential incident occurred in relation to a political game played by the national government as explained by the program manager (interview VERDER/ED). The national government preferred a robust roadway through Leidsche Rijn as an alternative to get to the national roadway A12 in case of a deadlock on the national roadway A2. This had to be discussed during a meeting since this proposal was not appreciated by public authorities in the Utrecht area. However, a press release with the decision in favor of the national government was send before the meeting was finished. In the end, the decision is corrected afterwards to please everyone since this incident harmed the trust relation in the collaboration severely.

Another challenge was the tendency of administrators to question already made decisions. During the process of composing the mixed package of measurements, the position of the aldermen in Utrecht changed the coalition due to the fall of the municipal bench. The program manager (interview VERDER/ED) explained that he tried to prevent new discussions by pointing to the objective assessment framework that was already approved on an administrative level. In this way, he tried to stick the administrators to the previous made decisions.

“I could constantly point out the objective assessment framework: ‘These measurements are assessed against objectives that you approved’.”
This approach worked, but the effect was short-termed. After the mixed package of measurements was formally approved in 2010, the administrators are still trying to put these decisions to discussion (interview VERDER/ED). Nowadays, the municipality of Utrecht questions some of the chosen measurements since the current bench of Mayor and Aldermen is politically more left-oriented than the more right-leaning bench during the decision-making phase in VERDER.

Sometimes, the feelings in the collaboration were running high and these needed to be calmed by the program managers to prevent severe incidents from happening. An approach to solve particular potential incidents was the escalation model explained by the program managers. The initial approach is to reach consensus among the public servants, but escalation to the administrative level is seen as necessary as an agreement is not reached. New solutions are created by involving the administrators. However, involving the administrators ‘without doing your homework’ is not appreciated. The program manager therefore emphasized the importance for limited use of this approach.

4.2.3. CONCLUDING FINDINGS VERDER

VERDER is characterized by many challenges in the multi-actor network of the collaboration. The interview respondents mainly elaborated on the interests, the mutual dependencies and the behaviour of the actors. The most mentioned difficulties in VERDER are:

1. **Actor interests**: Road authorities need to solve the bottlenecks in the road traffic system together, but all coalition partners have other individual interests.

2. **Decision-making**: Decision-making on an administrative level implied that each pulse had to be tested by the rank and file of every organization that was sitting around the table.

3. **Actor behavior**: Changes in the coalition due to political dynamics lead to the tendency of questioning already made decisions.

Unique in VERDER is the immense budget that is confirmed early in the process. While this can be seen as a flying start for the program, it also gave the collaboration a political character. Each of the coalition partners financially contributed to the collaboration, but preferred to see something in return for its own individual interests. Besides that, the broad geographical range of the program involved many road authorities. Ten coalition partners represented more than thirty road authorities, whereby the commitment of each public authority was needed for the collaboration due to the dependencies. This implicated that the decision-making process became very extensive, which is referred to as the excessive layers of government that took the collaboration in hostage sometimes. Furthermore, regular elections at three governmental levels
and the incidental fall of the municipal Bench in Utrecht hampered the process as it resulted in changes in the coalition. Although it was tried to stick the administrators to previous made decisions, their formal position allowed them to put these to discussion again. While the complexity in the road traffic system was also recognized, the main challenges were faced due to the complexity in the broad network of road authorities.
4.3. BEREIK!

The collaboration BEREIK! enclosed the road traffic system in the Rotterdam and the Hague area. The coalition partners are the municipalities of The Hague and Rotterdam, the city region Rotterdam (Dutch: Stadsregio Rotterdam), the city region the Hague (Dutch: Stadsgewest Haaglanden), the province of Zuid Holland and Rijkswaterstaat (RWS) as road authority of the national road ways in the area. Only the four last mentioned coalition partners provided a financial contribution to the collaboration, but all contributed by providing labour force. This coalition is illustrated in Figure 4-8. While the administrative agreement includes an infinite duration for the collaboration, the program contains budget for the upcoming two years. This financing structure originated from the previous collaborations on the road traffic system in this region.

In 2008, BEREIK! came into being through the combination of two former collaborations Nexus and SWINGH. Nexus found its origin in the Rotterdam area, while the road authorities in the Hague area set up SWINGH. Both collaborations focused on improving road management in their part of the road traffic system. Nexus included the initial platform to organize traffic management together, whereby road authorities of the Hague area joined the platform of Nexus while they were no coalition partners yet. This platform was called 'DVM Zuidvleugel' and provided the foundation for BEREIK!. This case description elaborates on the process of developing BEREIK! towards the current plan of action to organize the road traffic system together with these six coalition partners.

4.3.1. OBSERVED CHALLENGES IN THE ROAD TRAFFIC SYSTEM OF BEREIK!

One of the main challenges was that the main part of the traffic control instruments were not up-to-date and compatible (interview BEREIK/RB). The sets of instruments strongly differed between the individual road authorities since they developed their control systems by themselves. As stated by the respondent of the province (interview BEREIK/TA), it would be an
ideal situation to form a collaboration by starting on a new topic without preceding developments within the road authorities, but such situations are very rare. Nevertheless, the functionality of the traffic control instruments had to be updated to enable collective traffic management. The program manager explicitly stated that maintenance of the traffic control instruments is generally one's own responsibility (interview BEREIK/MS). The road authorities have the task to bring the traffic control instruments up-to-date to a sufficient level of functionality. However, the program manager also explained that collective budget is used to realize the necessary adaptation of some traffic control instruments (interview BEREIK/MS). This collective budget was gathered by the coalition partners from several governmental investment programs.

In line with the dependencies, it is stated that the execution of collective traffic management is dependent on the discipline of ‘infraproviding’. Maintenance activities are normally not financed by BEREIK!, but some exceptions are made in the collective interest to perform traffic management together (interview BEREIK/MS). Furthermore, a conflict is experienced in gearing the traffic management and the road work activities to one another since the road capacity is reduced by the maintenance activities. For this reason, a coordinating platform ‘Regioregie’ is set up since January 2013. ‘Regioregie’ coordinates the road work activities and some incidental events with traffic management activities in the area. These incidental events are regarded as planned disruptions which are also needed to be taken in account. According to the program manager (interview BEREIK/MS), it is thought to gear these schedules with each other.

To realize traffic management together in the area of the Hague/Rotterdam, four traffic control centers had to be coupled to enable interaction between the systems. The four control centers are owned by Rijkswaterstaat, the province Zuid Holland and both municipalities Rotterdam and The Hague. Without collaboration, those traffic control centers would act independently and would only optimize the traffic flows on the road ways that are assigned to their own control center (interview BEREIK/TA). The design challenge to realize the interaction between the separate designed systems is stated as one of the most complex difficulties (interviews BEREIK/RB and BEREIK/TA).

A coordinating control center ‘Regiodesk’ is initiated by BEREIK! to execute collective traffic management since September 2011. Such a coordinating control center has the function to coordinate the traffic management performed by four different control centers. In this way, traffic flows are controlled transcending the organizational boundaries of these four road authorities. The ‘Regiodesk’ is not warranted with full control over the traffic control centers, but only interaction with and between the centers is realized. This interaction enables the
The exchange of information which is used to gear the traffic management activities to one another. The collective control is executed according to the agreements in five tactical frameworks that are designed in relation to five subareas in the province Zuid-Holland. Subsequent to the tactical frameworks, control scenarios are designed for particular defined bottlenecks in the road traffic system. The tactical frameworks and control scenarios are designed collectively with the coalition partners. The control scenarios include conditions and preconditions to organize traffic management together and joint consensus had to be reached on these agreements on an administrative level (interview BEREIK/RB). An additional advantage of joining forces, as explained by (interview BEREIK/TA), is the enlarged labor capacity and expertise to realize 24-hour manning for example.

Several interview respondents mention the difficulty to determine what the benefits are of the collaboration (interviews BEREIK/TA, BEREIK/MS and BEREIK/JHB). The advantages of collaborating were not always clear to the coalition partners. For instance, financial means must be provided to switch from part-time to full-time manning of the traffic control center, but it is questioned whether the investments are worth the money. The program manager (interview BEREIK/MS) explained that it had to be figured out at what point collaboration could result in benefits and at what point it is better to continue alone. It is tried to create this insight by a quantitative description performed by a third party.

Besides the challenge to determine the effects of collaboration, it is also mentioned that the insight in the effects is important. The interview respondent of the province emphasized the importance of a clear to define result of the collaboration as follows (interview BEREIK/TA):

"Collaboration becomes very difficult if you cannot describe a clear defined result stating what you are doing together and which result you are aiming to achieve".

A clear defined end result is seen as a necessity since working without a goal is not motivating to the collaboration. For instance, the collaboration on innovation is put to a halt since the effects were unclear and disappointing. On the contrary, the effects of collective traffic management were clearly noticeable in the form of less heavy traffic. According to the interview respondents, this part of the collaboration is also regarded as successful.

4.3.2. Observed challenges in the multi-actor network of BEREIK!

The coalition consists of six coalition partners of which the two municipalities, the province Zuid Holland and RWS are road authorities and the City Regions of the Hague and Rotterdam are umbrella organizations. The road authorities are dependent on each other since measurements in Rotterdam have effects for the roadways in the Hague and the other way around. The interview respondent of the province explains this dependencies in a clear way:
"Provincial roadways are loose interdependent entities that are sometimes connected, but not in a coherent system. The provincial road traffic system only comes alive in combination with the municipal and national roadways."

Furthermore, the collaboration is dependent on the set of traffic control instruments owned by some road authorities who are no coalition partners or not represented by one of them. An example related to traffic lights is given by the respondent of the province (interview BEREIK/TA). These traffic lights are not owned by the coalition partners but are required for collective traffic management in the spanning area. Including these road authorities in the coalition was not preferred since an additional partner also changes the distribution of the financial contributions by the coalition partners. However, access onto these traffic lights was required. In exchange for access onto these traffic lights, the insufficient maintained instruments are updated with the budget of the collaboration.

The necessity to collaborate is thereby not felt as the activities are well-performed by an individual road authority in isolation. The province dealt with slipperiness on the roadways in a professional way and was not willing to collaborate on this activity. The interview respondent of the province (interview BEREIK/TA) explained that the added value to collaborate is not seen as it is already well organized. Setting up a collaboration on this activity would not serve the individual interest of the province and only give discussion without additional benefits. The interview respondent of the City Region Rotterdam explained the situation as follows:

"Setting up the collaboration for other topics was not as beneficial since some road authorities were under the impression that they could do without it."

Besides the attempts to collaborate on dealing with slipperiness on the roadways, BEREIK! also tried to work together on management of transport choices (Dutch: mobiliteitsmanagement). This implies that it is tried to influence the choice for the means of transport made by road users together. According to several interview respondents (interviews BEREIK/RB and BEREIK/MS), this attempt to collaborate did not work out since the interests, visions and characters of the cities Rotterdam and the Hague differed to a large extent. Based on a rough estimation, it is thought that Rotterdam had a budget of 40 million in comparison with a 1 million budget of the Hague to this topic (interview BEREIK/RB). This may symbolize the different priorities laid down by the municipalities.

As the interests strongly differed and the harbour of Rotterdam was extending, the coalition partners originating from Rotterdam initiated an additional collaboration. This collaboration is called 'De Verkeersonderneming' and also aimed to improve the accessibility of the Rotterdam
area in relation to the Rotterdam harbour. This became an important point of discussion in BEREIK!, because it was questioned what the purpose of BEREIK! was in relation to this topic. The coalition partners originating from the Hague area were dependent on BEREIK! to set up the collaboration for managing the transport choices made by road users, while the coalition partners originating from the Rotterdam area organized it independently from BEREIK! in ‘De Verkeersonderneming’. After a while, it was decided to bring the collaboration on this topic to a halt.

Nonetheless, BEREIK! succeeded to set up the collaboration on traffic management. The interests differed, but making these individual interests explicit during the process seemed to be effective. As mentioned by the program manager, it is aimed to avoid conflicting interests and focus on the interest of the road user to improve the traffic circulation on the road ways. This can be regarded as the collective interest in the collaboration.

As mentioned before, the collaboration of BEREIK! is characterized by many scope changes. BEREIK! started with a broad description of possible topics to collaborate aiming to discover the beneficial possibilities for collaboration (interview BEREIK/JHB). However, collaboration on innovation, management of transport choices and maintenance activities is brought to a halt in the course of time. From the first year onward, the collective plan of action is substantially changed each year. The program manager (interview BEREIK/MS) explained this as follows:

“The adaptations in the annual plans of action were the result of new insights that occurred in the course of time and the felt need to jump on all sorts of new technical and political developments”.

Besides that, another explanation is given by the interview respondent of the City Region Rotterdam (interview BEREIK/RB). The same coalition partners were assembling in diverse compositions for diverse collaborations. This led to new topics that were added to the agenda, because the public authorities involved were already sitting around the table. During the process, the program manager was told to focus the collaboration on the existing scope without adding new topics. It was thought that the scope of the collaboration otherwise could conflict with other collaborations in the area. BEREIK! is now mainly focused on traffic management.

Administrative approval was necessary to put the traffic control scenarios into action. This public support was not always guaranteed by the rank and file of the road authorities, as explained by the interview respondent of the City Region Rotterdam. It is tried to gain the public support for all topics of the initial broad scope. After more than two years, it became clear that the rank and file was limited interested and it was accepted to bring some parts of the collaboration to a halt (interview BEREIK/RB). In the course of time, new elections led to new
administrators which were all part of the right-leaning political party VVD. This development contributed to gain public support for BEREIK!.

At last, the extensive process of decision-making is regarded as an important barrier for collaboration. The commitment of all involved road authorities was necessary to get administrative approval. The City Regions of Rotterdam and the Hague facilitated the decision-making with these road authorities that were not involved as coalition partner (interview BEREIK/RB). The interview respondent of the province emphasized the complexity to collaborate with other public authorities as follows (interview BEREIK/TA):

“It is easier to make a contract for ten million euros with a building contractor, than trying to reach an agreement with public authorities to collaborate for a hundred thousand euros”.

The complexity lies with the extensive decision-making process to collaborate with public authorities. To the opinion of this interview respondent (interview BEREIK/TA), this is caused due to the limited mandates of public authorities at official level. Extensive preparation was required to gain administrative approval in the diverse consultations. The collective plans must be prepared by the public servants before bringing it to the administrative decision-making table. Initially, an intermediate platform named ‘Ambtelijke Beraad’ was initiated as coupling between the public servants and the administrators, but this is brought to a halt since it made the decision-making process even more complex.

4.3.3. **CONCLUDING FINDINGS BEREIK!**

A formal administrative agreement provides the basis for the collaboration and the positions of the coalition partners are regarded as equally important. It is regularly stated that each organization works in the collective interest to improve the road traffic system in the interest of the road user. The most mentioned difficulties in BEREIK! are:

1. **Actor behavior**: The scope of the collaboration continuously changed due to topics that were added on the agenda, adaptations as result of new insights that occurred in the course of time and the felt need to jump on all sorts of new developments.
2. **Interests**: Collaboration don’t get off the ground as some road authorities are not convinced of the useful purpose of the collaboration
3. **Decision-making**: The necessary support on an administrative level was sometimes lacking to make formal decisions with regard to the collaboration.

While the positions of the coalition partners are observed as equale and the aim is stated to focus on the collective interes, a focus in the scope of the collaboration lacked for a long time. Unique in this collaboration is the continuous scope changes. The collaboration started with a
broad description of possible topics to collaborate, but focus nowadays mainly on collective traffic management. The collaboration on some topics is brought to a halt since the road authorities were not dependent on each other to operate these specific activities together.
5. Defined difficulties

The empirical observations and findings of the three extensively described cases provides the foundation for the difficulties that are defined in this research. The aim of this chapter is to list and evaluated the difficulties that need to be overcome to succeed in setting up a collaboration. In section 5.1, the defined difficulties are more abstractly described than in the case descriptions to show at what level the cases come together and show overlap. The observed challenges differed for each case in detail, but some overlap is clearly recognizable at a higher level. Seeing the impact of some choices that are made in the initial phase of the process, two main dilemmas are additionally described in section 5.2. Section 5.3. includes an evaluation to determine the relative importance of the difficulties. These are ranked from major to minor.

5.1. Defining the difficulties

The defined difficulties are numbered and summarized in Table 5-1. Except the unique difficulty (number 8), those difficulties are all observed in the three cases although sometimes at another level of detail. While number 8 contains a challenge that is only experienced in BEREIK!, it is listed since the important implications it has for this particular case. Eight different research elements derived from both the actor and the system perspective are observed, but difficulties are defined for only seven. Additionally, an important note is made to the actor dependencies.

<table>
<thead>
<tr>
<th>Research element</th>
<th>Difficulty</th>
</tr>
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<tbody>
<tr>
<td><strong>System-related difficulties</strong></td>
<td></td>
</tr>
<tr>
<td>System dependencies</td>
<td>1. Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.</td>
</tr>
<tr>
<td>System functionalities</td>
<td>2. The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.</td>
</tr>
<tr>
<td>System behavior</td>
<td>3. The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.</td>
</tr>
<tr>
<td>System performance</td>
<td>4. The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.</td>
</tr>
<tr>
<td><strong>Actor-related difficulties</strong></td>
<td></td>
</tr>
<tr>
<td>Actor interests</td>
<td>5. The individual interests of the road authorities may become inferior to the collective interest of the collaboration.</td>
</tr>
<tr>
<td>Actor behavior</td>
<td>6. Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.</td>
</tr>
<tr>
<td>Actor behavior</td>
<td>7. Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.</td>
</tr>
<tr>
<td>Actor behavior</td>
<td>8. The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.</td>
</tr>
<tr>
<td>Decision-making</td>
<td>9. Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.</td>
</tr>
</tbody>
</table>
5.1.1. **System-related difficulties**

Based on the research elements derived from a system perspective, four difficulties are defined to illustrate the system-related difficulties that are faced during the process. The origin of each difficulty is given in relation to the cases and a brief description is provided.

**Difficulty 1: Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.**

The realization of collective traffic management is disabled as the traffic control instruments are insufficiently maintained by some road authorities. All cases experienced this challenge of overdue maintenance, especially in the PPA project. Traffic management uses those traffic control instruments (such as DRIP’s, TDI’s and VRI’s) to control the traffic flows in the desired way. For instance, a TDI had to be well maintained by its road authority to guarantee its functionality. The traffic control centre can otherwise not use the TDI to provide a well-balanced inflow of traffic on the roadways. However, the road authorities are individually responsible to maintain the functionalities of their equipment and sometimes lack this task. In the process of setting up a collaboration between the road authorities, it can be questioned who is going to repair the equipment to enable the collective traffic management.

**Difficulty 2: The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.**

By executing their activities, the functionality ‘infraproducing’ fences off parts of the road traffic system to perform maintenance activities, but thereby limits the road capacity detrimental to the functionality of ‘traffic management’. The severe reduction of capacity by road work activities to maintain the roadways challenges the traffic management tasks to optimize the traffic circulation on these roadways. This may sound trivial, but it is stated this way to emphasize the challenge of optimizing the overall system performance. Both functionalities are the responsibility of the road authorities, but optimizing both entails that other objectives are pursued. This may challenge the collaboration since it hampers to reach consensus about the optimal use of the road capacity.

**Difficulty 3: The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.**

In isolation, all road authorities were allowed to set up their own organizational structure and procedures with self-reliant objectives. But when traffic management is organized together across the organizational boundaries, the autonomously developed traffic control scenarios are likely to conflict. Each case enclosed a geographical range in which the traffic flows were managed by multiple traffic control centers. It is not likely to merge the three traffic control
centers as relinquishing control over the own set of instruments is observed as a sensitive topic. Some synchronization can therefore not be avoided while aiming to collaborate to control the road traffic system together.

**Difficulty 4: The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.**

A collaboration in the road traffic system implies a certain extent of interaction between the separate parts managed by individual road authorities. This implies additional couplings as the single systems cannot operate in isolation anymore, but need to interact. The many additional direct and indirect causal relations may hamper to gain a precise insight in the effects of collaboration due to the increasing complexity of the road traffic system. Questions arise such as what may be the positive and negative implications for the coalition partners and whether their investments will be worth the collaboration? While this difficulty is observed in all cases, this challenge resulted in bringing the collaboration on some topics to a halt in the specific case of BEREIK! since the effects were hard to clarify.

5.1.2. **Actor-related Difficulties**

The following difficulties are based of empirical observations on the research elements derived from an actor perspective. No difficulty is assigned to the element of actor dependencies, but a special note in the next paragraph is made to explain the related findings. The element of actor behavior showed a diversity of difficulties which explains the definition of three difficulties related to this research element.

**Difficulty 5: The individual interests of the road authorities may become inferior to the collective interest of the collaboration.**

It is found in all cases that a difficulty includes the challenge that the individual interests of some road authorities may become inferior while setting up a collaboration. An example is given to make this difficulty more explicit. Optimizing the overall performance of the road traffic system is in the interest of the collaboration. Solving the bottlenecks in the road traffic system required a joint approach, but collective traffic management implies that traffic flows are buffered on some roadways to stimulate high traffic circulation at other roadways. Since these roadways are assigned to the responsibility of various road authorities, this implies that some individual interests are harmed while striving for the collective interest of the collaboration. Considering the necessary commitment of each road authority, it is presumed that the individual interests of the road authorities all have to be incorporated in the collaboration.
Difficulty 6: Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.

It is experienced in all cases, especially in VERDER, that changes occur in the composition of the coalition due to political dynamics. These changes are the result of political elections, the fall of a municipal, provincial or national government or individual changes on the position of the administrators. Although occurrences at the individual level do not fit to the scope of this research, it is relevant in this context since a change on an administrative level may change the political colour present in the coalition as well. The political colours represented in the coalition might thereby have an influence on the perspective taken by the administrator on decisions. A collaboration that involves road authorities at municipal, provincial and national level is subject to three elections in four years as all governmental levels have elections at other moments. These elections provide short intervals of stable public support for the collaboration on an administrative level since the new administrator may try to bring previous made decisions up for discussion.

Difficulty 7: Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.

A common difficulty that is found in the cases is the presence of some incidents that are sometimes caused by strategic behaviour. Regarding those incidents, interview respondents refer to hidden agendas of other coalition partners, coalition partners who impose their own view on the collaboration or situations in which a coalition partner does not lay all their cards on the table. Such incidents harm the trust-relationship. However, this trust-relationship is stated as necessary in all cases and needs to grow during the process. This conflict of trust and strategic behaviour can be a difficulty to the process given the translated Dutch saying: “Trust comes on foot, but leaves on horseback”.

Difficulty 8: The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.

Different from the other cases, BEREIK! adapts its ‘plan of action’ annually due to topics that were added on the agenda, adaptations as result of new insights that occurred in the course of time and the felt need to jump on all sorts of new developments. Continuous scope changes are very common in the collaboration. In the course of time, topics were added on and removed from the agenda on purpose. On the one hand, this approach creates the flexibility to add the plan of action to particular development that arise along the process. It can therefore be discussed whether this is a difficulty or not. But on the other hand, it is observed that these scope changes also create a certain restlessness as the collaboration’s scope changes each year.
Difficulty 9: Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.

The decision-making on an administrative level introduces long decision-making processes. When a decision is made by the coalition partners, it is given to their rank and file to confirm their commitment to a proposed decision. In this way, just one coalition partner has to reject the proposed decision to force the coalition ‘to go back to square one’ and start all over again. This difficulty is particularly experienced in VERDER, stating that the excessive layers of government sometimes hold the collaboration in hostage.

5.1.3. Special note: Actor dependencies

It is presumed that the presence of actor dependencies creates the necessity to collaborate together to improve particular bottlenecks in the road traffic system. Knowing that no public authority has the full authority, the collaboration are formed since improving the road traffic system in a particular region implies the involvement of many road authorities. Each road authority namely owns a part of the road traffic system. On the contrary, setting up a collaboration without being dependent of each other is also tried in the case of BEREIK!. Diverse intentions to collaborate on particular topics in the road traffic system did not survive along the process. Those intentions did not lead to a collaboration. The relations between the coalition partner became weak as it was not necessary to work together. It is therefore stated that actor dependencies not only create the necessity to collaborate, but are also a necessary strong foundation to build the collaboration on.

5.2. Common dilemmas in the initial phase of the process

By analyzing the three cases, it is found that some topics bother the process of forming a collaboration. These dilemmas differ from difficulties as the dilemmas implicate a choice between two alternatives with both belonging advantages and disadvantages. Those topics are no difficulties that need to be overcome to succeed the process, but are choices that have to be made in an early phase of the process.

A. Involving umbrella organizations as representatives of groups of road authorities

Composing a coalition with or without umbrella organizations is the first dilemma that may be considered. In all cases, the coalitions of the partners are composed with umbrella organizations as representatives for groups of road authorities. On the one hand, it reduces the number of participants and thereby simplifies the decision-making. Less organizations are sitting around the conference table which enables the coalition partners to reach consensus more easily. But on the other hand, the umbrella organizations are actually small collaborations within a collaboration which is deteriorating the already excessive layers of government. It implies an additional step in the process of decision-making. The umbrella organizations are namely no
formal road authorities and are dependent of the commitment of the represented road authorities (and their rank and file) since they are the one who are legally in charge to make formal decisions.

**B. Financing structure of the collaboration**

Three options are observed in choosing a financing structure since all three case studies are organized in another way.

I. One coalition partner is the main investor, the other coalition partners contribute in other ways than financial means. For instance, by providing work force.

II. All coalition partners provide a financial contribution to the collaboration, but these contributions are unequal and may be with large differences.

III. All coalition partners provide a financial contribution to the collaboration and these contributions are almost equal.

Each choice for a particular financing option has different pro’s and con’s. The first option may simplify the process of reaching agreement considering that ‘the one who pays the piper calls the tunes’. But it may have an important implication for the balance of power in the coalition. In the PPA project, RWS gained a very powerful position as initiator and financer of the collaboration. Otherwise, a financing structure can be arranged with financial contributions of all participating organizations. This may realize an atmosphere of all partners participating in the collaboration. This can be realized with unequal or equal contributions. Option II implies a financial structure with unequal contributions, which can be compared with the VERDER case. Although a financial contribution may involve the coalition partners in a more intense way, the unequal financial contributions implies a difference in the positions of the involved authorities. The BEREIK! case initiated a financing structure with almost equal contributions of the coalition partners, which may have resulted in the equally valued positions.

The choices incorporate a trade-off since the alternatives all have other beneficial or adverse consequences. It is thought that these dilemmas can not be effectively conquered with strategies like the difficulties, but the possible implications of the choices need to be taken into consideration during the process. A theoretical exploration of these dilemmas in the upcoming chapter may help to make this trade-off.

**5.3. Evaluating the difficulties**

Considering that the difficulties are probably not of equal importance, the difficulties are evaluated on two axes. First, the gravity of the consequences is examined by analyzing what the implications are as the difficulties are not conquered. The consequences are ranked as vital, significant or moderate. Second, the frequency in which the difficulties occur is determined by
observing how often the respondents brought the topic up during the interviews. It is thereby examined whether all cases recognized these difficulties or just one case mentioned it. Difficulties that have a high gravity of consequences and are frequently mentioned in all cases are ranked as major difficulties, while minor difficulties have moderate consequences and are not frequently mentioned.

The difficulties are evaluated against two questions. 1) What is the gravity of consequences for the process as the difficulty is not effectively conquered?, and 2) To what extent do the interview respondents give attention to these challenges? The input for the evaluation on this second question is provided by the concluding findings of the case descriptions, namely the top 3 rankings. The foundation for the evaluation on the gravity of consequences is described in this section. The ranking is illustrated in Figure 5-1.

![Figure 5-1 Relative importance of the difficulties](image)

The gravity of consequences is evaluated with regard to the process of setting up a collaboration in the road traffic system. As the difficulty is evaluated as ‘vital’, it implies that not conquering this difficulty can have a decisive effect on the process. The process may not be possible to succeed as collaborating in the road traffic system may become very hard without solving it. It is expected that the following difficulties have vital consequences for the process. First, the commitment of the coalition partners to collaborate may come into danger as the individual interests become inferior to the collective interest (difficulty 5). In case this happens, the process is brought to a halt since the collaboration is dependent on the participation of all coalition partners. Second, collective traffic management is technically seen impossible as the traffic
control instruments cannot be used because of overdue maintenance (difficulty 1). Besides that, commitment of the coalition partners on an administrative level is a necessity to the support for the collaboration (difficulty 6). Without the commitment of the administrators, the decision-making process can be brought to a halt since they are the one who are formally in charge. The public servants are namely not warranted to collaborate with other public authorities in a formal way. Last, incidents due to strategic behavior severely harm the trust-relationship within a collaboration (difficulty 7), which may result in a ‘free fight’. The consequences can be that each coalition partner is going to strive for maximum gain in its own interest, without keeping an eye on the collaboration. Significant consequences are not necessary to solve, but still very important. It is expected that these difficulties cannot prevent the set-up of the collaboration, but the process can be severely hampered by this difficulty. In case the scope of the collaboration keeps changing in the course of time (difficulty 8), it can has beneficial or converse effects. On the one hand, it realizes some flexibility to adapt the collaboration to external developments. On the other hand, it may hamper the process to reach a final decision. The probable consequences for not reaching an overlapping approach for joint system control (difficulty 3) can be significant, but only interaction by information-sharing between the traffic control centers may also be sufficient to synchronize the used scenarios.

The difficulties with consequences evaluated as moderate are preferable dealt with, but no heavy consequences are likely to happen otherwise. While a decision-making process that is muddling through is not preferable (difficulty 9), it may only has implications for the lead time of the process. It is thereby assumed that consensus is still reached, but only took more time. In case no consensus is reached to incorporate both conflicting functionalities like ‘traffic management’ and ‘infra-providing’ (difficulty 2), it can thereby be chosen to only include one of the functionalities in the collaboration. This does not necessary implicate that the region of the collaboration has to be adapted. Furthermore, the coalition partners may prefer to make decisions during the process based on calculated expectations (difficulty 4). But the implications of not fully knowing the effects beforehand is limited, as long as the coalition partners still intend to collaborate. It is presumed that the effects are learned along the way.

Analyzing these ranked difficulties from top right to bottom left, it is presumed that three main conclusions can be drawn from this evaluation. First, it can be concluded that the actor-related difficulties are evaluated as relatively more important than the system-related difficulties. Only the difficulty of overdue maintenance (difficulty 1) is an exception. Second, the consequences of incidents due to strategic behavior that severely harmed the trust-relationship are probably
underestimated by the interview respondents. The consequences are presumed to be vital, but this challenge is not frequently discussed. By contract, the extensive decision-making process is frequently mentioned, but the consequences of long decision-making process are moderate as it only prolongs the decision-making process.

5.4. **Concluding Findings**

Nine difficulties are defined on the basis of empirical observations on the research elements derived from the system and actor perspectives. These system-related and actor-related difficulties are observed in each case, except one difficulty concerning continuous scope changes in the collaboration. An evaluation provided insight in the relative importance of the difficulties, from this it is concluded that there are three major difficulties to set up a collaboration:

- **Difficulty 5**: The individual interests of the road authorities may become inferior to the collective interest of the collaboration.
- **Difficulty 6**: Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.
- **Difficulty 1**: Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.

By determining the relative importance of the difficulties, three conclusions are drawn. First, it is concluded that the actor-related difficulties are evaluated as generally more important to the process than the system-related difficulties as illustrated in Table 5-2. This implicates that the actor-related difficulties need specific attention to succeed in setting up the collaboration.

<table>
<thead>
<tr>
<th>Major</th>
<th>Actor-related difficulties</th>
<th>System-related difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interests of actors - Diff. 5</td>
<td>System dependencies - Diff. 1</td>
<td></td>
</tr>
<tr>
<td>Actor behavior - Diff. 6</td>
<td>System control - Diff. 3</td>
<td></td>
</tr>
<tr>
<td>Actor behavior - Diff. 7</td>
<td>System functionalities - Diff. 2</td>
<td></td>
</tr>
<tr>
<td>Actor behavior - Diff. 8</td>
<td>System performance - Diff. 4</td>
<td></td>
</tr>
<tr>
<td>Decision-making - Diff. 9</td>
<td>System control - Diff. 3</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-2 Relative importance of actor-related and system-related difficulties
Second, the vital consequences of incidents due to strategic behavior for the necessary trust-relationship are probably underestimated since the interview respondents did not frequently mention this. Third, the importance of the extensive decision-making process is by contrast overestimated, as the consequences are moderate in only prolongating the process while it is frequently discussed during the interviews and therefore perceived as being important.
6. Confronting the Empirical Findings with Theory

By a theoretical exploration of the defined difficulties, it is aimed to gain a better understanding why those difficulties occur. The defined system-related and actor-related difficulties are explored with theory derived from the system and actor perspective. This chapter intends to explore the underlying reasons of the occurrence of these difficulties as it is thought that a more complete understanding is necessary to effectively deal with these.

6.1. Exploring System-Related Difficulties with Theory

Based on empirical observations, the following four system-related difficulties have been found:

1. Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.
2. The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.
3. The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.
4. The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.

To explore those empirical findings from a system perspective, the road traffic system is evaluated as a System of Systems (SoS). According to Maier (1998), these SoS have five characteristics, which are described on the next page. These characteristics are used to explore the system-related difficulties defined in the previous chapter. A system is called a SoS when all or a majority of these characteristics are present. Subsequent to this, it is discussed for what reasons it is stated that the road traffic system is regarded as a SoS.

Before elaborating on the System of Systems theories, a definition of a conventional system is given to make a clear distinction with the SoS. Many conventional systems are special purpose-built. According to Sage and Cuppan (2001), those conventional systems can be massive in size, but are monolithic in purpose. Rechtin (1992) have provided a definition of what a system is which would be recognizable in many sciences:

“A system is defined as a set of different elements so connected or related as to perform a unique function not performable by the elements alone.”
In line with this system definition, DeLaurentis and Callaway (2004) state that the combination of a set of different systems forms a larger System of Systems that performs a function not performable by a single system alone. According to Maier (1998), they have five characteristics that make the system of systems designation most appropriate.

1. Operational independence of the individual systems.
2. Managerial independence of the systems.
3. Geographic distribution.
4. Emergent behavior.
5. Evolutionary development.

The separate parts of the road traffic system are managed by the road authorities autonomously. These parts are regarded as individual systems since the road traffic system consists of all these separate systems managed by the road authorities. The characteristics 1, 2 and 4 are used to explore the difficulties. However, the road traffic system also fits to the other two characteristics. The geographic dispersion of individual systems is often relatively large since the parts of the road traffic system are spread over the whole country. Furthermore, the road traffic system is subject to evolutionary development. According to Maier (1998), the development of these systems is evolutionary over time and with structure, function and purpose added, removed and modified as experience with the system grows and evolves over time. As stated in an article of NM Magazine by Ster, Farber, and Nuijten (2012), many couplings are made between the systems of the different road authorities in previous years.

**Difficulty 1: Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.**

A System of Systems is composed of systems that are independent and useful in their own right. If a system of systems is disassembled into the individual systems, these individual systems are capable of independently performing useful operations independently of one another (Maier, 1998). The composition of the road traffic system in separate parts fits to the situation of no collaboration. Each road authority has its own roadways for which infrastructure is maintained and traffic management is performed. This operational independence of the individual systems challenges the process of forming the collaboration. Before the intention to collaborate existed, the road authorities were completely independent in organizing their road management activities. Bad maintenance of the traffic control instruments was only encountered by the road authority itself. However, it is thought that the intention to collaborate creates a System of Systems.
Aiming to improve the traffic circulation across the organization boundaries of the road authorities requires collective traffic management. Through collaboration, the operational independence is reduced since bad maintenance of one coalition partner hinders the full coalition to perform collective traffic management in the area.

Difficulty 2: The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.

Collaboration between the road authorities presumes connections between the separate parts of the road traffic system, but also incorporates the differing disciplines in road management. Traffic management and ‘infraproviding’ both serve other, conflicting functionalities. The corresponding systems such as traffic control centers and instruments enable traffic management, which strongly differs with the outsourced activities to provide maintenance activities to infrastructure and control instruments in the road traffic system. Another system decomposition can therefore be mentioned in this context since these separate systems are also parts of the individual systems of the road authorities. As both functionalities are incorporated in the collaboration, the operational and managerial independence of these functionalities may be partially reduced.

Difficulty 3: The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.

In isolation, the road authorities manage their roads to the objectives stated by the public organizations themselves and organizes its road management activities in its own way. This fits to the second characteristics of System of Systems, since managerial independence implies that the individual systems generally operate independently to achieve an intended purpose. According to Maier (1998), the individual systems are generally individually acquired and integrated and they maintain a continuing operational existence that is independent of the System of Systems. In this line of reasoning, the managerial independence of the individual systems partially disappears through collaboration. These independently designed scenarios to control the individual systems need to be geared to one another to realize joint system control.

Difficulty 4: The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.

The System of Systems performs functions and carries out purposes that do not reside in any individual system. These behaviors are emergent properties of the entire System of Systems and not the behavior of any individual system (Maier, 1998). Emergent properties are often used to distinguish complex systems from applications that are merely complicated. They can be thought of as unexpected behaviors that stem from interaction between the components of an
application and the environment (Johnson, 2006). It is therefore presumed that emergence leads to the limited insight in what the effects of collaboration may be for the system performance.

**Short recap:** From a system perspective, it can be considered that collaboration increases the system complexity and the network complexity faced by the public authorities in the road traffic system. First of all, the individual systems are connected to organize the road traffic system together. Considering that new additional system dependencies arise due to these connections, it is thought that collaboration implicates that the system complexity is increasing. This can result in emergent system behavior, which for example makes the effects of collaboration less predictable. Second, it is presumed that these new connections hinder the managerial independence of the individual systems. While the road authorities can still manage the individual systems in own interest, some synchronization is required to enable collective organization. This implicitly means that the road authorities become more dependent on each other while managing the road traffic system together. Seeing that the relations between the road authorities increase due to collaboration, it can be considered that the network complexity is increasing as well.

### 6.2. Exploring Actor-Related Difficulties with Theory

From an actor perspective, difficulties are defined for the actor interests, the actor behaviour and decision-making. These difficulties are defined based on empirical observations and are explored with theory in the upcoming paragraphs. Those actor-related difficulties are:

1. The individual interests of the road authorities may become inferior to the collective interest of the collaboration.
2. Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.
3. Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.
4. The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.

However, no difficulty is assigned to the aspect of actor dependencies, which does not imply that actor dependencies are not important in a collaboration. The actor dependencies result in the necessity to collaborate. For this reason, a special note is made first according to the influence of actor dependencies in a collaboration.
The dependencies between the road authorities are the reason that collaboration is a necessity to make better use of the current infrastructure and optimize the traffic circulation across the organizational boundaries. The road authorities manage the separate systems independently according to own interests which challenges the process of forming a collaboration. Or as formulated by De Bruijn and Herder (2009), because the actors have differing interests and perceptions, cooperation between them cannot be taken for granted. However, cooperation is essential because the relationships between the actors are interdependent: each needs the support of the others. No actor is able to solve the problem on their own. Together, these dependences are termed a network. This implies that the geographical range of the road traffic system to collaborate on is restricted as one of the actors decides to withdraw the process.

**Difficulty 5: The individual interests of the road authorities may become inferior to the collective interest of the collaboration.**

One of the characteristics of a network is the variety of many different actors, interests, means of power et cetera. Due to the variety, actors have mutual differences which hampers cooperation and joint decision-making (De Bruijn & Ten Heuvelhof, 2012). Besides the probable conflicting individual interests, it is presumed that a collective interest has to be defined as well. According to Kaats and Opheij (2012), a shared vision is of main importance to bind the coalition partners. A joint agenda, collaboration aims or, here called a collective interest, is the rationale for the collaboration. From the empirical observations it is found that the individual interest of a particular organization may become inferior to the collective interest. This difficulty implicates that decisions can be made in factor of the collaboration, while some individual interests are harmed. A comparable situation is mentioned by Huxham and Vangen (2008) as follows; (...) at first glance it may appear that partners only need to be concerned with the joint aims for the collaboration, whilst in reality organisational and individual aims can prevent agreement because they cause confusion, misunderstanding and conflicts of interest. It is thought that passing by the individual interests of the road authorities can have vital consequences to the process of setting up a collaboration.

According to Koppenjan and Klijn (2004), the multi-actor setting is regarded as dynamic in at least two ways; actors and issues. The theory concerned with the dynamics in issues is used in the exploration of the scope changes (difficulty 8), while the dynamics in actors is discussed to explore the upcoming difficulty of coalition changes (difficulty 6).
Difficulty 6: Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.
The dynamics in the multi-actor setting implies that certain actors may choose to withdraw at any time during the decision-making process, as they believe that their interests will be better served by not taking part in the decision-making. Or they see other issues to which they wish to devote their attention. According to the vision of Koppenjan and Klijn (2004), it is possible that new actors will join the decision-making process. However, it is experienced in the cases that the composition of the coalition does not change with regard to the partners that are participating, but changes occur due to political dynamics.

Difficulty 7: Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.
According to De Bruijn and Ten Heuvelhof (2012), a decision-making process in a network will only be effective if it is joint decision making. But because actors attempt to realize their own interests, joint decision making can be difficult (Edelenbos & Klijn, 2007). Edelenbos & Klijn performed a theoretical and empirical exploration of trust in complex decision-making networks. They state that decision making is also hampered by institutional complexity or by the unwillingness of actors to share information, because they fear opportunistic behavior from other actors. In this same article, trust is mentioned as an important success factor for inter-organizational cooperation. However, a trust-relation has to grow with the participant along the process. The unwillingness of actors to share information is not explicitly stated by the interview respondents, but the occurrence of opportunistic behaviour to defend the individual interests is commonly mentioned. Knowing that a trust-relationship needs to be built while the fear of opportunistic behaviour is present, an approach is needed to prevent incidents that harm the growing trust-relationship.

Difficulty 8: The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.
The unique challenge found in one of the three case studies concerns continuous scope changes. Setting up the collaboration and thereby determining the scope of the collaboration is in this research compared with a process of decision-making. De Bruijn and Ten Heuvelhof (2012) elaborate on such a situation as substantive capriciousness, which means that the content of a problem and of a solution shifts constantly. A theoretical explanation that is given is that the dynamic of actors and the dynamic of the content means that not only new opportunities arise for the actors involved, but that decision-making is also constantly under threat. In the particular case, the dynamic is only observed in the content. De Bruijn and Herder (2009) mention that the sometimes continuous redefinition of issues may occur as it is of interest to the
actors involved. The scope of the collaboration is redefined as the focus to improve the traffic circulation is for example broadened due to the intention of one actor for collective slipperiness control. Since many opportunities occur in the lead time of the process to set up a collaboration, this difficulty can endanger the process to muddle through for a long time. However, the dynamics in the process can also be of value since the environment of a collaboration changes as well.

**Difficulty 9: Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.**

Collaboration between public organizations such as the road authorities implies the indirect involvement of the rank and file of all coalition partners. The involvement of the rank and file has an important influence on the lead time of the process. Agranoff (2006) mentions such decision-making processes as reaching intergovernmental agreements. He states that in collaborative bodies, decisions and agreements are necessarily based on consensus, inasmuch as participating administrators are partners, not superior – subordinates. Among the partners, it is unlikely that any single agency or representative at the table will have the legal authority or financial resources to completely approach a problem. Agranoff (2006) furthermore states that the all-important potential for agency-based implementation for most collaborative solutions lies not in the network itself or in any one agency or program but among the many. Since locking out some partners or the rank and file of an coalition partner is no possibility, it is concluded that the dependencies in the decision-making process have to be well understood.

6.3. **EXPLORING DILEMMAS WITH THEORY**

Two main dilemmas for the initial phase of the process are found on the basis of empirical observations. These dilemmas are 1) composing a coalition with or without umbrella organizations as representatives of groups of road authorities and 2) designing the financing structure of the collaboration. Since both dilemmas involve choices that imply other consequences regarding the collaboration, these dilemmas are explored with theory as well to create an understanding of the trade-off that has to be made.

**A. Involving umbrella organizations as representatives of groups of road authorities**

According to Kickert et al. (1997), who elaborate on the number of actors as condition in their book *managing complex networks*, many assume that the more actors are involved in interaction processes, the more difficult it becomes to reach an agreement. Owing to the need for keeping or making situations of collective action manageable, endeavoring to reduce the number of players is understandable. This is expected to enhance control of the situation. However, it is further stated in the book that the concept of selective activation does not hold in this setting since it
will not always be possible to exclude actors, simply because of the existing relationships of dependency. Additionally, Koppenjan and Klijn (2004) state in the book ‘Managing Uncertainties in Networks’ that as the number of actors involved in a problem increases, the conflicts of interests become greater, and there is greater variety in dependences. Therefore, it becomes more difficult to gain an overall view of the pattern of dependences. Eventually, it may become impossible for any actor to understand the situation entirely. For these theoretical reasons, it is stated that it will be of added value to reduce the number of coalition partners as much as possible.

In practice, umbrella organizations are used as representatives of groups of road authorities to reduce the actors that are sitting around the decision-making table. On the one hand, reducing the number of actors is valuable as Kickert et al. (1997) emphasizes that it should be kept in mind that an increase in the number of actors causes not only increased complexity, but also an increase in the number of permutations for achieving an adequate approach to problems. On the other hand, it is presumed that incorporating umbrella organizations brings in an additional layer, which worsen the already excessive layers of government (Dutch: Bestuurlijke drukte).

Besides that, it may be considered that “networks of networks” will emerge as the umbrella organizations are incorporated. Some of the actors may well also have relationships with each other in other “arenas” regarding entirely different issues. Where there is a true “network of networks,” as mentioned by De Bruijn and Herder (2009), the complexity increases significantly: a large number of actors, dependences, conflicting interests, and extremely limited recognizability of the overall set of dependences. This implies that the outcome of the decision-making process on an issue in the collaboration cannot be understood without knowledge of other issues out of the collaboration.

B. Financing structure of the collaboration

It is previously stated that the financing structure will change the balance of power in the coalition given the fact that the one who pays the piper calls the tunes. De Bruijn and Ten Heuvelhof (2012) explain the power paradox in a multi-actor network as follows: the more power an actor has, the more moderation he should practice. Reasons for this are the system responsibility the most powerful actor has regarding the functioning of the multi-actor network as a whole. If power is used without moderation, this responsibility becomes problematic. Besides that, an actor’s power position may erode when he uses his means of power. It provokes resistance among other actors with a so-called catch-as-catch-can attitude.

In that line of reasoning, it is considered that choosing an option were all coalition partners financially contribute to the collaboration, suggests the intention to strive for a win-win
situation. Also in the context of win-win situations, power plays a major role in influencing perception. All parties will try to use their power position and optimize their gain (De Bruijn & Ten Heuvelhof, 2012). For this reason, it is thought that unequal contributions pushes the coalition partners to make the most of it in their individual interest. This may lead the focus of the collaboration on individual interests instead of keeping an eye on the collective interest as well. On the contrary, it is thought by the researcher that equal contributions presume an equal balance of power which seems fair, but which also makes the multi-actor network closed to interventions of any coalition partner since everyone is equally powerful. It can then be questioned; who will be leading in the collaboration? Missing a leader may result in a process that is continuously muddling through.

6.4. **CONCLUDING FINDINGS**

The main finding derived from the theoretical exploration via the system perspective is that collaboration in the road traffic system increases both the system and the network complexity. A larger System of Systems (SoS) is formed by the combination of a set of individual systems managed by different road authorities. Due to the new connections made between the separate parts of the road traffic system, additional system dependencies and an increasing amount of relations between the individual road authorities arise. Understanding the increasing system and network complexity is seen as a necessity to deal with the difficulties effectively and succeed in setting up a collaboration in the road traffic system. Upcoming chapters therefore focus on defining strategies that can be used to create this understanding among the coalition partners.

SoS are characterized by operational and managerial independence of the individual systems, geographic distribution, emergent behavior and evolutionairy development. Some of these SoS characteristics explain the system-related difficulties that occur during the process. It is found that the difficulties of the system dependencies, system functionalities and system control (difficulty 1 to 3) are caused by the reduced operational and managerial independence of the individual systems. While the individual road authorities can still autonomously manage their part of the road traffic system, some synchronization is necessary in order to collaborate. Furthermore, increasing interaction between the individual system parts results in unpredictable system behavior due to the emergent properties of the entire road traffic system. This partially explains the challenge to predict the effects of collaboration beforehand (difficulty 4).

From an actor perspective, it is explored that a focus on a collective interest is the rationale for the collaboration, but the individual interests can prevent agreements. A balance need to be found to serve both. It is thereby concluded that the trust-relationship in a collaboration is hard
to establish due to the fear of opportunistic behavior in complex decision-making. It is therefore emphasized that incidents that harm the growing trust-relationship need to be prevented. Additionally, attention must be paid to prevent changes in the content and the actor constellation as it brings decision-making constantly under threat. It is thereby stated that understanding the network dependencies is important to deal with this extensive decision-making process. A balance must be found in including umbrella organizations or individual road authorities since locking out some road authorities is no possibilities due to the dependencies. On the one hand, umbrella organizations incorporate an additional governmental layer which results in a further increasing network complexity. On the other hand, dealing with the network complexity is more difficult as the number of coalition partners grows.
7. Strategies

Although being aware of the difficulties that may be faced during the process is essential, knowing in what way these can be dealt with is the key to succeed in setting up a collaboration in the road traffic system. In this chapter, it is aimed to define strategies that can be used to effectively deal with the defined system-related and actor-related difficulties. This is done by analyzing which approaches that were used in the case studies seemed to be effective, which is described in section 7.1. These approaches are defined as strategies by making explicit what actions can be done for which specific motive to act. The descriptions of these strategies are given in section 7.2, including the belonging advantages and disadvantages. Presuming that effective use of the strategies is not similar in each situation, the conditions are determined in section 7.3. by the use of the theoretical framework. In section 7.4., three relations between strategies are explained that need to be taken into consideration before choosing for the combined use of strategies.

While it seemed reasonable that strategies fitting the actor perspective can be used to deal with actor-related difficulties, it can also be concluded that cross-application is of added value. Cross-application implies that strategies fitting the system perspective can also be effective in dealing with actor-related difficulties, and the other way around. It is thereby concluded that the collective use of particular design-strategies serves two important functions, namely enabling learning among the coalition partners and creating shared mental models carried by the collaboration. In this way, a shared understanding of the increasing complexity is gained which helps to unravel the complex relations within the system and network.

7.1. Dealing with the difficulties: Analysis of empirical observations

The defined difficulties are used as starting points for this analysis. Strategies are defined for all difficulties, except for the difficulty concerning continuous scope changes (difficulty 8). Reason for this delineation is that the difficulty is only recognized in one case study which was not able to deal with this effectively. Besides that, strategic masterplans are hardly ever used to combat the dynamic of the content in a process as stated by De Bruijn and Ten Heuvelhof (2012). The theoretical exploration of this difficulty in Chapter 6 is of added value to gain an understanding why this difficulty may occur. Being aware of such constant changes due to the dynamics in the process is of main importance to manage this difficulty. Since all cases recognized the other difficulties, it is analyzed in which way the cases dealt with the defined difficulties. It is examined to which extent the approaches overlap, differ and complete each other. The effectiveness of the
approaches is thereby discussed. As the cases are already extensively described in Chapter 4, only a brief description is given from the major to the minor difficulties.

**Difficulty 5: The individual interests of the road authorities may become inferior to the collective interest of the collaboration.**

Dealing with the diversity of interests in the collaboration is done in divergent ways. The most invented approach is seen in the VERDER case with the design of the objective assessment framework as an approach to incorporate all diverse interests, objectives and criteria in a collective plan. This framework is used to make joint decisions by composing a mixed package of measurements to serve all interests of the involved organizations. Seeing the relative rapid process of decision-making in VERDER, the use of these strategies is considered to be effective. The interview respondents mentioned that a well-balanced package was composed.

- ➔ Strategy 1: Outline an objective assessment framework
- ➔ Strategy 2: Compose a mixed package of measurements

**Difficulty 1: Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.**

The required adaptations of some insufficient maintained traffic control instruments is in two cases (VERDER and BEREIK!) financed with the budget of the collaboration, although the individual road authorities are liable for sufficient maintenance. A deviating approach is used in the PPA project since the control over the particular instruments is fully warranted to the project organization for the project's time span. However, it is a temporal solution as these instruments are 'given back' after finishing the PPA project. Until now, no structural solution is found for the future.

It is presumed that financing overdue maintenance on the traffic control instruments with the collective budget stimulates bad performance of the individual road authorities. The road authorities that lacked well-performed maintenance extremely benefit from such an approach. While participating in the collaboration, their bad performance on maintenance is solved with budget invested by other road authorities. This makes the solution unattractive to road authorities who have everything well-maintained since they are paying for bad performance of others. This approach is therefore considered as no effective strategy to solve this difficulty.

- ➔ No effective strategy found
Difficulty 6: Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.

Regarding the cases, no persistent approach is found to deal with the changes in the coalition due to political dynamics. The regular elections, a sudden fall of the government or the changing of an administrator are developments that make the coalition liable to political dynamics. It is regularly tried to closely involve the administrators to gain and preserve the support on an administrative level. In the VERDER case, it is explicitly stated that administrative approval of particular decisions can be used to stick the administrators to these previous made decisions. But when it comes to the crunch, the administrators are the one who are formally in charge.

⇒ No effective strategy found

Difficulty 7: Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.

All cases mentioned the importance of facilitating a transparent process, but no commonly used approach appeared. However, harmful incidents are avoided in different ways. This is called the escalation model in VERDER, a consequential advice with suspending effect in "Regioregie" in the context of the PPA project and the opportunity to scale eventual incidents up to solve at a higher level in BEREIK!. In the end, those three strategies imply the same approach which are merged to one strategy.

⇒ Strategy 3: Move potential incidents up to a higher level

Difficulty 9: Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.

All collaborations made use of an administrative consulting body to involve the administrators of the coalition partners in the collaboration. The decisions are prepared by the public servants, whereupon the administrative consulting body tries to reach consensus on decisions. However, this body lacks the formal power of decision, which means that the decision still has to be given to the rank and file of each coalition partner. In this way, three sequential phases are recognized. In VERDER, the collaboration explicitly initiated an 'administrative puzzle' to reach agreement on an administrative level. This instrument implies that allowing a shifting in a proposed plan is useful to reach consensus on the administrative decision-making table.

⇒ Strategy 4: Follow successive phases during decision-making
⇒ Strategy 5: Allow shifts in the proposed plan on the administrative decision-making table.
**Difficulty 3: The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.**

An overlapping approach is the design of a joint control strategy. In all cases, this strategy is regarded as necessary to succeed in organizing the control together. The use of such a strategy requires that the systems for traffic control can interact. This is regarded as an effective approach to enable the interaction between the traffic control centers while no one relinquishes control over the own set of instruments. Additionally, BEREIK! makes use of one central desk (Regiodesk) to coordinate several traffic control centres in the area.

As final step to organize the control together, the designed joint control strategy must be approved on an administrative level. Nevertheless, it is presumed that the administrators lack the technical expertise and knowledge to form a well-founded opinion of the control strategy. The importance of translating the technical control strategy to the interests of the road authorities is stated in all cases. In this way, the control strategy is explained in relation to the objectives of the administrators.

- **Strategy 6:** Design a joint control strategy
- **Strategy 7:** Translate the technical control strategy to interests of the road authorities

**Difficulty 2: The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.**

Notable is another overlapping approach to form separate collaborations for the separate system functionalities. In the PPA project en BEREIK!, these collaborations fall under the supervision of a coordinating platform. For instance, the ‘Regieteam’ is a platform in Noord-Holland that coordinates the collaborations in the area, among which the PPA project. Nevertheless, the separate collaborations in the Utrecht area regarding ‘infraproviding’ and ‘traffic management’ are not coordinated as such.

- **Strategy 8:** Accommodate conflicting functionalities to separate collaborations

**Difficulty 4: The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.**

Creating an understanding of the effects of collaboration is done in divergent ways such as the suggestion to use simulation models, making a cost benefit analysis and other quantitative analyses executed by third parties.

- **Strategy 9:** Quantify the expected gains and losses of collaborative measurements
**Short recap:** Besides showing the empirical underpinning of nine defined strategies, this analysis provides an additional insight seeing that two difficulties lack effective strategies; 1) Bad-performed maintenance by individual road authorities is stimulated as overdue maintenance is financed with the collective budget and 2) Networking and trying to stick administrators to previously approved decisions are no solid effective strategies since the administrators are the one who are formally in charge. The defined list of strategies in this research project lack effective strategies to deal with these difficulties. Considering that both difficulties are evaluated as major difficulties with vital consequences for the process, it is recommended to pay specific attention to these difficulties in further research projects.

7.2. **Description of the strategies**

Nine strategies are defined to deal with the defined difficulties. The number of strategies is not intended beforehand, but determined on the amount of effective strategies described in the previous section. This section aims to describe the purpose of the strategies to explain for which motive to act the strategies can be used. Nevertheless, for every advantage there is a disadvantage. These comments are based on common sense. Besides stating the potential benefits, it is considered that some warnings need to be taken into consideration as well.

The strategies can be used by public authorities working in the road traffic system, if desired under the coordination of a program manager. In case a program manager is appointed from the very beginning of the process, the program manager is responsible to design and manage the process of setting up a collaboration between the relevant public organizations in the road traffic system. The strategies then serve as action-oriented approaches to design the process while aiming to deal with the defined difficulties.

**Strategy 1: Outline an objective assessment framework**

The framework is outlined in the beginning of the decision-making process. In relation to the divergent interests in the coalition, the framework rationalized the trade-off that had to be made to design the package deal. Since the objectives and criteria were incorporated in the framework, it is assumed that a well-balanced assessment is realized. Some advantages are considered to be of main value. A purpose of this strategy is to trigger the actors to make their interests explicit in an early phase of the process. As it is desirable for an actor that its interests are taken into consideration during the process, the actor will mention its interest that are of main value. Otherwise, these interests are not incorporated in the framework and not taken into consideration during the trade-off. This is considered to be very useful since De Bruijn and Ten Heuvelhof (2012) state that knowing the underlying interests, creates room for decision-making which makes negotiations possible.
Some disadvantages need to be considered as well. Bringing the interests to the table in an early phase may also narrow the solution space during the process. The coalition partners are triggered to bring their interests to the table and may value the interests incorporated in the framework as an established fact. The use of this strategy may therefore freeze the context of the process, which is a risk in case of situations that are not easily solvable in that particular setting.

**Strategy 2: Compose a mixed package of measurements**

Since many kinds of interests have to be incorporated in a collective plan for the collaboration, one of the case studies explicitly focused on making a mixed package of measurements. It is considered that this strategy is of additional value to form a joint plan that is carried by the collaboration as a whole. By composing a mixed package of measurements, a package deal is made and consensus may be reached while the interests are diverse. According to De Bruijn and Ten Heuvelhof (2012), a package deal is a set of decisions containing a large number of solutions for a large number of problems. Such a package deal is the result of seeking a win-win situation. Seeking a win-win situation helps to stimulate that some actors are open to other, not neccessary beneficial solutions as they get something in return. The package should bring more 'gain' than 'loss', creating gain for each party and ensuring sufficient support for the package (Mandell, 1988). On the other hand, some risks can occur while seeking a win-win situation. There is the risk of focusing on the individual gains and losses of the coalition partners and forgetting to keep an eye on the collective added value. This is not encouraged since the implication can be that the mixed package is a product of only 'giving and taking' in the end, without trying to create a collaborative added value through combining each other’s strengths.

**Strategy 3: Move potential incidents up to a higher level**

In case incidents may occur that can severely harm the relationships, the coalition partners in the collaboration can consider 'to make use' of the possibility to move the incident up to a higher level. In this way, the problem is shaven on to someone else considering that the situation is probably solvable at another level. If this is indeed the case, the potential incident is conciliated without severe harm to the relationships. Taking care of these relationships between the coalition partners is of main interest, since those are one of the foundations in a collaboration. On the contrary, the confrontation is avoided while this may be useful to improve the relations. Discussion could lead to a better understanding of each other's perceptions, standpoints and interests. For this reason, limited use of this strategy is recommended.

**Strategy 4: Follow successive phases during decision-making**

It is found that many layers of government originating from many public organizations are involved in the decision-making process to form a collaborative plan. It is thought to design
some successive phases to provide a clear structure to the extensive administrative decision-making process. These phases are illustrated in Figure 7-1. First, a joint plan is prepared to submit to the administrative consulting body. In this phase, the public servants of the organizations have to prepare this collective plan together. Thereupon, the administrators are going to decide on the prepared plan in the second phase. However, since the administrative consulting body lacks formal power of decision, a follow-up phase is defined after consensus is reached. Phase three is necessary to ensure that the agreement is formally approved by the individual road authorities on an administrative level.

![Successive phases in the decision-making process](image)

It is presumed that knowing these successive phases is important to create understanding for the decision-making process in a collaboration. On the other hand, using sequential phases to structure the extensive decision-making process implies that iterations are not possible. This limits the opportunities of improvements afterwards since iterative learning is not supported as successive phases are followed.

**Strategy 5: Allow shifts in the proposed plan on the administrative decision-making table**

It is considered that a little shift in the proposed plan is useful to make the proposed plan fit to the administrators. By allowing a shifting, some room for maneuver is created during the process. This is necessary to reach consensus among the coalition partners at all levels. The aim of this strategy is to make sure that every participating coalition partner can justify the agreement that is reached in the administrative consulting body to its own rank and file. To create some flexibility that enables such small adjustments, having some ‘change’ is necessary to have. Creating some room to maneuver for the administrators also requires a constructive attitude of the involved public servants that have specific expertise. The content of the proposed plan may change significantly while the administrators lack some particular expert knowledge. In the eyes of the public servants, such changes may do harm to the proposal in a technical sense.

**Strategy 6: Design a joint control strategy**

A joint control strategy implies a framework of agreements concerning the way in which the traffic flows are managed. First, the bottlenecks in the network have to be assigned. This provides the basis for the design of traffic management measurements that need to be incorporated in the control strategy to improve the traffic circulation in the region of concern.
Second, the roadways are to be prioritized. This implies that it must be decided which roadways may be used to buffer the traffic flows to lighten the amount of traffic on other roadways with a high priority. Furthermore, agreements have to be made regarding the buffer capacity of low priority roadways. For example, it has to be decided to what distance buffering is allowed on the roadways to prevent harm to individual interests of the road authorities. In this way, a framework of agreements is made with conditions and preconditions for collective traffic management. By making agreements about the buffer capacity to improve the overall system performance, some roadways are prioritized over other roadways. This implies that some road authorities have to give in without getting direct gains in return.

**Strategy 7: Translate the technical control strategy to interests of the road authorities**

A control strategy has to be approved by the administrators. For this reason, this strategy is designed aiming to reach consensus on an administrative level by showing and explaining the relation between the system effects and the interests. The purpose is that the complex relations in the road traffic system are well and clear explained to the administrators. A way to realize this is to translate the expected system effects to the interests of the road authorities. This should be done with care, since ‘retranslating’ the control strategy to the interests is very complex and may result in jumping to conclusions in case the relations are not well understood.

**Strategy 8: Accommodate conflicting functionalities to separate collaborations**

This strategy implies to lay down the divergent, conflicting system functionalities in separate roles. This strategy corresponds to the role model designed by Rijkswaterstaat (RWS). RWS designed this model in correspondence with three different roles in road management as illustrated in Figure 7-2; the director, the traffic manager and the provider. The aim of this model is to support a transparent trade-off and to optimize the quality of the decisions by assigning the diverse interests with different roles. It is assumed that by a clear distinction of those roles, the interest of the road user is at the centre of decision making (KpVV, 2011). This role model is designed to organize these disciplines within one road.

![Figure 7-2 Role model Rijkswaterstaat](image)
authority. However, it is found that these functionalities are separately accommodated to other collaborations as well. Thus, one collaboration focuses on traffic management and another collaboration focuses on the road working activities for maintenance of the infrastructure. In this way, the collaborations can operate an own role with one collective interest. While a conflict between the functionalities is created, the risk lies with focusing on the confrontation instead of finding a solution to gear the activities to one another.

**Strategy 9: Quantify the expected gains and losses of collaborative measurements**

A way to indicate the effects of collaboration in the road traffic is to quantify the expected effects of particular measurements. This can be expressed in gains and losses for the road authorities. The purpose of this strategy is creating a quantitative insight in the effects of measurements to be expected. Calculations can objectively clarify the expected effects which may provide insight in the added value of the collaboration that is intended to be formed. The intended purpose to quantify the expected effects of these measurements is difficult since complex effects are hard to determine exactly. Indirect effects can be of main importance, but are hard to predict since many factors determine the behavior of the road traffic system.

### 7.3. **Conditional use of strategies**

Seeing that the use of strategies may not be effective in every situation by definition, it is of added value to analyze under what conditions the strategies may be most effective. These conditions are determined by the use of theory. Besides making a distinction between system-related and actor-related difficulties, the theoretical framework described in Chapter 2 also enabled to make a distinction between strategies fitting the system or actor perspective. Determining the conditions for the use of strategies is done with the following three steps:

1. the underlying principles of the strategies are made explicit,
2. the principles of the strategies are linked with the theoretical assumptions to split the strategies up to the system or actor perspective,
3. the conditions for effective use of the strategies are determined based on the connection with the theoretical assumptions from one of the other perspectives.

It is thereby important to know that the rational actor approach fits to the assumptions of the system perspective, while the assumptions of the network approach fits to the actor perspective. The approaches are described in Chapter 2, but the assumptions are summarized in Table 7-1.
Table 7-1 Summarized assumptions of theoretical approaches (Kickert et al., 1997)

<table>
<thead>
<tr>
<th>Rational actor approach</th>
<th>Network approach</th>
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<tr>
<td>• Concerned with optimizing effects of decisions and calculating the costs and benefits connected with those decisions.</td>
<td>• Public policy making takes place in networks consisting of various actors none of which possess power to determine the strategies of the other actors.</td>
</tr>
<tr>
<td>• Focus on behavior of rational actor who would reach a decision within a situation of being fully informed and of complete and clear preference ranking.</td>
<td>• Interdependent parties with often conflicting rationalities, interests and strategies.</td>
</tr>
<tr>
<td>• Policy process proceed in stages.</td>
<td>• Interaction process in which actors exchange information about problems, preferences and means and trade-off goals and resources.</td>
</tr>
</tbody>
</table>

The defined strategies delineated below fit to the rational actor approach considering that the underlying principles of the strategies relate to the theoretical assumptions. Linking the strategies to the rational actor approach implies that the actors act according to the corresponding assumptions. The explanation of this linkage is given, whereupon the conditional use of the strategies is explained. It is considered that the use of these strategies is most effective as the stated conditions are met.

- **Strategy 1. Outline an objective assessment framework**, because the interests are incorporated as objective criteria and aims to rationalize making choices. It underlines the assumption that actors behave rational. Condition to use this strategy effectively is that the actors act rational and are willing to make their interests explicit in the early phase of the process.

- **Strategy 4. Follow successive phases during decision-making**, as use of this strategy implies that the policy process proceeds in stages. This strategy aims to provide a clear structure in complex decision-making. For this reason, this strategy can be effectively used as the actors are fully informed to first analyze the problem and the alternatives before making a rational decision.

- **Strategy 6. Design a joint control strategy**, considering that the underlying principles of assigning traffic bottlenecks, prioritizing the roadways and making buffer agreements implies that an optimal solutions exists. A condition to realize effective use of this strategy is that the separate traffic control systems can interact in some way.

- **Strategy 9. Quantify the expected gains and losses of collaborative measurements**, because the strategy intends to calculate the costs and benefits connected with the decisions. Nevertheless, the use of this strategy requires that quantification is possible.
Reasons to argue the fit of the other strategies to the network approach are given below. Here, the conditions for effective use are also given.

- **Strategy 2. Compose a mixed package of measurements**, as it implies that the coalition partners may have conflicting interests that all have to be incorporated to seek a win-win situation. The use of this strategy requires that the collaboration has a broad scope, including other topics to discuss. Otherwise there is nothing to negotiate about.

- **Strategy 3. Move potential incidents up to a higher level**, because it underlines the assumption that actors have diverse and conflicting interests and that public policy processes take place in a network. Last assumption implies that none of the actors possess the power to determine the strategies of the other actors, which means that conflicts need to be solved together since hierarchical intervention in no possibility. To use this strategy, other organizational levels of the involved coalition partners have to be involved as well.

- **Strategy 5. Allow sifs in the proposed plan on the administrative decision-making table**, which implies that a policy process is an interaction process instead of a process proceeding in stages. It is important to have some 'change' to create the necessary flexibility to ensure the effect of this strategy. Otherwise the principle of 'giving and taking' is not applicable.

- **Strategy 7. Translate the technical control strategy to interests of the road authorities**, because the strategy implies that actors make decisions according to their interests instead of being concerned with optimizing the effects of decisions. An important condition for effective use is that the interests of the actors are known and the complex system behavior in the road traffic system is well understood.

- **Strategy 8. Accommodate conflicting functionalities to separate collaborations**, since this strategy concerns separate collaborations that defend conflicting objectives which implies an interaction process including a trade-off of goals and resources. It is of key importance that the trade-off between the interests of the separate collaborations must be made by a third coordinating platform.

7.4. **Relations between strategies**

The defined strategies are not completely isolated from each other. Some can be used in combination, some represent conflicting purposes or others transcribe contradictory conditions. Three important relations are explained in this section:

1. compose the mixed package of measurements (strategy 2) through the use of an objective assessment framework (strategy 1),
II. broaden the scope to compose a mixed package of measurements (strategy 2) is contrary
to narrowing the scope by accommodating conflicting functionalities to separate
collaborations (strategy 8),

III. aim for sequential phases by following successive phases during decision making
(strategy 4) contrast with the stimulation of an iterative process by allowing shifts in the
proposed plan on an administrative level (strategy 5),

These relations must be taken into consideration before choosing to use a combination of
strategies.

7.4.1. **COMPOSE MIXED PACKAGE BY USE OF OBJECTIVE ASSESSMENT FRAMEWORK**
Using strategy 1 and 2 independently from each other is possible, but a combination of both
strategies can be very useful and effective. The combination is considered to be effective seeing
the relative rapid process of decision-making in the VERDER case as previously argued, which
provided the empirical basis for the design of both strategies. The outlined objective assessment
framework (strategy 1) can be used as support to compose the mixed package of measurements
(strategy 2). Since this framework includes the criteria set outlined by the coalition partners, a
well-balanced package can be composed to incorporate the individual interests while keeping an
eye on the final result for the collaboration.

A possible disadvantage of using both strategies in combination is that the outlined assessment
framework may limit multi-issue decision-making. According to De Bruijn and Ten Heuvelhof
(2012), multi-issue decision-making can have some important benefits such as creating room for
giving and taking. But by explicitly laying out the interests on the table in an early phase of the
process, it may freeze the context of a collective plan. In this way, the use of strategy 1 narrows
the solution-space that is necessary for the effective use of strategy 2. It is considered to be
important that the scope of the collaboration include a broad range of topics to discuss to
provide some room to seek a win-win situation.

7.4.2. **BROAD SCOPE VERSUS NARROW SCOPE**
Considering that the use of composing a mixed package of measurements (strategy 2) requires a
broad scope of the collaboration, the accommodation of conflicting functionalities within the
road traffic system to separate collaborations (strategy 8) conflicts with this condition. The
implications of using strategy 8 only narrows the scope, which may reduce the effectiveness of strategy 2 since the condition of a broad scope cannot be met. The combined use of these strategies can still be possible, but seeking a win-win situation can be challenged since the opportunities to reach consensus including the diversity of interests are limited.

7.4.3. Sequential process versus iterative process

Two strategies imply other, contrasting approaches for phasing the process. Following successive phases during decision-making (strategy 4) aims to realize a sequential process including three steps to reach decisions. In contrast with this approach, allowing a shifting in a proposed plan to reach consensus on an administrative level (strategy 5) implies a more iterative process. The combined use of both strategies is therefore not effective and even possible since sequential phases exclude the possibilities for iterations.

7.5. New insights in the application of strategies

Besides the main purpose of the defined strategies as described in section 7.2., it is presumed that the defined strategies can have additional advantages. Two suppositions are argued in this section. First, it is presumed that some strategies can support the learning process to create an understanding in the complexity of collaborating in the road traffic system. By collectively using these strategies, shared mental models can be created. Second, it is found that cross-application of strategies is common and useful. The foundation of both suppositions are argued in the upcoming paragraphs.
7.5.1. Learning complexity and creating shared mental models

As stated before, collaborating in a sociotechnical system such as the road traffic system increases the network and the system complexity. It is of main importance to create an understanding of this complexity to effectively deal with the difficulties that may occur. It is considered that an additional benefit of some strategies is that these support the learning among the participants. Three strategies are considered to be useful to enable this process of learning.

- Strategy 2. Compose a mixed package of measurements.

The purposes of these strategies are diverse. Each strategy aims to realize a specific outcome, but it is presumed that the way towards this outcome may be even more valuable. Along the way, the participants are going to understand the relations within both the extending multi-actor network and the complex road traffic system. Without knowing the dependencies between road authorities and the effects within the road traffic system, no frameworks, packages or control strategies can be effectively designed.

Considering that a clear understanding is necessary to effectively use the strategies, the complex relations in the multi-actor network and the complex system must first be learned. While outlining the objective assessment framework, the interests of the coalition partners are made explicit. It makes the coalition partners aware of the enormous diversity of interests, the important relations in the network and which trade-offs need to be made in the course of time. Some interests will be in line with each other, other interests may be conflicting or may frustrate other actors. Seeking a win-win situation by composing a mixed package of measurements thereby requires a clear understanding of the system. The effects of proposed measurements need to be predicted to estimate the effect on each other’s interest. Furthermore, an extensive analysis of the road traffic system is necessary to design a joint control strategy. In the course of time, the participants unravel the road traffic system step by step to assign the bottlenecks, prioritize the roadways and make buffer agreements. The coalition partners learn what the direct, the indirect and the side-effects may be for particular traffic management measurements since the behaviour must be unravelled for the road traffic system as a whole. The increasing system and network complexity is learned and understood in the course of time.

Additionally, together going through these learning processes create another additional benefit. The outcomes of the strategies are shared mental models. By collectively outlining, designing and composing the outcomes of those three strategies, a shared understanding is gained of the
complexity. For instance, the coalition partners created a shared insight in the trade-off of individual interests as these may be conflicting or very diverse. It is considered that the strategies are of additional value to the process as these are collectively created. The joint use of the three listed strategies is an important step towards the creation of a shared mental model carried by the coalition partners.

7.5.2. **CROSS-APPLICATION OF STRATEGIES IS COMMON AND USEFUL**

The application of strategies to overcome the difficulties that occur during the process, is given in Table 7-2. Seeing that strategies from the rational actor approach can be used to overcome actor-related difficulties and the other way around, it is presumed that cross-application of strategies is common. Cross-application implies that strategies from one of the perspectives can be used to deal with the difficulties from the contrasting perspective.

**Table 7-2 Cross-application of strategies to deal with difficulties from the contrasting perspective**

<table>
<thead>
<tr>
<th>System-related difficulties</th>
<th>Cross-application of strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>S4</td>
</tr>
<tr>
<td>Difficulty 1</td>
<td>Difficulty 2</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actor-related difficulties</th>
<th>Cross-application of strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>Difficulty 5</td>
<td>Difficulty 6</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Cross-application of strategies is presumed to be useful, especially for using strategies from the system perspective to deal with actor-related difficulties. The main functions of using strategies fitting the rational actor approach to solve actor-related difficulties seemed to be creating an objective overview of diverse interests and structuring complex decision-making processes. An important note must be made to the limitations of cross-application. If actors in a network are faced with a structured problem, one right solution is assumed and they have little freedom of action (De Bruijn & Ten Heuvelhof, 2012). It is therefore concluded that the use of strategies from a system perspective to solve actor-related difficulties must be used with care.
7.6. **Concluding Findings**

First of all, it is concluded that no effective strategies are defined for two major difficulties. This implicates that it will be of added value to focus further research on new strategies to deal with these difficulties as well. By using the difficulties as starting point, strategies are defined of which four fit to the system perspective and five strategies fit to the actor perspective.

<table>
<thead>
<tr>
<th>Strategies from a system perspective</th>
<th>Strategies from an actor perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ S1. Outline an objective assessment framework</td>
<td>▪ S2. Compose a mixed package of measurements</td>
</tr>
<tr>
<td>▪ S4. Follow successive phases during decision-making</td>
<td>▪ S3. Move potential incidents up to a higher level</td>
</tr>
<tr>
<td>▪ <strong>S6. Design a joint control strategy</strong></td>
<td>▪ S5. Allow shifts in the proposed plan on the administrative decision-making table</td>
</tr>
<tr>
<td>▪ S9. Quantify the expected gains and losses of collaborative measurements</td>
<td>▪ S7. Translate the technical control strategy to interests of the road authorities</td>
</tr>
<tr>
<td>▪ S8. Accommodate conflicting functionalities to separate collaborations</td>
<td></td>
</tr>
</tbody>
</table>

Strategies fitting the system perspective are considered to be effective as actors behave rationally, implying that the rational actor reaches a decision within a situation of being fully informed and of complete and clear preference ranking. This implicates that an objective assessment framework can only be outlined as the actors are willing to make their interests explicit in an early phase of the project. Besides that, the system complexity must be understood to design a joint control strategy and to quantify the expected gains and losses. The strategies from the actor perspective fit the assumptions of the network approach, which implies that none of the actors possesses the power to determine the strategies of the other actors and that difficulties need to be solved together in a process of interaction including a trade-off of goals and resources.

The added value of the strategies printed in **bold** in Table 7-3 is that collective use creates a learning process which leads to a shared mental model carried by the coalition partners. This is presumed to be of added value since creating a shared understanding is a necessity to deal with the system and network complexity that is increased through collaboration. Seeing that strategies from the system perspective are commonly used to overcome actor-related difficulties and the other way around, it is concluded that cross-application is common and useful. Cross-application implies that strategies from one perspective can be used to deal with difficulties from the contrasting perspective. This implicates that strategies from a system perspective can help to structure complex decision-making processes and create an objective overview of the variety of interests. Although this way of cross-application can be useful, it must be used with care since it creates little freedom of action.
8. Discussion: validity and applicability of the findings

The research findings are discussed in an expert meeting. The meeting was organized with the aim to test the validity and applicability of the research findings. The validation is discussed in section 8.1, while making a distinction between the actor-related and system-related difficulties. Furthermore, all strategies are discussed in this section. In section 8.2, the applicability of the research findings to the fields of water and railway are briefly discussed.

8.1. Validity of research findings

The research findings are based on the interviews listed in Appendix B. Whether those findings can be regarded as valid is determined with the involvement of some experts that are working in diverse fields of practice. The organization of the expert meeting is described in Appendix D, including a list of the experts involved.

8.1.1. Validity of the defined difficulties

The majority of the difficulties is clearly recognized by the experts. Only the unique difficulty related to the continuous scope changes is not discussed since the time for the expert meeting was limited and it is chosen to focus on more major and common difficulties.

Validity of actor-related difficulties

One of the main remarks was the choice to analyze the process at the level of the organizations without considering the significant influences of the individuals. Although the choice to analyze the process at the level of organizations is understood, the influence of the individuals is now underestimated. Leaving this aside, the actor-related difficulties are all recognized:

✔ The individual interests of the road authorities may become inferior to the collective interest of the collaboration.

✔ Changes in the coalition due to political dynamics provides no stable support for the collaboration on an administrative level.

✔ Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.

✔ Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.

Those actor-related difficulties are relatively easy to validate since those are defined at a more abstract level. For this reason, some important remarks have to be made. The difficulties listed above are clearly recognized by discussing the validity regarding the process of setting up
collaborations between public organizations, not specifically with regard to road authorities. The difficulty regarding the actor interests is recognized by the experts, but it is discussed that the interests at individual level are even more important than the interests at organizational level. However, the difficulty is valued as valid since it has a major influence on collaborations between public authorities. The coalition partners must be very committed to the collaboration if the course of events is against the interests of the own organization.

The difficulty of coalition changes due to political dynamics is briefly discussed. A change of administrators is indeed feared. The main question stated in such situations is whether the collective agreements are still of value.

The difficulty regarding the trust-relationship is clearly recognized by the experts. This process of building and losing trust is valued as partly rational and partly irrational. It is discussed as an issue of competences and unintended behaviour. The process is not only a completely intended strategic game. Hidden agendas are rarely seen in such processes since the partners will probably see each other again sometime in another context. However, harmful incidents occur and these are often conceived as the result of strategic behaviour, but it is discussed that such incidents are often the result of not clearly overlooking all network relations. It is often seen by the experts that the behaviour of actors creates tension in a trust-relationship without doing it on purpose.

The difficulty with respect to the decision-making process is recognized, but the normative label of ‘long’ is discussed. “Yes, the decision-making process takes many time, but what is the problem with that?”. It is seen as a fact that the decision-making process in collaborations is extensive. For some complex decisions, it is thought by the experts that it can even be an advantage that the decision-making process takes many time because it gives the organizations and the collaboration some space to create commitment among the coalition partners. For this reason, long decision-making processes are only regarded as a difficulty when it must be glanced for each, little decision. However, it is stated that it is indeed of main importance that the procedures of decision-making are well known during the process. In some situations, the administrators come only together few times a year and this determines the milestones in a planning. Thereby, the internal decision-making within the organizations of the coalition partners determines the speed of the process.

Validity of system-related difficulties
The difficulties that are derived from a system perspective are more specifically described for the road traffic system, which makes validating a bit more complex since the experts are
working in diverse fields of practice. However, most system-related difficulties are discussed as valid.

? Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.
✓ The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.
✓ The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint system control.
✓ The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.

The common situation of overdue maintenance in the road traffic system is rarely seen in other fields of practice. This difficulty is valued as difficulty, but not in the context of the collaboration. It is discussed that such a situation cannot be allowed. In case the collaboration will take care of this difficulty, ‘bad behavior’ is actually stimulated since the road authority who lacks sufficient maintenance is helped and the road authorities who have well-maintained equipment is partly paying for this solution. Before the process starts, clear agreements must be made to point the road authorities to their responsibility. It is advisable to use the situation to create more urgency within the organization of the road authority.

The presence of the conflicting system functionalities is recognized, but an additional note must be made; the fact that this conflict is not temporarily is a main difficulty for the collaboration. The complexity of collective control is clearly recognized as well. Before collective control is possible, an agreed system performance must be defined. The difficulty to indicate the effects of collaboration beforehand is validated as well in a more broad sense. Since modern systems are complex, the effects of the system indeed need to be learned along the way. In the course of time, an understanding is created about the effects of collaboration.

8.1.2. VALIDITY OF THE DEFINED STRATEGIES
By validating the defined strategies, the usefulness and practicability is discussed for most strategies. The main remarks are described for each strategy. The first three strategies fit to the rational approach, while the other strategies belong to the network approach.

Outline an objective assessment framework
The main benefit of this strategy would be to trigger the coalition partners to make their interests explicit in the early phase of the process. It is stated by the experts that this strategy can be used as an instrument to guide the dialogue between the coalition partners and it gives
structure to the process. However, it must be noted that interests may be dynamic and change over time.

**Follow successive phases during decision-making process**
This strategy has been seriously discussed. The design of a substantive proposal by the public servants cannot be strictly divided from the decision-making phase on an administrative level. Those ‘worlds’ need frequent interaction. It is therefore discussed that the decision-making processes cannot be designed with successive phases, but only in cyclical rounds. It is stated that the administrators are indirectly sitting around the table with each other via their public servants during the phase of designing a substantive proposal. In this way, it is tried to prepare the decision as good as possible to make the formal moment of decision-making only a matter of routine. Following strict successive phases is not advisable, but some structure must be provided to go through the process.

**Design a joint control strategy**
The design of a network vision is valued as very useful. From a practical point of view, such a control strategy only functions within the determined boundaries of the system that is controlled. The range for collective control is broadened, but is still limited to the area.

**Compose a mixed package of measurements**
The design of a mixed package of measurements is discussed as useful. One important remark is made. The combined use of the strategy to compose a mixed package of measurements with the use of the objective assessment framework may indeed limit the opportunities to create additional value for all the coalition partners by enlarging the scope and the solution space. The objective assessment framework sets preconditions and thereby narrow boundaries. It is a good strategy, but not when it is dogmatically used.

**Allow shifts in the proposed plan on the administrative decision-making table**
Creating some room to manoeuvre is valued as very useful. It is important that the coalition partners all know that such a shifting can occur and that it is necessary to gain consensus on an administrative level. It is furthermore discussed that no percentage must be assigned to this change.

**Accommodate conflicting functionalities to separate collaborations**
The role model is interpreted as organizing an useful conflict. The functionalities are split up, which is valued as a good strategy, but the effectiveness of this strategy is determined by the third role. A risk may be that the focus will lie on the conflict between the system functionalities
and the design of a solution gets a lower priority. An additional advantage of the role model is that the system is made less complex for the collaborations.

8.2. **Applicability of Research Findings to Other Fields in Practice**

During the expert meeting, a short analysis is made to make a comparison with difficulties that occur as public authorities are going to collaborate in the Dutch water sector. The difficulties are mainly recognized, but the strategies are not directly applicable. This section briefly elaborates on the water infrastructure system and the belonging network of public authorities in relation to the road traffic system. Additionally, one similarity is found with the organization of the Dutch railways system.

**Applicability of the research findings to the Dutch water infrastructure system**

The Dutch water infrastructure system can be evaluated as a networked infrastructure system as well. Many water authorities at all governmental levels manage the waterways in the Netherlands. The water boards are unique public authorities in the Netherlands. These water boards are partially responsible for the control of the dikes for safety, the water quantity and the water quality. The administrators of the water boards are also chosen by elections. Another water authority is the national government. The provinces and municipalities are no formal water authorities, but have a role in water management.

The following three differences between the network of water authorities and road authorities are defined:

I. The excessive layers of government are even more layered in the water sector due to the additional role of the water boards.

II. The formal position of the water boards is under discussion at this moment, which makes them focused to keep their position as autonomous organizations.

III. The water sector is generally more hierarchically organized in the interest of the national safety.

While the defined actor-related difficulties are mainly recognized, these differences has some implications for the applicability of the research findings to the water infrastructure system. The experts mentioned the complexity of decision-making between the water authorities, whereby the national government is more experienced in such complex processes than the water boards are. The more centralized organization of water management thereby provides the national government with a relative more powerful position in the decision-making process compared to the management in the road traffic system. While consensus is tried to be reached with the water boards, the minister makes the final decision. It is stated by the experts that developing a
trust-relationship between the public authorities is probably a main challenge to set up a collaboration in the water sector.

The system-related difficulties are also applicable to the water sector. The main similarity is found in relation to the difficulty of collective system control and conflicting system functionalities. In the water sector, this difficulty is clearly recognized in the control of the local water level. First a final system performance must be determined, but the water sector has a facilitating role and an eternal conflict arises between the agriculture industry and nature conservation. The agriculture sector prefers a lower water level than the organizations concerned with nature conservation. Another example is given in relation to the control of the water level in the Ijsselmeer. A high water level enables draining into the Waddenzee and create freshwater buffers, but also requires higher dikes for national safety. However, the defined strategies are not directly applicable since the ministry has a more powerful position in decision-making due to more centralized management in the water sector. The water boards have no direct authority to decide over the water level and only maintain the water level as desired by the national government. The more centralized management in the water sector created more uniform systems since the norms and procedures are hierarchically delegated from above.

### Applicability of the research findings to the Dutch railway system

Despite the fact that the Dutch railway system is no networked infrastructure system, one additional comparison is made. The difficulty regarding the conflicting system functionalities and the strategy to divide those over different roles is compared with the relation between NS and ProRail. For instance, NS prefers extra ‘rail switches’ to gain flexibility in the exploitation of the train service, but this conflicts with the ‘infraproviding’ function of ProRail. Extra ‘switches’ may result in additional interruptions and expands the maintenance activities. In this setting, the third role is not yet clearly assigned which indeed leads to conflicts and less solutions to steer this relation in the right way.

### 8.3. CONCLUDING FINDINGS

Proceeding from the discussion, the actor-related difficulties are validated although at a high abstract level. It is found that the extensive decision-making process in collaboration between public organizations can also be of use to create commitment among the coalition partners. A long lead time is only a difficulty to the collaboration as it applies to each small decision. Also the system-related difficulties are often recognized and validated, despite the difficulty of insufficient maintenance of system elements. This is not seen in other fields of practice. Although most strategies are validated, some important warnings are given by the experts. It
must be bared in mind that although interests may be dynamic and change over time, following strict successive phases is not advisable and the assessment framework narrows the boundaries.

Although the difficulties are often similar in the water sector, it is found that the usefulness of the strategies is limited for setting up a collaboration in the water infrastructure system. The sector is more centrally organized than management in the road traffic system which makes the collective design of an objective framework, mixed packages of measurements and a joint control strategy less relevant. The waterways are also controlled by public authorities at all governmental levels, but the water infrastructure system is managed in a more top-down manner than the road traffic system. This implicates that new initiatives can be enforced from above. However, it is stated by the experts that creating commitment between those public authorities can be of added value since the water infrastructure transcends the organizational boundaries.
9. CONCLUSION AND RECOMMENDATIONS

The conclusion reflects on the research objective and provides the final answers on the research questions. Subsequent to this, some recommendations are given to offer an advice for further research steps.

9.1. CONCLUSION

The central research question that is answered by this research is defined as follows; In what way can public authorities effectively deal with the difficulties that occur in the process of setting up a collaboration in a networked infrastructure system, specifically in the road traffic system at a regional level? Input to provide an answer to this question is derived by 1) defining which difficulties challenge this process based on empirical observations, 2) exploring how these difficulties come about with theory and 3) defining strategies to deal with these difficulties.

The practical relevance of the research is derived by gaining an understanding of the difficulties that occur in the process of setting up a collaboration and the defined strategies that can be used to deal with these. During the research phases, the combined use of the system and the actor perspective provided a holistic view to examine the process from the intention to collaborate till a collective plan is made to manage the road traffic system together. The scientific aim of this research is to explore the value of combining the system and actor perspectives in analyzing the process of setting up a collaboration in a complex sociotechnical system like the road traffic system.

Relative importance of the defined difficulties

The defined difficulties include four system-related difficulties (1 – 4) and five actor-related difficulties (5 – 9). Each difficulty is recognized in each case, except the difficulty concerning continuous scop changes (difficulty 8). The system-related difficulties that need to be conquered for setting up a collaboration in the road traffic system are:

1. Traffic control instruments are maintained in an insufficient way by several road authorities which closes the door to introducing collective traffic management.
2. The road traffic system includes conflicting functionalities which may hamper to reach consensus about the optimal use of the road capacity.
3. The road traffic system is controlled with diverse autonomously developed scenarios while an overlapping approach is necessary for joint control.
4. The costs and benefits of collaboration in the road traffic system are not fully known beforehand since the effects are hard to indicate due to the system complexity.
Subsequent to this, the actor-related difficulties that challenge the process are:

5. The individual interests of the road authorities may become inferior to the collective interest of the collaboration.
6. Changes in the coalition due to political dynamics provide no stable support for the collaboration on an administrative level.
7. Strategic behavior to defend the individual interests conflicts with the necessary trust-relationship within the collaboration.
8. The scope of the collaboration continuously changes as topics are added on and removed from the agenda due to strategic behavior from coalition partners.
9. Collaboration involves the rank and file of all coalition partners, which introduces long decision-making processes.

By evaluating the relative importance of these difficulties from top right to bottom left, three conclusions are drawn from Figure 9-1. First, it is concluded that the actor-related difficulties (difficulties 5 to 9) are evaluated as generally more important to the process than the system-related difficulties as illustrated below. This implicates that the actor-related difficulties need specific attention to succeed in setting up the collaboration. Second, the vital consequences of incidents due to strategic behavior for the necessary trust-relationship (difficulty 7) are probably underestimated since the interview respondents did not frequently mentioned these difficulties on their own accord. Third, the importance of the extensive decision-making process (difficulty 9) is by contrast overestimated. The consequences are moderate as it only prolongs the process while it is frequently discussed during the interviews.

Figure 9-1 Evaluation of the relative importance of the difficulties
Besides these difficulties, it is presumed that two dilemmas need to be taken into consideration. Those dilemmas are choices that have to be made in an early phase of the process. The first dilemma is whether a coalition is composed with or without umbrella organizations representing groups of road authorities. On the one hand, umbrella organizations incorporate an additional governmental layer which results in a further increasing network complexity. On the other hand, dealing with the network complexity is more difficult as the number of coalition partners grows. A balance must be found in including umbrella organizations or individual road authorities since locking out some road authorities is no possibility due to the dependencies. The second dilemma concerns the chosen financing structure. It is presumed that the choice for one main financer, unequal or equal financial contributions changes the balance of power between the coalition partners given the fact that ‘the one who pays the piper calls the tunes’.

Although being aware of the difficulties that may be faced during the process is essential, knowing in what way these can be dealt with is the key to succeed in setting up a collaboration in the road traffic system. The defined strategies can be used by public authorities to deal with the defined difficulties. These strategies are listed in Table 9-1, including the distinction between strategies fitting the system or actor perspective.

<table>
<thead>
<tr>
<th>Strategies from system perspective</th>
<th>Strategies from actor perspective</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>▪ <strong>S6. Design a joint control strategy</strong></td>
<td>▪ S5. Allow shifts in the proposed plan on the administrative decision-making table</td>
</tr>
<tr>
<td>▪ S9. Quantify the expected gains and losses of collaborative measurements</td>
<td>▪ S7. Translate the technical control strategy to interests of the road authorities</td>
</tr>
<tr>
<td></td>
<td>▪ S8. Accommodate conflicting functionalities to separate collaborations</td>
</tr>
</tbody>
</table>

**Learning to deal with increasing complexity due to collaboration**

By exploring the difficulties with theory, the main finding derived from the theoretical exploration by the system perspective is that collaboration in the road traffic system increases both the system and the network complexity. A larger System of Systems is formed by the combination of a set of individual systems managed by different road authorities. Due to the new connections made between the separate parts of the road traffic system, additional system dependencies and an increasing amount of relations between the individual road authorities arise.
Understanding the increasing system and network complexity is therefore seen as a necessity to effectively deal with the difficulties and succeed in setting up a collaboration in the road traffic system. The added value of the strategies printed in bold is that collective use of these strategies creates a learning process. Each strategy aims to realize a specific outcome, though it is presumed that the way towards this outcome may be even more valuable. Experiencing these learning processes together creates a shared understanding among the coalition partners. It is presumed that the increasing system and network complexity is understood in the course of time.

**The added value of combining the system and actor perspective**

It can be concluded that several strategies can be used to overcome the difficulties to set up a collaboration in a networked infrastructure system. Table 9-2 shows what strategies are applicable to what difficulties.

**Table 9-2 Cross-application of strategies to deal with difficulties from the contrasting perspective**

<table>
<thead>
<tr>
<th>System-related difficulties</th>
<th>Strategies from system perspective (rational actor approach)</th>
<th>Strategies from actor perspective (network approach)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty 1</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 2</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 3</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 4</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actor-related difficulties</th>
<th>Strategies from system perspective (rational actor approach)</th>
<th>Strategies from actor perspective (network approach)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty 5</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 6</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 7</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Difficulty 9</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Two main advantages are given to clarify the added value to analyze the process of setting up a collaboration in the road traffic network with the combined use of the system and the actor perspectives. First, the difficulties that are defined from both perspectives differ strongly. This implies that a more coherent understanding is gained than when difficulties are assigned from one of the perspectives. The second advantage is the use of cross-application. Seeing that strategies from the system perspective can be used to overcome actor-related difficulties and the other way around, it is presumed that cross-application of strategies is common and useful. Cross-application implies that strategies from one of the perspectives can be used to deal with
the difficulties from the contrasting perspective. This implicates that strategies from a system perspective can help to structure complex decision-making processes and create an objective overview of the variety of interests. Although this way of cross-application can be useful, it must be used with care since it creates little freedom of action for the actors.

**Applicability of the research findings to other fields of practice**

The research findings related to the road traffic system are discussed with experts to investigate the validity and the applicability to other networked infrastructure systems. The actor-related difficulties are validated although at a high abstract level. It is discussed that the extensive decision-making process in collaboration can also be of use to create commitment among the coalition partners. Additionally, despite the difficulty of insufficient maintenance of system elements, the system-related difficulties are often recognized as well. This is not seen in other fields of practice. Although the difficulties are often recognized in the water sector, it is found that the usefulness of the strategies is limited for setting up a collaboration in the water infrastructure system since the sector is more centrally organized than road management. It would therefore be a bit presumptuous here to conclude that the research findings are applicable to all other networked infrastructure systems.

9.2. **Recommendations**

A few recommendations can be given for further research. It must be mentioned that this list of difficulties is not complete since it is only based on the selected eight research elements. Extending this list with further research will be of added value to gain an even more coherent picture of the difficulties that occur in the process of forming a collaboration in the road traffic system. Besides that, extensive research in other fields of practice is necessary to broaden the applicability of those research findings. It is recommended to apply this research methodology to other networked infrastructure system such as the water infrastructure system in the Netherlands. In this way, the list of difficulties can be completed and it can be examined which difficulties overlap in the networked infrastructure systems. Furthermore, international oriented research could also be part of further research steps.

It is thereby striking that no effective strategies are found to deal with two major difficulties. First, it is recommended to make agreements to deal with the difficulty of overdue maintenance on beforehand of the process. It can be examined what rules of the game might be designed to support a transparent process. Second, the process is challenged by coalition changes at an administrative level due to political dynamics. A recommendation for further research is to study the feasibility of organizing road management disciplines in a legal organizational form to reduce the political influence on the collaboration.
10. **Reflection**

The research findings are applicable for collaborations between public authorities on networked infrastructure systems. There are five main reflections points stated.

First, a case study research of three cases is a very limited foundation to state that the described cross-application may be applied to collaborations that are set up in complex sociotechnical systems. Many differences may be found between diverse fields of practice. Particularly, the system-related difficulties may not all be applicable to the process of setting up a collaboration in other networked infrastructure systems. Besides that, the eight selected elements on which the difficulties are based are limited and lack to provide a complete list. For instance, differences in corporate cultures of the organization are not taken into consideration.

Second, the empirical observations are gathered by interviews with respondents that are involved in one of the three cases. However, the cases are selected on the criteria that the process was already started a few years ago and some interview respondents found it hard to memorize the exact details of some experiences that were discussed. In the course of time, the perceptions can be changed which make the empirical observations less reliable.

Third, the strategies fit to the rational actor approach and the network approach described in the theoretical framework. Thereby it is stated that the rational actor approach corresponds to the assumptions of the system perspective and the network approach to the actor perspective. However, the actor and system perspective are broader world views than only those approaches since the perspectives cover various disciplines.

The research is delineated to the organizational boundaries in the road traffic system. Although, the public organizations, and especially the individuals involved at the administrative level, meet each other in processes that are concerned with other public policies as well. Developments on other policy issues can have an influence on the state of affairs in the process analyzed. The scope is narrowed down to delineate the topic to a manageable research context for a graduation project, but therefore some influences that can be of significant importance are not taken into consideration.

Fifth, by analyzing the process at the level of organizations, the influence of the individuals involved in the collaboration is neglected. This gives the research findings an abstract character. In the end, it can be considered that the behaviour and performance on the level of the organizations is the result of the occurrences on individual level. This is an important limitation of the research since the effect of the personal ‘click’, a charismatic leader and the attitude of individuals can be decisive factors during the process.
LITERATURE


APPENDICES

A  List of definitions and abbreviations
B  List of interviews
C  Checklist interview questions
D  Organization expert meeting
E  Screening and selection of cases
**APPENDIX A LIST OF DEFINITIONS**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actor</td>
<td>The organizations that are involved in the collaboration, which can be directly as coalition partner or indirectly as organization represented by an umbrella organization.</td>
</tr>
<tr>
<td>Actor behavior</td>
<td>The ways in which the actors behave during the process. For example, this can be purely rational or strategic.</td>
</tr>
<tr>
<td>Actor dependencies</td>
<td>The relations between and within the actors, which make that the actors cannot act autonomously.</td>
</tr>
<tr>
<td>Actor interests</td>
<td>The objectives that are not temporarily strived for by the actors, but those that justify the rationale of the actor’s existence.</td>
</tr>
<tr>
<td>Decision-making</td>
<td>The result of the process of interaction between the actors.</td>
</tr>
<tr>
<td>Difficulties</td>
<td>The barriers that occur during the process and which have to be overcome to continue the process successfully.</td>
</tr>
<tr>
<td>Dilemmas</td>
<td>The situation that an important choice has to be made between two options with both divergent pro's and con's.</td>
</tr>
<tr>
<td>System</td>
<td>The whole of the system elements that together perform a particular function.</td>
</tr>
<tr>
<td>System behavior</td>
<td>The ways of getting from the present state of the system to the desired state of the system, which can be intended or unintended behavior in complex systems.</td>
</tr>
<tr>
<td>System dependencies</td>
<td>The relations between and within the single systems, which make that the systems cannot function autonomously.</td>
</tr>
<tr>
<td>System functionalities</td>
<td>The objectives strived for by the diverse disciplines in the road traffic system.</td>
</tr>
<tr>
<td>System performance</td>
<td>The end state of the system which is the intended result achieved with coordination and control mechanisms or unintended due to uncertainties that occurred.</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS

DRIP  Dynamic Route Information Panels (type of traffic control instruments)
PPA   Praktijkproef Amsterdam (one of the cases studied)
TDI   Installations for controlled access to the motorways (type of traffic control instruments)
VRI   Traffic lights (type of traffic control instruments)
# Appendix B List of Interviews

<table>
<thead>
<tr>
<th>Name</th>
<th>Reference</th>
<th>Organization</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PPA project</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ronald Adams</td>
<td>PPA/RA</td>
<td>Rijkswaterstaat</td>
<td>Project manager PPA project</td>
</tr>
<tr>
<td>Daniel van Motman</td>
<td>PPA/DM</td>
<td>Municipality of Amsterdam (DIVV)</td>
<td>Sr. advisor traffic management</td>
</tr>
<tr>
<td>Arthur Rietkerk</td>
<td>PPA/AR</td>
<td>Province</td>
<td>Traffic manager</td>
</tr>
<tr>
<td><strong>VERDER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eric Diepstraten</td>
<td>VERDER/ED</td>
<td>Province Utrecht</td>
<td>Program manager VERDER</td>
</tr>
<tr>
<td>Jos van Loon</td>
<td>VERDER/JL</td>
<td>Rijkswaterstaat</td>
<td>Program manager VERDER</td>
</tr>
<tr>
<td>Bastian Jansen</td>
<td>VERDER/BJ</td>
<td>City Region Utrecht</td>
<td>Strategic policy advisor</td>
</tr>
<tr>
<td>Jan Jaap van Dijke</td>
<td>VERDER/JJD</td>
<td>Province Utrecht</td>
<td>Program manager RVM</td>
</tr>
<tr>
<td><strong>BEREIK!</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan Harm Brouwer</td>
<td>BEREIK/JHB</td>
<td>Province Zuid Holland</td>
<td>Manager</td>
</tr>
<tr>
<td>Marc Schenk</td>
<td>BEREIK/MS</td>
<td>City Region Rotterdam</td>
<td>Program manager</td>
</tr>
<tr>
<td>Thomas Arts</td>
<td>BEREIK/TA</td>
<td>Province Zuid Holland</td>
<td>Director DBI - Dienst beheer infra</td>
</tr>
<tr>
<td>Roel Bouman</td>
<td>BEREIK/RB</td>
<td>City Region Rotterdam</td>
<td>Sr. policy advisor</td>
</tr>
</tbody>
</table>
APPENDIX C CHECKLIST INTERVIEW QUESTIONS

This checklist is used during the interviews to give it a semi-structured attitude. This checklist is based on the eight elements selected. Depending on the function or the knowledge the interview respondent had, the focus is sometimes shifted by adding or removing some topics during the interview. Nevertheless, this is the most overlapping checklist used.

**Persoonlijke achtergrond**
- Opleiding en werkervaring
- Functie bij organisatie & samenw.
- Ervaring met dergelijke projecten

**Aanleiding voor samenwerking**
- Motivaties (intern)
- Andere ontwikkelingen (extern)
- Eigen rol en betrokkenheid

**Verwachtingen m.b.t. samenwerking**
- Persoonlijke verwachtingen
- Gedeelde verwachtingen
- Invloed en relevantie van gedeelde verwachtingen

**Afhankelijkheden**
- Middelen (geld, kennis, systeem)
- Besluitvorming

**Belangen**
- Persoonlijke belang
- Gedeelde belang
- Conflicterende belangen
- Invloed op proces: botsing/draagvlak

**Relatie met bestuurlijke achterban**
- Ontwikkeling van deze relatie
- Middelen om relatie vorm te geven
- Relevantie van deze relatie

**Invloed van de kartrekker**
- Rol
- Reden
- Invloed en relevantie voor proces

**Realisatie voordelen door samenwerken**
- Welke voordelen
- Synchronisatie van taken of activiteiten
- Verandering in taakverdeling
- Implicaties van verandering in taakverdeling

**Invloed van complexiteit op het proces**
- Ervaring van complexiteit
- Op welke elementen
- Verklaring van deze invloed
- Omgang met complexiteit

**Invloed externe kansen en bedreigingen**
- Soorten kansen en bedreigingen
- Momenten dat deze zich voordeden
- Invloed van aangegrepen kansen
- Invloed van bedreigingen

**Intentie samenwerking lange termijn**
- Aanwezigheid van lange termijn intentie
- Gedeelde intentie
- Relevantie van lange termijn intentie

**Succesvolle samenwerking**
APPENDIX D ORGANIZATION EXPERT MEETING

Experts involved in the expert meeting are listed in the table below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reijer Baas</td>
<td>Director Housing &amp; Real estate</td>
<td>Proces and program manager complex spatial problems</td>
</tr>
<tr>
<td>Wim Gideonse</td>
<td>Director Infrastructure, urban development and environment</td>
<td>Process and project manager in complex environments</td>
</tr>
<tr>
<td>Rob Prins</td>
<td>Consultant Infrastructure, urban development and environment</td>
<td>Stakeholder management and ‘combining functions’</td>
</tr>
<tr>
<td>Joost Rengers</td>
<td>Sr Consultant Infrastructure, urban development and environment</td>
<td>Process manager and policy advisor in water management</td>
</tr>
<tr>
<td>Rudolf Rijkens</td>
<td>Sr Consultant Infrastructure, urban development and environment</td>
<td>Proces manager complex problems</td>
</tr>
<tr>
<td>Gerard Scheffrahn</td>
<td>Project manager Infrastructure, urban development and environment</td>
<td>Project manager in large infrastructure projects</td>
</tr>
<tr>
<td>Pau Lian Staal</td>
<td>Sr Consultant Infrastructure, urban development and environment</td>
<td>Project and process manager in stakeholder environments</td>
</tr>
<tr>
<td>Jan-Floor Troost-Oppelaar</td>
<td>Sr Consultant Infrastructure, urban development and environment</td>
<td>Project manager traffic and transport sector</td>
</tr>
<tr>
<td>Erik van der Veen</td>
<td>Consultant Infrastructure, urban development and environment</td>
<td>Consultant in the public transport industry and complex administrative decision-making</td>
</tr>
</tbody>
</table>
Toepasbaarheid van onderzoeksresultaten bepalen voor andere sectoren binnen AT Osborne

Expert meeting – Afschudden MSc CME, TU Delft
Carla de Koning
30 augustus 2013, BAAAN

Programma

10.00 – 10.15 Korte toelichting onderzoeksproject
Doel Expert Meeting
10.15 – 11.00 Herkenning van moeilijkheden in het proces
11.00 – 11.15 Koffiepauze
11.15 – 12.00 Bruikbaarheid van strategieën bespreken

Onderzoeksproject

Onderzoeksdoel:
Bepalen van moeilijkheden die voorkomen in het proces om samenwerking op 'networked infrastructure systems' vorm te geven tussen publieke organisaties op alle overheids-niveaus en strategieën ontwerpen om hiermee om te gaan.
Afbakening: beheer en gebruik van de weginfrastructuur

Doel Expert meeting

Herken jullie de resultaten voor andere sectoren?

1. "Networked infrastructure systems": infrastructuur systemen die beheerd worden door een netwerk van publieke organisaties.
2. Sectoren waarin AT Osborne actief is m.b.t. publiek-publieke samenwerkingen.

Onderzoeks perspectief

Comp neuze sociaal-technische systemen
- Verschillende systeemtagen
  - Beheer en onderhoud
  - Verkeer en transport scenario's
  - Verkeer en infrastructuurmanagement
- Verschillende landen
  - Gemeenten
  - Provincies
  - Het Rijk

Onderzoeks perspectief

Comp neuze sociaal-technische systemen
- Verschillende systeemtagen
  - Beheer en onderhoud
  - Verkeer en transport scenario's
  - Verkeer en infrastructuurmanagement
- Verschillende landen
  - Gemeenten
  - Provincies
  - Het Rijk

System perspectief
- Systemen inzet
- Systemen inzet
- Systemen inzet
- Systemen inzet
OnderzoeksPerspectief

Complexe sociaal-technische systemen
- Verschillende systeemlagen
  - Beheer en onderhoud
  - Verkeensvriendelijke controle scenario's
  - Verkeersmanagement
- Verscheidenheid aan beheerders
  - Gemeenten
  - Provincies
  - Het Rijk

Actorperspectief
- Ambt van voorzitter
- Actoren, er is geen oplossing, bood u waarden aan lokale

Moeilijkheden in het proces om samenwerking op te zetten in een infrastructuurwerk dat behaard wordt door verschillende publieke organisaties

VANUIT BEIDE PERSPECTIEVEN

Moeilijkheden

1. Belangen: bereidwilligheid om samen te werken wordt aangezet doordat individuele belangen ondergeschikt kunnen worden een gezamenlijk belang om het "overal system" te verbeteren
2. Besluitvorming: besluitvormingsproces in de samenwerking dun neemt door noodzakelijke bredere opvattingen naar de schepping
3. Gedrag van actoren: veranderingen in de context door politieke belangen biedt geen stabielen draagvlak voor samenwerking (bestuurlijke nieuw)
- strategisch gedrag om de belangen te behartigen, conflictvrij met de gewenste verbetering van de samenwerking
- focus verdriet doordat onderleveren strategische invoering wordt toegevoegd of afgenomen
4. Systemen/hypertyperen: systemen van voorzitters zijn een doel van verschillende organisaties
- Systemenfunctionele, verschillende disciplines binnen het systeem hebben andere, conflictheffende doelstellingen om te behalen
5. Systemenperspectief: systemen zijn oorspronkelijk gecompliceerd om de gewenste verbetering te behalen
6. Systemenpunt vandaag: systemen worden beheerd met verschillende sceenstge en procedures om de gewenste verbetering te behalen

X. Systemenperspectief: systemen zijn oorspronkelijk complex en compliceert om de gewenste verbetering te behalen

Moeilijkheden - Belangen

Belangen
Bereidwilligheid om samen te werken wordt aangezet doordat de individuele belangen ondergeschikt kunnen worden aan het gezamenlijk belang om het gehele systeem te verbeteren.
Moelijkheden - Belangen

Belangen
Bereidwilligheid om samen te werken wordt aangetast doordat de individuele belangen ondergeschikt kunnen worden aan het gezamenlijk belang om het gehele systeem te verbeteren.

Voorbeeld
De wethouder van de gemeente Deist moet toestemming geven dat de stoplichten ‘op zijn weg’ langer op rood mogen staan om de doorstroming in het gebied Haaglanden te verbeteren.

Moelijkheden

Langdurige besluitvorming
Bestuurlijke besluitvormingsprocessen in de samenwerking duren lang door noodzakelijke terugkoppeling naar de achterban.

- Bestuurlijk overlegorganisatie zonder bestissingsbevoegdheid
- Deelname overkoepelende organisaties

Voorbeeld
De goedkeuring van een besluit moet na overeenstemming in UVKB teruggekoppeld worden naar RWS, twee provincies, twee gemeenten, twee stadjewesten en het BRU.

Moelijkheden

Gedrag van actoren
Veranderingen in de coalitie door politieke wisselingen biedt geen stabiele draagvlak voor samenwerking op bestuurlijk niveau.

Voorbeeld
Een eerder genomen besluit wordt in twijfel getrokken doordat een andere wethouder de portefeuille verkeer heeft gekregen na de gemeenteraadsverkiezingen.
Gedrag van actoren
Strategisch gedrag om de belangen te behartigen conflicteert met de gewenste vertrouwensrelatie binnen de samenwerking.

Voorbeeld
Een besluit wordt genomen door RWS, zonder het DIVV te betrekken. DIVV komt erachter dat er sprake is van een verborgen agenda, wat het vertrouwen niet ten goede komt.

Gedrag van actoren
De focus van de samenwerking verandert doordat agendapunten (strategisch) worden toegevoegd of afvallen.

Voorbeeld
BeRLIK probeert een samenwerking op te zetten op verschillende onderwerpen. De onderwerpen op de agenda veranderen, want ‘we zitten nu toch met elkaar om tafel’.

Moelijkheden
Systeemafhankelijkheden
Systeemonderdelen zijn onvoldoende onderhouden om het gebruik van de infrastructuur gezamenlijk te optimaliseren.

VANUIT SYSTEEM PERSPECTIEF
Moeilijkheden

Systeemafhankelijkheden
Systeemonderdelen zijn onvoldoende onderhouden om het gebruik van de infrastructuur gezamenlijk te optimaliseren.

Voorbeeld
40 tot 60% van het areaal (VRP's, TDI's, DRIP's) in de provincie Noord Holland functioneert niet. Hierdoor kan de Praktijkproef Adam geen verkeersmanagement uitvoeren.

Moeilijkheden

Systeemfuncties
De verschillende disciplines binnen het systeem hebben andere, soms conflicterende doelstellingen om te behalen.

Voorbeeld
Verkeersmanagement streeft naar optimale benutting van het infrastructuurnetwerk, maar werkvloeraamheden voor het onderhoud beperken de capaciteit van het wegennet.

Moeilijkheden

Systeemdynamiek
Het systeem wordt beheerst met verschillende scenario's en procedures om de gewenste prestatie te behalen.

Voorbeeld
Elke beheerder laat verkeersmanagement uitvoeren door een verkeerscentrale. Deze verkeerscentrale heeft zijn eigen controle-scenario's om de doortromming op eigen wegen te bevorderen, zonder de effecten in de regio mee te nemen.

Moeilijkheden

Systeemprestatie
Het systeem is zodanig complex dat de effecten van een samenwerking op het systeem niet goed te identificeren zijn.
Moelijkheden

Systeemprestatie
Het systeem is zoodanig complex dat de effecten van een samenwerking op het systeem niet goed te identificeren zijn.

Voorbeeld
De effecten van gezamenlijk verkeerstijdsmanagement zijn moeilijk aan te tonen. Want staat er nu minder file door de gezamenlijke aanpak, of komt het door de recessie?

Strategie – Belangen

Stel gezamenlijk een plan op om alle belangen te behartigen.
- Ontwerp objectief *assessment framework* om plannen aan te toetsen:
  - Rationaliseren van de afweging in belangen.
  - Uitgebalanceerd voortaan als resultaat.
  - Geveel gezamenlijk beeld en verhaal.
- Keur het *assessment framework* op bestuurlijk niveau goed: geeft een fundering om gezamenlijk op terug te vallen.
- Ontwerp ‘package deal’ in fasen m.b.v. framework:
  - Start met makkelijke besluiten (‘no regret en ‘quick wins’).
  - Sluit af met moeilijke besluiten.

Strategie – Besluitvorming

Organiseer een bestuurlijke puzzel:
- Sta een verschuiving in voorgestelde plan toe van ± 10%.
- Zorg dat je wisselgeld hebt – Elke bestuurders heeft ‘iets’ nodig om ‘naar huis te gaan’.
- Sta ‘over-programmering’ toe om - Meer maatregelen inzetten dan er budget voor is om tegenvallers op te vangen.

Strategie – Gedrag van actoren

Wisselingen in coalitie door politiek:
- Zorg dat tussentijdse plannen op bestuurlijk niveau zijn goedgekeurd als fundering om op terug te vallen.
- Breng samenwerking in rechtvorm met mandaat binnen afsprakenkader dat op bestuurlijk niveau is goedgekeurd.
  → Aanbeveling: haalbaarheid onderzoeken.

Strategisch gedrag en vertrouwensrelatie
- Stimuleer transparantie in het proces van belangenafweging.
- Voorkom Incidenten die vertrouwen op de proef stellen.
  - Escolieren: Schaal eventueel conflict op naar bestuurlijk niveau om het probleem op te losen op een ander niveau.
  - Val terug op de inhoud.
Strategie – Gedrag van actoren

Wees je bewust van de 'gevaren' van scopewijzigingen in de samenwerking door strategisch gedrag:
- 'Agenda-setting', want de partijen zitten al om tafel.
- Samenwerking wordt 'vehicle' van de omgeving.

Strategie – Systeemafhankelijkheden

Systeemonderdelen onvoldoende onderhouden
- Geef volledig beheer over aan één organisatie (mogelijk indien één machtige speler in coalitie).
- Aanpassen en aanschaffen van systeemonderdelen (mogelijk indien grote pot met geld beschikbaar).
- ...

Strategie – Systeemfunctie

Rolmodel implementeren in samenwerking:
- Afweging tussen de functies laten maken door een afdeling op hoger organisatorisch niveau.

Strategie – Systeemdynamiek

Ontwerp gezamenlijk controlevlis voor de regio – afspraken kader hoe het systeem wordt gebruikt, d.m.v.:
- Categoriseren van herkomst en bestemming om knelpunten in het netwerk te definieren.
- Prioriteiten stellen; waar sta je bufferen toe en tot welke grenzen om netwerk-brede knelpunten op te lossen?
- Koppelen van coördinatiecentra om interactie mogelijk te maken of coördinatie vanuit één overkoepelende centrale.

Strategie – Systeemprestatie

Inzichtelijk maken van de effecten van samenwerking d.m.v.
- "Doorvertalen" van de systeemprestatie naar de belangen (technisch verhaal → bestuurlijk verhaal).
- Gezamenlijk ontwerpen 'assesssment framework' leidt tot inzicht van effecten.
- Kosten-batenanalyse kan verdieptijkten of de samenwerking (waarschijnlijk) de gewenste baten oplevert.
- Gebruik simulatiemodellen om de effecten voor het gehele, maar ook de lokale systemen aan te tonen.

OPZET NAAR CONCLUSIE
### Opzet naar conclusie

<table>
<thead>
<tr>
<th>Autor dilemma: Belangen</th>
<th>Autor strategie</th>
<th>Systeem strategie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autor dilemma: Belangen</td>
<td>Ontwerp “pakking deal” om alle belangen te behartigen</td>
<td>Objectieve benaderingslijn voor belangen afweging (rationaliseren)</td>
</tr>
<tr>
<td>Systeem dilemma: Systeemprestatie onvoldoende</td>
<td>“Doomvangers” systeem- prestatie naar de belangen</td>
<td>Gebrek simulatietoepassingen voor onderscheid tussen netwerk en lokale effecten</td>
</tr>
</tbody>
</table>

**En nu?**

---

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## APPENDIX E SCREENING AND SELECTION OF CASES

<table>
<thead>
<tr>
<th>Road management tasks</th>
<th>CFA</th>
<th>EFA</th>
<th>IFA</th>
<th>MFA</th>
<th>PFA</th>
<th>SMU</th>
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<tbody>
<tr>
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<td>Sustainable intention long term</td>
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<tr>
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<td>• Evaluation/audit reports</td>
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<tr>
<td>• Administrative agreements</td>
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<tr>
<td>• Interviews/key players</td>
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