The Infrastructural Decision Room
‘A Simulation Instrument for Group Decision Making in Infrastructural projects’

Master thesis - Final Report - P5
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PREFACE

This report is written for the use of the P5 exam at the Delft University of Technology. The P5 exam is the endterm of a design project or a research project. The final product of the project completes the master’s track at Delft University of Technology.

This report is about the design project of an infrastructural decision room: The Simulation Game Box – KOM. This report describes the designer’s motive, the design stages of the project and scientific foundations.

The product is development in the laboratory Urban Decision Room of the Faculty of Architecture, Urbanism & Building Sciences; Department of Real Estate & Housing - Urban Area Development.

In this context, I want to thank P.P. van Loon and I. Bruil for their enthusiastic support during my master studies and the theoretical contributions in the project. Furthermore, I want to thank P. Barendse and R. De Graaf for the efforts, technical knowledge and a pleasant time in this project.

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SUMMARY

This Master thesis is about the Game Simulation Box KOM. In this master thesis is explained what the Game Simulation Box is and how it is developed. In the first chapter you can read in a glance about the product, the need of the client, the user of the product, the team that developed it and what method is applied to make it.

In chapter 2 is explained what the Simulation Game Box is. The Simulation Game Box KOM consists of a simulation instrument and multiple game situations. The simulation instrument is built on the foundations of the Urban Decision Room and is a computer based Open Design tool. To be more specific, it is a group decision room that is adjusted to be used as the representation of decision making processes in infrastructural projects. All stakeholders having an interest can influence the design. As such they become decision makers, i.e. parties who collectively decide on how the design will ultimately look. Decision makers are, therefore, stakeholders who have influence on the design.

A game will challenge the stakeholder manager to think about decision-making in several mentioned approaches/strategies. It will make stakeholder managers (more) aware of consequences of decisions in urban area development under variable circumstances in a multi-actor environment.

Chapter 3 is a theoretical introduction to the constraints of the Simulation Game Box. In the need of the client it is asked to develop this simulation instrument with game situations on the basis of the Urban Decisions Room. The result of playing the games should be that 'stakeholder managers should gain (more) awareness through gaming situations in the simulation instrument'. This theoretical introduction breaks down the need in smaller pieces. These pieces indentify the key constraints of the client. These pieces are the user, the product to develop and the result.

The development of the Simulation Game Box is done according to the engineering design process of Clive I. Dym & Patrick Little. Engineering design is a thoughtful process for generating designs that achieve objectives within specified constraints. In chapter 4 is set out how the engineering design method is applied both by the development of the simulation instrument as the development of a game situation.

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1 Loon, P.P.J. van, Heurkens, E., Bronkhorst, S. | Urban Decision Room, een stedebouwkundig sturingsinstrument | 2008
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1. INTRODUCTION

This Master thesis is about the Game Simulation Box KOM. In this master thesis is explained what the Game Simulation Box is and how it is developed. In this chapter you can read in a glance about the product, the need of the client, the user of the product, the team that developed it and what method is applied to make it.

1.1. The Product

The Game Simulation Box KOM is a tool for stakeholder managers. Stakeholder managers can use this tool to learn and get better understanding of their own profession. The emphasis of the tool is on giving insight in the process of decision making in an infrastructural development. The Game Simulation Box consists of 2 basic components. The one component is a simulation instrument. The other component is a pallet of game situations.

1.2. The Need

The motive to develop the IDR simulator originates from the need of the client, King. King has the desire to develop a tool that gives insight into factors and actors that stakeholder managers have to deal with. ²

1.3 The Client

The client of the Simulation Game Box is the Community of Practice of KING. KING is a collaborative program of Rijkswaterstaat and ProRail. KING is aimed at the development and exchange of knowledge which is gained in the realization of large infrastructural projects.

Figure 1.1. Logo of client organization ³

The goal of KING is to increase and develop the quality of project management of Rijkswaterstaat and ProRail, through this knowledge. KING consists of 10 Communities of

² Kennis in het groot | King Omgevingsmanagementspel: Verhelderend en blikverruimend | 2009
³ Kennis in het groot | www.kennisinhetgroot.nl | November 2009
1.4. The User

The product is to be used by stakeholder managers of Rijkswaterstaat and ProRail. The task of stakeholder managers is “to involve stakeholders proactively in order to identify and achieve common goals to maintain lead in the execution of projects”.

1.5. The Developer

The developer is Delft University of Technology. To be more precise: The simulation Game Box is evolved in the laboratory Urban Decision Room of the Section Design and Decision Systems. This laboratory is at the Faculty of Architecture, Urbanism & Building Sciences of Delft University of Technology.

![Figure 1.2. Logo of developer organization](https://www.tudelft.nl/live/pagina.jsp?id=efca4ac7-df2e-49b2-8b80-e24286061af4&lang=nl)

The team consists of 4 people: Peter Barendse MSc (assistant professor, developing the allocation model), Rein de Graaf MSc. (assistant professor, developing the optimization model), Peter Paul van Loon Phd. (professor, developing the concept, managing overall picture) and Pascal ter Laak BSc. (master graduate, developing the game, designing interfaces).

1.6. The Approach

The development of the Simulation Game Box is done according to the engineering design process of Clive I. Dym & Patrick Little. Engineering design is a thoughtful process for generating designs that achieve objectives within specified constraints. In the engineering design method of Dym & Little, 7 main steps are to be recognized to realize the product (= step 7. Final Design) from the initial thought to start the design process (= step 1. Client Statement).

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4 Kennis in het groot || Jaarverslag KING 2008 || April 2009
5 DUO werkgroep omgevingsmanagement | Projecten komen, projecten gaan, maar de beheerder blijft bestaan - Een visie op het regionale omgevingsmanagement van RWS || 2007
6 TU Delft || https://www.tudelft.nl/live/pagina.jsp?id=efca4ac7-df2e-49b2-8b80-e24286061af4&lang=nl || 2010
These 5 steps in between initiation of the project and the project result are the Problem Definition, the Conceptual Design, The Preliminary Design, the Detailed Design and the Design Documentation.

The Design Communication is the document as you are reading now. In chapter 4 is described what the engineering design process is of the simulation instrument and what the engineering design process is of one of the games.

In that chapter is set out how the engineering design method applied both by the development of the simulation instrument as the development of a game situation.
2. THE SIMULATION GAME BOX

The Simulation Game Box KOM consists of a simulation instrument and multiple game situations. The simulation instrument is built on the foundations of the Urban Decision Room\(^7\) and is a computer based Open Design tool. To be more specific, it is a group decision room that is adjusted to be used as the representation of decision making processes in infrastructural projects. All stakeholders having an interest can influence the design. As such they become decision makers, i.e. parties who collectively decide on how the design will ultimately look. Decision makers are, therefore, stakeholders who have influence on the design\(^8\).

The technical environment in which this simulation instrument is embedded is Microsoft Excel.

The simulation instrument projects the proposed development of the A13/A16 alignment on the north site of Rotterdam.

![Figure 2.1. Situation with proposed alignments A13/ A16](http://www.rijkswaterstaat.nl/wegen/plannen_en_projecten/a_wegen/a13/a13_a16_rotterdam/index.aspx)

Since this A13/A16 has not been accomplished yet nor has a detailed plan been confirmed yet, the following remark has to be made: The situation in the simulation

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\(^7\) Loon, P.P.J. van, Heurkens, E., Bronkhorst, S. | Urban Decision Room, een stedebouwkundig sturingsinstrument | 2008
\(^9\) Rijkswaterstaat | http://www.rijkswaterstaat.nl/wegen/plannen_en_projecten/a_wegen/a13/a13_a16_rotterdam/index.aspx | 2010
instrument is an accurate representation of the location on the north site of Rotterdam. The allocation of the highway in the simulation instrument is an educated guess of the probable alignment of this road.10

An infrastructural project has a wide variety of constraints. The origin of these constraints is diverse and is set by stakeholders, shareholders, regulations, policies and other factors of importance. It is evident that a constraint is always related to the infrastructural object to be created and to the activity taking place on that location.

Implementation of the prelimiting conditions in an infrastructural project is a difficult and complex task, but desirable and even necessary. Desirable, because including these conditions gives the project a solution that is in favor of the parties involved. Necessary, since ignoring these constraints harms the project and may lead to delay or even cancellation. Including these constraints in the project and molding the project around these constraints is an important task which is executed by the stakeholder manager.

To assist stakeholder managers in understanding and improving their tasks, the Simulation Game Box KOM is developed. The aim is to let stakeholder managers gain (more) awareness through games that are related to and cover the field of actual decision making processes in infrastructural projects.

2.1. The Simulation Instrument

The decision making process that the simulation instrument is aimed at, is the optimized allocation of land among stake holding functions. The representation of this decision making process is threefold, answering essential questions:

1. KOM bi1
   What area is subject of the solution space? The first element of the instrument is to define the total search area in the study area. In other words: It demands the user to think and to point out the outlines of the search area in the study area. The start of the search area is already marked by the white colored zones in the map. If desirable, this search area can be changed in favor of a larger solution space.

2. KOM bi2
   What are the constraints of the stake holding functions? Stake holding functions have their demands and wishes. These have to be entered in the model to see if this bundle of constraints meets the first criterion: Fitting in the search area.

3. KOM bi3
   In what ratio should the available area be divided among the functions? The assumption is that all the constraints do fit in the search area at this point. The problem to solve is to optimize the assignment of available land to the functions involved. This optimization of this division is calculated by the simulation instrument.

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9 Rijkswaterstaat
http://www.rijkswaterstaat.nl/wegen/plannen_en_projecten/a_wegen/a13/a13_a16_rotterdam/index.aspx | 2010
3. KOMa

Where do the optimized surfaces of functions have to be allocated? The last step of the simulation instrument is to (try to) optimize the allocation of all the optimized functions based upon allocation preferences of the stakeholders. For every function a minimum necessary area has to be designated as preference area. Several areas can have multiple designated preferences. The optimization of these allocation preferences is calculated by the simulation instrument.

Figure 2.3. KOMa

2.2.1. Component KOM bi1

The first component of the simulation instrument is KOM bi1. It is used to define the total search area in the study area. The study area is the collection of all zones in the simulation instrument. The search area is that specified area in which the function of a zone may change (in favor of a solution or because it is prohibited for one or more functions). A zone is the smallest defined entity in the instrument and it is representing one function.

In the study area are several functions. A function (actor) is to be defined as ‘an activity of use for an area’. The following functions are to be noticed: Agriculture, Green, Nature, Industry, Green house, Office, Living and Water function. Every function has its own color.

Figure 2.4. KOM bi1

The development of the A13/A16 has consequences for functions in the study area. Consequences for functions can be direct tangible: the alignment cuts through locations where these functions are situated. Other consequences have indirect implications for functions e.g. the sensitiveness of a function in the vicinity of the road causing crill and noise (factors).

Defining the Search Area

As mentioned previously, the search area is that specified area in which the function of a zone may change in favor of a solution or because it is prohibited for one or more functions. The starting point of the search area is clear to see in KOM bi1; the white colored
zones on the map. The collection of these zones marks the impact area alongside the alignment.

Adding a new zone to the search area can be accomplished by clicking on that zone. The selected zone has a red border now (Clicking this zone once more deselects it from the search area again).

![Figure 2.5. Non selected zone](image1)

![Figure 2.6. Selected zone](image2)

The collection of selected zones plus the collection of white zones make the total search area. This total search area is the sphere of influence of the infrastructural project in which the solution of the optimization is to be realized.

### 2.2.2. Component KOM bi2

In component KOM bi2 constraints are entered that apply on the functions in the total search area. The goal is to match the constraints and the search area.

![Figure 2.7. KOM bi2](image3)

The origin of the constraints is diverse and is set by stakeholders, shareholders, regulations, policies and other factors of importance.

The constraints are related to the location and to the activity taking place on that location. The constraints can be expressed in hectares of the concerning functions or in percentages of hectares of the concerning functions.
The constraints are categorized into 3 groups:

- Increase of a function: What is the minimum and maximum new surface of a function desired to increase the existing functions?
- Decrease of a function: What is the minimum and maximum accepted decrease of surface of a function?
- Compensation of a function: What is the desired new surface of a function to compensate the decrease of surface of a function?

<table>
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<th>Function</th>
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<td>Compensation min.</td>
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<tr>
<td>Compensation max.</td>
<td></td>
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<tr>
<td>Decrease min.</td>
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<tr>
<td>Decrease max.</td>
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<tr>
<td>Increase min.</td>
<td></td>
<td></td>
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<tr>
<td>Increase max.</td>
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Figure 2.8. Concept: Expression of constraints

When all the constraints are entered, two results are possible: 1. the bundle of constraints doesn’t fit in the search area or; 2. the bundle of constraints fits in the search area.

1. The bundle of constraints doesn’t fit in the search area

The search area isn’t large enough to fit the set restrictions. Several actions (or a combination of these actions) can be taken. One of the possible actions is to go back to the search area in KOMbi1 and define new boundaries for this area. Defining new boundaries could make the area big enough to fit the constraints. The other action is to negotiate (the values of) the constraints. Defining different values for the constraints could make the conditions fit in the area.

When, after these actions, the bundle of constraints fit in the search area, an optimization can be run. If this is not possible, it must be concluded that, within these constraints, an optimized solution is not possible for this area.

2. The bundle of constraints fits in the search area

The search area is large enough to fit the set restrictions. An optimization can be run. The division of functions in the available area will then be optimized. The result is an optimized surface for every function.

The result of an optimized surface for every function is based on the set of constraints combined with at least one function to be maximized.

2.2.3. Component KOM a

In KOM a preferences are given for the allocation of functions. For every function a minimum necessary area has to be designated as preferred area. Preferences are expressed by assigning a function to a zone. The collection of designated zones for a function makes the preferred area of that function. Multiple preferences can be designated to one zone.
Figure 2.9. KOMa

The optimization of these allocation preferences is calculated by the simulation instrument. The result is an optimized allocation of functions. This result is expressed in the map (A.) where the colors of the zones represent the optimized preferred function. This result is also expressed in the table (B.) where the surfaces (ha.) of the optimized preferred functions are shown.

When the final result meets the demand, the process of optimizing the allocation of functions within the set constraints may stop. After all, this is the goal. If the result is inadequate or if the result is to be altered, the following measures (or a combination of these) can be taken:

- The surface of the search area has to be discussed (go to KOMb1);
- The constraints for the functions have to be discussed (go to KOMb2);
- The function-to-maximize has to be discussed (go to KOMb2);
- The preferences of the functions have to be discussed (go to KOMa).

2.2 The Game

The Simulation Game Box KOM is developed as a learning tool for stakeholder managers. The box consists of the simulation instrument and games. The simulation instrument is the learning environment of the games; the games are the means to learn aspects of stakeholder management.

Game situations

The game situations are developed for stakeholder managers. In the games, the stakeholder managers can gain (more) awareness of aspects in the field of stakeholder
management. In particular about aspects of consideration that are related to decision-making processes in infrastructural projects:

- **Fixation - Enrichment**: What decisions are fixed and what decisions are still open to give new ideas a chance?
- **Limitation - Unlimitation**: Is the study area small or are there many other areas involved?
- **Capricious - Orderly**: Can the process run as it presents itself or is the process strictly planned?
- **Power full - Not powerfull**: Is the deadlock to be broken with power or is still tried to come to an agreement?

In short: An infrastructural development is planned. For the environment, in which this alignment has to be fit in, this has implications. The stakeholders of this environment will want to express their needs and desires. In the simulation instrument, the stakeholders can input values and preferences for their functions of interest. The combination of these inputs constructs a solution space. This represents the environment of decision-making for stakeholder managers giving numerical and geometrical information about the area.

In the game, the stakeholder manager is put in a situation in which decisions have to be made. One or more decisions need to be made to keep the process of the infrastructural project going. One or more solutions are possible and these solutions are related to the aspects of consideration. Different solutions have different implications. The aim is to let stakeholder managers recognize the different situations in a decision-making process and to let them learn which measures can be taken to keep the process going towards a solution.

A game will challenge the stakeholder manager to think about decision-making in at least one of the above mentioned approaches/strategies. It will make stakeholder managers (more) aware of consequences of decisions in urban area development under variable circumstances in a multi-actor environment.

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11 Bruijn, H. de, Teisman, G., Edelenbos, J., Veeneman W. | Meervoudig ruimtegebruik en het management van meerstemmige processen | 2004
3. THEORETICAL INTRODUCTION

This chapter is a theoretical introduction to the constraints of the Simulation Game Box.

In the need of the client it is asked to develop a simulation instrument with game situations on the basis of the Urban Decisions Room. The result of playing the games should be that ‘stakeholder managers should gain (more) awareness through gaming situations in the simulation instrument’.

This theoretical introduction breaks down the need in smaller pieces. These pieces indentify the key constraints of the client. These pieces are the user, the product to develop and the result:

- Stakeholder manager - user;
- Simulation Game based on the Urban Decision Room - product;
- Awareness (Learning) - result.

3.1. The Stakeholder Manager – User

Stakeholder management is defined as "to involve stakeholders proactively in order to identify and achieve common goals to maintain lead in the execution of projects". The users of the simulation instrument are going to be stakeholder managers of Rijkswaterstaat and ProRail.

These organizations use the Integrated Project Management (IPM) model for the realization of infrastructural projects. The stakeholder manager is a role in the IPM-model. The stakeholder manager is the mediator between the (project) organization and the stakeholders in the environment of the project.

![Figure 3.1. IPM model](image)

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12 DUO werkgroep omgevingsmanagement | Projecten komen, projecten gaan, maar de beheerder blijft bestaan - Een visie op het regionale omgevingsmanagement van RWS | 2007
13 Expertgroep Projectmanagement | Rolprofielen IPM | February 2008
The core tasks of stakeholder management are:

- Stakeholder Management;
- Communication & Information;
- Traffic management;
- Conditioning.

In chapter 4, developing the simulation instrument, a more extended explanation of the role of the stakeholder manager will be given.

In the simulation instrument it has to be possible for the stakeholder manager to gain more awareness in one or more of the above mentioned core tasks of their profession.

3.2. A Simulation Game based on the Urban Decision Room - Product

Urban decision Room

The starting point to develop this simulation game box goes back two years. A demonstration session was held with the Urban Decision Room (UDR) with the case ‘Heijsehaven’15. Inspired by this, the client delivered the demand to develop a Simulation Game based on the Urban Decision Room for stakeholder managers.

The Urban Decision Room is a specific group decision room. The room is interactive, with several people gathered in a room with several computers. The computer network enables the participants to communicate with each other about the relevant topics. The network enables also to make calculations of the ‘results’ of this communication and to represent it at each computer.

Figure 3.2. Urban Decision Room

The UDR is specifically aimed at decision-making processes in the practice of urban planning, and particularly at complex urban area development projects. The participants in the interactive UDR sessions are asked to provide concrete solutions for urban planning design problems (in terms of preferences for particular functions, number of plots, etc.) and

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14 Rijkswaterstaat Directie Projecten | Concept Werkwijzer Aanleg Deel 2: Proceskaders per IPM-rol | April 2008
to enter them in a simulation model. A computer network is then used to calculate the common solution space of all the proposals, which is then projected onto a central screen.

This outcome provides the basis for further discussions and negotiations, after which another round can be held.

The result is one common solution space. A solution space within which a set of different preferences are possible and feasible. The UDR is a support instrument in the search for a final and common objective. The UDR seeks to create a solution space within which the ultimate solution (= joint goal) should be found. This search is goal oriented. This Urban Decision Room is the basis for the simulation game box.

Simulation game
The word "simulation" refers to a dynamic model of essential features or elements of a real or hypothetical system, process or environment. A simulation instrument is a representation of reality. It is a simplified learning environment in which one can practice conventions and habits.

Simulation is the imitation of some real thing, state of affairs, or process. The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system.

Simulation is used in many contexts, including the modeling of natural systems or human systems in order to gain insight into their functioning. Simulation can be used to show the eventual real effects of alternative conditions and courses of action. The simulation instrument is the environment in which simulations can take place. In which games can be played.

The word 'game' indicates actions and decisions of players: Players, who play roles, try to achieve objectives, accomplish goals and experience constraints. General features of a game are tension and uncertainty. 'Is it possible to solve the game or to win?'

In the definition of play it is not necessary to solve or to win a game. The activity of trying to find a solution is 'play'. Play is not real life. Play is a temporary activity that takes place in its own context, out of normal life. A play is set within certain boundaries of time and place. By playing a game, the player develops physical and selective abilities.

A simulation game is a combination of 'simulation' and 'game'. A simulation game usually consists of a number of elements like:

- Scenario events (events);
- Game;
- Rules;
- Roles;
- Models;
- Decisions and their consequences.

The goal is to develop a multi actor simulation instrument that makes it possible to play situations as they may occur in real life. Real life is simplified in a simulation instrument. By playing with the simulation instrument, the stakeholder manager should gain (more) awareness (learn) about the tasks of stakeholder management.

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16 Caluwé, L. de, Geurts, J., Buis, J.D., Stoppelenburg, A. | Gaming: Organisatieverandering met spelsimulaties | 1996
18 Caluwé, L. de, Stoppelenburg, A. | Gaming: een krachtig leermiddel | 2002
19 Huizinga J. | Homo Ludens | 1938
3.3. Awareness (Learning) – Result

Awareness is the state or ability to perceive, to feel, or to be conscious of events, objects or sensory patterns. In this level of consciousness, sense data can be confirmed by an observer without necessarily implying understanding. More broadly, it is the state or quality of being aware of something. In a wider context, awareness can be defined as learning. One has learnt by generating awareness.

A simulation game as a learning tool is described by L. de Caluwé as a 'greenprint' intervention. In greenprint interventions, the simulation game should function as a 'mirror' (How are you, the player, doing in the game?) and as a 'window' (What alternative ways are there of doing things? Better ways or different ways).

In greenprint interventions, people:
- experiment and explore;
- ask for feedback;
- want to learn and reflect;
- want to search new boundaries;
- share good examples.

Simulation gaming has the potential to develop a closer relationship (tight coupling) between thinking and doing. In a game individuals are thinking, considering, acting and doing almost at the same time. They frequently go through the cycle: what is my decision and how will I act and vice versa: what did I do and is this what I want to do? And why do I want to do this? During the game, but surely during the debriefing these are impactful questions and learning points. The Kolb learning cycle (1991) explains the learning steps: (1) concrete experience (2) observations and reflections (3) formation of concepts and practice theory and (4) acting and testing in new situations.

A game run is a series of learning cycles.

![Figure 3.3. The Kolb learning cycle](http://en.wikipedia.org/wiki/Awareness)

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21 Caluwé, L. de, Vermaak, H. | Leren veranderen | 2006
4. DEVELOPING THE SIMULATION GAME BOX

4.1 The Simulation Instrument

The development of the Simulation Game Box is done according to the engineering design process of Clive I. Dym & Patrick Little. Engineering design is a thoughtful process for generating designs that achieve objectives within specified constraints.

In that chapter is set out how the engineering design method is applied both by the development of the simulation instrument as the development of a game situation.

4.1.1. Client’s Statement

The motive to develop the IDR simulator originates from the need of the client, King. King has the desire to develop a tool that gives insight into actors and factors that stakeholder managers have to deal with.

4.1.2. Problem Definition

During problem definition, the client's objectives have to be clarified and gather the information needed to develop an engineering statement of the client’s wants. The means include literature reviews, interviews and observations.

- Clarify design objectives
  The demand is to develop a simulation instrument for stakeholder managers on the basis of the Urban Decision Room. The intent of the instrument is to make stakeholder managers (more) aware of consequences of decisions in urban area development under variable circumstances in a multi-actor environment. The stakeholder managers should gain (more) awareness through gaming situations in the simulation instrument. Reading the design objectives carefully it is concluded that it is important that stakeholder managers are able to simulate decisions in urban area development.

- Establish user requirements
  To establish the user requirements for the simulator it has to be explored what the field of stakeholder management is and what the core tasks of the stakeholder manager

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22 Kennis in het groot | King Omgevingsmanagementspel: Verhelderend en blikverruimend | 2009
are. The exploration of the core tasks has been made through literature reviews, workshops and a qualitative interview.

The users of the simulation instrument are going to be stakeholder managers of Rijkswaterstaat and ProRail. Rijkswaterstaat defines stakeholder management as "to involve stakeholders proactively in order to identify and achieve common goals to maintain lead in the execution of projects".23

Rijkswaterstaat is part of the Dutch Ministry of Transport, Public Works and Water Management. Its role is the practical execution of the public works and water management, including the construction and maintenance of waterways and roads. The mission of the organization is: "Rijkswaterstaat is the national agency that provides dry feet, clean and sufficient water and a quick and safe flow of traffic"24.

ProRail is a government task organization that takes care of maintenance and extensions of the national railway network infrastructure (not the metro or tram), of allocating rail capacity, and of traffic control. Prorail is a part of NS Railinfratrust (The Dutch railway infrastructure owner). Funding for ProRail is provided by a government subsidy, and a fee paid by the railway operators.26

Since about ten years the Integrated Project Management (IPM) model is in use at Rijkswaterstaat. Through this model, every infrastructural project has a management team which consists of five roles. Each role has its own task fields. (Figure 4.2.). The stakeholder manager is one of those roles. The stakeholder manager is the mediator between the (project) organization and the stakeholders in the environment of the project.

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23 DUO werkgroep omgevingsmanagement | Projecten komen, projecten gaan, maar de beheerder blijft bestaan - Een visie op het regionale omgevingsmanagement van RWS | 2007
25 Kennis in het groot | www.kennisinhetgroot.nl | November 2009
26 Wikipedia | http://en.wikipedia.org/wiki/ProRail | 2010
Global task fields\textsuperscript{26}
- Project manager: project management;
- Manager project control: control time, budget, risks and documents;
- Stakeholder manager: contact with stakeholders, (public) participation;
- Technical manager: technical input content;

Stakeholder Management is a relatively new role compared to other IPM – roles, especially in the exploration phase and design phase. Its task fields lean on 4 pillars\textsuperscript{29}:

1. Stakeholder Management
   The stakeholder manager is responsible for inventorying constraints given by the environment, making a stakeholder analysis, coordination and contact with various parties, reviewing the brief in the environment and controlling the area specific risks.

2. Communication & Information
   The stakeholder manager is also responsible for drafting the communication plan. Communication includes the method of communicating activities to environmental parties. In addition he answers media questions, the analysis of the received public input and addressing issues from stakeholders within the project team.

3. Traffic management
   Limiting nuisance to road users, due to construction activities, falls also within the remit of the stakeholder manager. The stakeholder manager suggests nuisance mitigation measures, is consulting stakeholders and ensures the adoption and implementation of these measures. Furthermore is the stakeholder manager responsible for traffic safety and the emergency plan.

4. Conditioning
   In the exploration phase and the design phase is the stakeholder manager responsible for delivering the environmental constraints for the Program of

\textsuperscript{27} Expertgroep Projectmanagement | Rolprofielen IPM | February 2008
\textsuperscript{28} Krol, M. | Thesis: Nieuwe Werkwijze Omgevingsmanagement | August 2009
\textsuperscript{29} Rijkswaterstaat Directie Projecten | Concept Werkwijzer Aanleg Deel 2: Proceskaders per IPM-rol | April 2008
Requirements. Another important task is the establishment of a management agreement to conclude the exploration phase. Besides, the stakeholder manager makes an inventory of the areas needed for project implementation and to what extent acquisition is necessary.

Furthermore is in the realization phase (and in the preparation of such) a large number of permits and notifications required. The stakeholder manager collects these and interprets which permits have to be obtained by which parties. Throughout the project, the stakeholder manager ensures proper handling of the legislative frameworks and the concerning procedures.

Conclusions on the user requirements

Stakeholder managers within Rijkswaterstaat are the link between the project team and the stakeholders. This manager is responsible for the areas of stakeholder management, communications, traffic management and conditioning. These tasks are operational of nature and take mainly place in the execution phase of an infrastructural project. The task fields of the stakeholder manager serve the implementation of the design in the execution phase which is developed in the exploration and design phases. The design is set and these decisions are not to be changed in the execution phase.

To make stakeholder managers (more) aware of consequences of decisions in urban area development they have to see the implications of an infrastructural project. They have to experience the issues that are at stake when the conformation of functions in an area is to be changed due to an infrastructural development. The new organization of these functions is, among other things, based upon constraints given by stake holding parties.

Organizing these constraints in a satisfactory plan is an essential element of urban area development and therefore an essential element in the task of the stake holder manager.

- **Identify constraints**

  In the design objective it is set out that through the product ‘the stakeholder managers should gain (more) awareness through gaming situations in the simulation instrument.’ The constraint of this element of the final design is that it has to be a simulation instrument. This constraint has been explained extendedly in chapter 3.

  In brief: A simulation instrument is the environment in which simulations can take place. Simulation is the imitation of some real thing, state of affairs, or process. The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system.

  Simulation is used in many contexts, including the modeling of natural systems or human systems in order to gain insight into their functioning. Simulation can be used to show the eventual real effects of alternative conditions and courses of action.\(^\text{30}\)

- **Establish functions**

  The use of the Simulation Game Box KOM has been formulated by King. This is presented in the brochure of King 'King Omgevingsmanagementspel: Verhelderend en blikverruimend' in which is explained what the usages of the gaming simulation instrument will be:

  To provide insight into stakeholder management

  The instrument can provide insight into the impact of a particular decision. To show consequences that decisions have for the stakeholders of a project. KOM lends itself well for a group to get started and find answers to such questions. This makes it suitable to

experience with project members, alliance partners or other PPP-partners what stakeholder management stands for;

To use for training and workshops
KOM is useful for training and workshops. For starting stakeholder managers it is a good introduction to the complex field of stakeholder management. They can evaluate played strategies to explore the impact of certain choices. And they can experience what they also face in practice. Experienced stakeholder managers can bring in their knowledge and experience and gain new insights through KOM;

To use as means of intervention to approach a project from a new perspective
A project may be in a stalemate or it is not clear what the next step in a project should be. A session with KOM can help to break the deadlock - to think 'out of the box' together. Testing alternative strategies in a familiar setting can provide new insights for solutions within the project;

To evaluate possible scenarios
With KOM you can try out strategies without obligation. To understand what you can expect during the implementation of the project. To see what the bottlenecks may be. And to find out what the opportunities are. In this way you discover what specific strategies have implications for the environment;

To create unity at the kick off of a project
To discover how everyone is looking at the things in the team. In the pre-phase of a project, it is possible for stakeholder managers and project managers to work out a simulation together. KOM helps to discover what role stakeholder management plays in this collaborative project. 31

4.1.3. Conceptual Design

The conceptual design specifications are developed on the basis of 3 workshops with stakeholder managers of Rijkswaterstaat and ProRail. The main outcome of these workshops is that 'decisions in infrastructural development are object related'. This statement is the foundation of the simulation instrument. The object is the road.

The concept of the design is that taking decisions to realize a highway affects other functions in that specific area. The functions that are affected are represented by stakeholders. These stakeholders have their influence on the development and will express their desires and demands (constraints).

- Establish design specifications
An area is subjected to the construction of an infrastructural project. This area is the study area. Before making a decision about the realization of this project, the developing party wants to consider how the road fits best into its surroundings. Not only in the area as it is now, but also how it can fit in plans that exist for that area. Or in which way can plans that follow out of this infrastructural development fit in the current development. Plans regarding the (re)arrangement of residential areas. Plans regarding the expansion of residential areas. But also plans for green areas, nature reserves and other functions of spatial planning.

31 Kennis in het groot | King Omgevingsmanagementspel: Verhelderend en blikverruimend | 2009
The following questions (among others) can be addressed to find out the best fit:
- How does the road (RD) fit in between the existing residential areas (DWL)?
- How does the road (RD) fit in the area concerning the noise?
- Is it still possible to develop new residential areas? If so, where?
- Is it possible to preserve the existing industrial area (IND)? Is it even possible to extend the industrial area (IND)?
- Do green areas (GRN), that are affected by the construction of the new road, have to be compensated somewhere else?

The answers to these questions give views on the objectives, principles and preconditions that should be achieved with the construction of the road (if possible). Rijkswaterstaat cannot produce the answers by themselves. The stakeholders involved in the various topics might know the answers to these questions. The stakeholder manager starts to do its job.

1. Describing the current functions in the study area.
   The study area of figure 4.3. features the functions dwellings (DWL), green area (GRN) and industry (IND).

   ![Figure 4.3. Current function in study area](image)

   In numbers:

   ![Table 4.1. Surfaces of current functions in the study area](image)

2. Describing the infrastructural project
   The total area is intersected by a road (RD). The intersection by the road affects the study area and the surfaces of the dwellings, the green area and the industry (Figure 4.4.).
3. Impact of the infrastructural project on the current functions
The impact of the infrastructural project on the current functions in the study area is set out in a table.

In numbers:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>1000</td>
<td>1000</td>
<td>0</td>
</tr>
<tr>
<td>Dwellings</td>
<td>100</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Green area</td>
<td>700</td>
<td>520</td>
<td>180</td>
</tr>
<tr>
<td>Industry</td>
<td>200</td>
<td>160</td>
<td>40</td>
</tr>
<tr>
<td>Road</td>
<td>0</td>
<td>300</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.2. Impact of infrastructural project on current functions

4. Starting the process of optimizing the solution.
The stakeholder manager starts the implementation of its stakeholder management tasks:
- The stakeholder manager organizes and directs the environmental management;
- The stakeholder manager gathers constraints and wishes of stakeholders and introduces these in the project team (int. al. the technical manager and the project manager).

5. Determining the general solution space
The solution space, within which the search for a proper integration of the road in the study area is, finds itself:
- On the one hand between acquiring (buying) the necessary land to develop the road and doing nothing in the rest of the study area;
- On the other hand by re-arranging the study area with all the demanded compensations of lost functions and the increase/decrease of all proposed functions.

To stakeholder manager is to find an answer to the question of where in the solution space is the best fit for all of the stakeholders involved. This question is split up into sub questions/ solutions:
Sub question 1: What is the minimum and maximum new surface of a function desired by the stakeholders to increase the existing functions?

![Diagram showing current and future surface](image)

Figure 4.5. Increase

Increase can have:
- A minimum limit (at least as much increase as stated);
- A maximum limit (not more increase than stated).

In numbers:

<table>
<thead>
<tr>
<th>Function</th>
<th>Surface</th>
<th>Minimum increase %</th>
<th>Minimum surface</th>
<th>Maximum increase %</th>
<th>Maximum surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwellings</td>
<td>100</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Green area</td>
<td>700</td>
<td>10</td>
<td>70</td>
<td>20</td>
<td>140</td>
</tr>
<tr>
<td>Industry</td>
<td>200</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.3. Upper and lower limits for increasing existing functions
Sub question 2:
What is the minimum and maximum accepted decrease of surface of a function by the stakeholders?

Figure 4.6. Decrease

Decrease can have:
- A maximum limit (not more decrease than stated);
- A minimum limit (at least as much decrease as stated).

In numbers:

<table>
<thead>
<tr>
<th>Function</th>
<th>Surface</th>
<th>Maximum Decrease %</th>
<th>Maximum Surface</th>
<th>Minimum Decrease %</th>
<th>Minimum Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwellings</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Green area</td>
<td>700</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Industry</td>
<td>200</td>
<td>40</td>
<td>80</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 4.4. Upper and lower limits for decreasing existing functions
Sub question 3:
What is the new surface of a function desired by the stakeholders to compensate the decrease of surface of a function?

As the above question implicates, compensation is a reaction to decrease. Compensation can result in one of the following 3 outcomes:

![Diagram of compensation](image-url)

**Current surface**  
**Future surface**

Figure 4.7. Compensation

In numbers:

<table>
<thead>
<tr>
<th>Function</th>
<th>Surface</th>
<th>Project</th>
<th>Impact</th>
<th>Compensate %</th>
<th>Compensate surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Dwellings</td>
<td>100</td>
<td>20</td>
<td>80</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Green area</td>
<td>700</td>
<td>520</td>
<td>180</td>
<td>50%</td>
<td>90</td>
</tr>
<tr>
<td>Industry</td>
<td>200</td>
<td>160</td>
<td>40</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Road</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.5. Compensation of removed function surfaces

For the functions dwellings, green area and industry has to be decided what the future amount of surface will be after the intervention of the road. It has to be decided if an affected function:
• has to be compensated;
• may shrink compared to the current situation;
• should expand compared to the current situation.

The first aim of the simulation instrument is to look for a feasible design program. In other words, which feasible solutions are possible in terms of urban planning programs, given the various starting points and preconditions of the individual participants?

These starting points and preconditions may be based on all kinds of considerations: financial, economic, social, urban planning, or on general social background factors.  

4.1.4. Preliminary Design

The preliminary design phase brings the abstract conceptual design towards a tangible and visible first design. The preliminary design is the outline for the final design. For the simulation instrument this is the phase in which the context is generated and the technical fundamentals are put down.

• Location
The simulation instrument first needed to have a truthful context in which the games could take place. The current development of the highway A13/A16 (figure 4.8) is chosen to be the gaming environment of the instrument. It is an infrastructural project that is near its start of the execution phase, which makes it a modern project with up-to-date information. Besides it has several stakeholder meetings coming up, providing valuable insights and information for the design project.

Figure 4.8. Situation with proposed alignments A13/ A16

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33 Rijkswaterstaat | http://www.rijkswaterstaat.nl/wegen/plannen_en_projecten/a_wegen/a13/a13_a16_rotterdam/index.aspx | 2010
Simulation game for stakeholder managers

- Technical fundamentals
  The simulation instrument is built up in 2 software programs:
  1. AutoCAD (ACAD) of Autodesk;
  2. Excel of Microsoft with the implemented application What’s Best!

1. AutoCAD (ACAD)
   AutoCAD is a CAD (Computer Aided Design or Computer Aided Drafting) software application for 2D and 3D design and drafting. In this project, the program is used to:
   - Draw up the conceptual designs of the highway A13/ A16 (figure 4.9.);

![Figure 4.9. Aerial photograph study area](image)

   - Divide the study area into zones referring to functions of use (figure 4.10.);

![Figure 4.10. Zones in study area](image)

   - Measure and collect the surfaces of all zones of every function of use. It also has the measures of the functions that are affected by the development of the road (figure 4.11.). This information is exported into excel.
Excel

Excel is a spreadsheet program. With the implementation of the application What’s Best! it is suitable to calculate Linear Programming optimizations. Through Linear Programming the constraints for the infrastructural project can be joined, resulting in a solution space for the area.

This combination of the software program and the mathematical approach is the engine of the simulation instrument. It is used to calculate optimized surfaces for involved functions and to allocate these functions optimized over the available zones of the area.

Calculate

In Excel a table is constructed (figure 4.12.). The table consists of the 8 functions of use and its surfaces: Agricultural, Green areas, Industry, Offices, Green houses, Nature, Railways, Water, Roads, and Dwellings.

Furthermore is the impact of the road on every function to be read. For each function it can be said if the decrease by the development of the infrastructural project has to be compensated or that a function must increase/ decrease. It is possible to run an optimization and calculate what a suitable solution is that fits the constraints and wishes. See figure 4.13.
Allocate

The allocation of the optimization values from the calculation can be done in the 2nd stage of the simulation instrument. This stage makes it possible to decide the size of the area of allocation. In that area the preferences for the allocation of every function can be given. After declaring all the preferences, an optimization run will allocate functions in possible zones. See figure 4.14.

Figure 4.13. Screenshot interface optimization model

Figure 4.14. Screenshot interface allocation model
• Test and evaluate preliminary design

With the simulation instrument as mentioned before, a test meeting took place with 6 stakeholder managers (figure 4.15.). The meeting was to see how the instrument was working in its preliminary design phase and how the target group would respond to the instrument. The stakeholder managers got a small introduction of the concept and the use of the model. After that introduction they had the freedom to do some exercises and to just ‘play around’. This test meeting resulted in several findings.

Input for model improvements

The test session’s first finding was that the simulation instrument connected with the professional context of the stakeholder managers:

- Participants have much affinity with the term (noise) sensitivity / influence;
- The sequence of events that had to take place in the instrument appeared to correspond with real life.

Further interviewing, listening and observing the participants lead to remarks to improve or alter the simulation instrument. The remarks have been summarized in 3 groups, demanding changes to the input possibilities of the instrument, the communication about the instrument and the appearance of the instrument. In brief:

Instrument:
- An input model to define the search area has to be added;
- The desire to input constraints not only in percentages, but also in absolute values.

Explanations:
- There should be a manual.

Usability
- Uncertainty about: which button to choose, which action a button represents;
- Look-and-feel.
4.1.5. Detailed Design

The detailed design phase is used to implement the findings of the user group test meeting and to refine and optimize the chosen design from a designer’s perspective.

Instrument
An input model to define the search area is developed. This is the part of the instrument that we now know as KOM bi1.
In the optimization model, that is from now on called KOM bi2, the input possibilities are both absolute and in terms of percentages.

Usability
Major changes are in the layout of the simulation instrument. The desire for better usability and look-and-feel resulted in several design alterations:

- The tables in the optimization and allocation model are rotated 90° and colored:

<table>
<thead>
<tr>
<th>Function</th>
<th>Surface</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Dwellings</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Green area</td>
<td>700</td>
<td>520</td>
</tr>
<tr>
<td>Industry</td>
<td>200</td>
<td>160</td>
</tr>
<tr>
<td>Road</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.16. Table in preliminary design  Figure 4.17. Table in detailed design

This rotation is a solution to get the information of the functions in both KOM bi2 and KOM a better on the screen. By coloring the cells of the functions corresponding to the zones in KOM a, a natural legend is created for the instrument.
Another important advantage of the rotation is that KOM bi2 and KOM a ‘communicate with each other’, because of the consistent interfaces.

- The set up of the tables is clear. Every function has the same possible alteration possibilities;
- The device ‘less is more’ is applied, resulting in useful information presented in an unambiguous way;
- Information in the interfaces is grouped. This makes relations between actions and information evident;
- The pallet of ‘action’-buttons has been enlarged. Buttons in the instrument have been chosen carefully and are applied in accordance to ‘conventions’.

Example: The convention of an action button is that activating it starts a processing. The convention of a radio button leads to an ‘on’ or ‘off’ switch of an aspect in the simulation instrument.

<table>
<thead>
<tr>
<th>Function</th>
<th>Study area</th>
<th>Dwellings</th>
<th>Green area</th>
<th>Industry</th>
<th>Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>1000</td>
<td>100</td>
<td>700</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>1000</td>
<td>20</td>
<td>520</td>
<td>160</td>
<td>300</td>
</tr>
</tbody>
</table>

Figure 4.18. Buttons
4.1.6. Final Design

The final design is realized as you are reading. In favor of this thesis, the product is considered finished. Small adjustments are still made. Tests to improve the instrument will also take place after the print of this report. In depth reflection are given in chapter 5.
4.2 The Game

Stakeholder managers within Rijkswaterstaat are the link between the project team and the stakeholders. This manager is responsible for the areas of stakeholder management, communications, traffic management and conditioning. These tasks are operational of nature and take mainly place in the execution phase of an infrastructural project. The task fields of the stakeholder manager serve the implementation of the design in the execution phase which is developed in the exploration and design phases. The design is set and these decisions are not to be changed in the execution phase.

To make stakeholder managers (more) aware of consequences of decisions in urban area development they have to see the implications of an infrastructural project.

4.2.1 Client’s Statement

The motive to develop the IDR simulator originates from the need of the client, King. King has the desire to develop a tool that gives insight into actors and factors that stakeholder managers have to deal with. 34

4.2.2 Problem Definition

During problem definition, the client’s objectives have to be clarified and gather the information needed to develop an engineering statement of the client’s wants. The means include literature reviews, interviews and observations. The game has to represent a situation in which the user is confronted with a problem. The problem situation has to make the user (learn to) think and act in process interventions.

- Clarify design objectives

Stakeholder managers have to experience the issues that are at stake when the conformation of functions in an area is to be changed due to an infrastructural development. The new organization of these functions is, among other things, based upon constraints given by stake holding parties. Organizing these constraints in a satisfactory plan is an essential element of urban area development and therefore an essential element in the task of the stake holder manager.

The decision-making process in organizing constraints in urban area development can be done in several manners. For the games is chosen to play with the following process interventions 35:

- Fixation – Enrichment: What decisions are fixed and what are still open to give new ideas a chance?;
- Limitation – Unlimitation: Is the study area small or are there many other areas involved?;
- Capricious – Orderly: Can the process run as it presents itself or is the process strictly planned?;

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34 Kennis in het groot | King Omgevingsmanagementspel: Verhelderend en blikverruimend | 2009
35 Brujin, H. de, Teisman, G., Edelenbos, J., Veeneman W. | Meervoudig ruimtegebruik en het management van meerstemmige processen | 2004
• Powerfull - Not powerfull: Is the deadlock to be broken with power or is still tried to come to an agreement?

• Identify constraints
In the design objective it is set out that through the product ‘the stakeholder managers should gain (more) awareness through gaming situations in the simulation instrument.’ The constraint of this element of the final design is that it has to be a game. This constraint has been explained extendedly in chapter 3.

In brief: The word 'game' indicates actions and decisions of players: Players, who play roles, try to achieve objectives, accomplish goals and experience constraints. General features of a game are tension and uncertainty. ‘Is it possible to solve the game or to win?’

• Establish functions
Functions of the game:
• To encourage the user to think in and make use of process interventions;
• To make the user aware of different approaches that lead to a solution;
• To learn to work with the simulation instrument through ‘learning-by-doing’.

4.2.3. Conceptual Design

The conceptual design of the game finds its origin in the "Watertoets". (The “Watertoets” is a process tool that can be used in urban area development. The aim of the tool is to answer in the interests of water affairs during decision-making in urban planning.) In the conceptual design of the game one has not used the ‘Watertoets’. That is not a crime. But if they would have used this process tool the problems, as they occur in the game, would probably have been avoided.

What actions have to be undertaken to keep the process of the infrastructural development going?

4.2.4. Preliminary Design

Steps in the game:
1. A preliminary design of the infrastructural plan is presented (situation).
   → Intervention: in this preliminary design, a Water Standard has to be implemented. In the current situation that is not possible (problem to solve).

2. Two options to solve this problem are given (process interventions)
   Each option to solve the problem gives conflicts on another aspect in the game (conflict).
   → Intervention: Choosing a manner to realize a Water Standard within the given constraints.

3. Each conflict can be solved in 3 ways (process interventions)
   → Intervention: Choosing a manner to adapt other (f)actors to realize the infrastructural plan.

In table 4.1. on the next page, the options of the preliminary design of the game are shown in a schematic way. (The extended, written version is to be found in the appendix.)
# 1. The infrastructural plan

## 2. Realizing the Water Standard (Surface)

- **2.a.** Partly tunneled road → small water surface
- **2.b.** Road fully on ground level → large water surface

## 3. Realizing the Living Standard (Money for quality)

- **3.a.1** Negotiate another Living Standard to be realized. → same water surface, infrastructural plan and search area to realize a less strict Living Standard.

- **3.a.2** Negotiate a larger search area. → The Living standard can be carried (money) by a larger area.

- **3.a.3** Tunnel a smaller part of the road → More money will be available to realize a higher Living Standard

## 3. Realizing the Housing standard (Surface for housing)

- **3.b.1** Partly tunnel the road → More surface will be available to realize the Housing Standard.

- **3.b.2** Negotiate the Housing Standard → same water surface, infrastructural plan and search area to realize less houses.

- **3.b.3** Negotiate a larger search area. → The Housing standard can be realized in a larger area.
4.2.5. Detailed Design

For the detailed design is chosen for the following script:

1. The infrastructural plan;
2. b. Realizing the Water Standard in the situation that the road is fully on ground level. This means that has to be dealt with a large water surface;
3. b. Realizing the Housing Standard, with options of

   - 3.b.2. Negotiating the Housing Standard.
   - 3.b.3. Negotiating a larger search area.

This script has been written out fully and been tested. The tests showed that the game worked:

- The game made participants think about and discuss over process interventions naturally;
- The user played with the game and the instrument;
- The user had fun. There was eager to keep on playing;
- The user learned to use the instrument through the game;
- The game was understandable for the uninitiated.

The tests also lead to points to improve in the game:

- The instruction of the game was at several points too strict. It was not taken into account that every computer has different configurations. Because of this the manual was not always correct;
- The player lost overview/ the picture of the original (current) function organization of the area;
- The player sometimes could not match the game instructions with the simulation instrument.

4.2.6. Final Design

The points to improve the game have been enforced:

- Instructions that may be confusing, because of configurations of computers, have been removed (Less is more). The responsibility of the execution of these instructions has moved from the player to the instructor of the game;
- A map with the original (current) function organization of the area is added to the instruction materials (Appendix X);
- A map with all the interfaces of the simulation instrument has been added to the instruction materials (Appendix X). In this map is a description of all necessary information of the simulation instrument. Every part of information has a unique number. In the game instructions is a number-reference included to help the player find its way in the simulation instrument.

The final design of the game is realized as you are reading. The game is part of the Appendix. In favor of this thesis, the product is considered finished. Small adjustments are still made. Tests to improve the game also will take place after the print of this report.

Besides, the game will be played with stakeholder managers. The game will be played with the goal to let stakeholder managers gain (more) awareness into the factors and actors that stakeholder managers have to deal with.
5. THEORETICAL REFLECTIONS ON THE SIMULATION GAME BOX

5.1 The Urban Decision Room and the Simulation Game Box

The simulation Game Box is built on the foundations of the Urban Decision Room. The Urban Decision Room is a type of group decision room.

A group decision room is an interactive ‘room’, with several people gathered in a room with several computers. The computer network enables the participants to communicate with each other about the relevant topics.

The network enables also to make calculations of the ‘results’ of this communication and to represent it at each computer. These results may form the basis for further discussions and negotiations.

Figure 5.1. Urban Decision Room

For the participants a, b and c in figure 5.1. this means that they all deliver their input. These constraints are gathered in the computer of participant X. Participant X projects the solution space that is derived from the inputs of participants a, b and c.
The simulation instrument is in development to be used as a group decision room as described. At this moment of the development, the instrument is to be explained as a standalone single user optimization tool.

![Infrastructural decision room – current situation](image)

The 'group' is represented by inputs a, b and c. These inputs are entered directly in the computer of participant X. The results of the optimization are as if the instrument is a group decision room. The results can also be discussed and altered as if the instrument is a group decision room.

In the future development of the simulation instrument, a computer network will be the next step. The technique to construct such a network has been used previously in the case of 'Heijsehaven'. It will then be possible to enter the inputs a, b and c by more than one individual, making the instrument a true group decision room.

5.2 System approach of the Simulation Game Box

The term gaming/simulation is used when there is a (simulated) model of a (real) system and there are actors who, in various roles, attempt to meet objectives within a set of rules.\(^{36}\) In this definition, which does not differ in essence from most definitions, the four most important concepts are model, actors, rules and objectives. The ingredients for a systems perspective on simulation games are obviously present. In terms of systems thinking, a simulation game is a system (model) of actors (roles) and the interrelations between them (regulated by rules), pursuing a, specific goal.\(^{37}\) The system is aimed at adaptive steering of stakeholder managers. The system of the instrument is as follows:

KOM

KOM represents a decision making environment in an infrastructural development process. The decision making process that the simulation instrument is aimed at, is the optimized allocation of functions in the search area within the constraints.

Stakeholders give the inputs in the decision-making process: the definition of the search area and the numerical and allocation constraints. The inputs are related to the

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36 Caluwé, L. de, Geurts, J., Buis, J.D., Stoppelenburg, A. | Gaming: Organisatieverandering met spelsimulaties | 1996
surfaces of the functions. With these inputs, the stakeholders express what they desire and accept as a change of surface of their function.

Figure 5.3. Reticulation KOM

The total system of KOM is represented in figure 5.4. The inputs in this system deliver the circumstances of the output. The objective of KOM is to produce an optimized allocation of functions in a search area within given constraints. KOM is constructed out of 3 main components: KOMbi1, KOMbi2 and KOMa, representing stages in an infrastructural development project.

The following page shows an overview of the total system with zooms into the 3 components. Next there will be an explanation of every component individually.
Simulation game for stakeholder managers

An optimized allocation of functions in the search area within the constraints

1. Map definition of search area, numerical constraints, allocation constraints

2. KOMb1 Level 2

3. AutoCAD Level 3

4. Excel Level 3

5. KOMb2 Level 2

6. LP model

Shpfile Level 4
Polygon Level 4

ACZXL Level 4
AreaMap Level 4

Draw map
Define map
Generate map

KOMb3 Level 3

An optimized allocation of functions in the search area within the constraints
The input of KOM bi1 consists of the map of the study area and the definition of the search area by the user. The map is simplified into zones. These zones represent the 8 major functions of land use in the study area. The definition of the search area is an interactive part of the user of the simulation instrument.

The output of this component consists of geometric specifications (numerical and function definition of the search area). This information is input for KOM bi2 and KOM a.

Zooming in KOM bi1 gives insight in the processing of the information that enters this component. It shows in which way the information is processed that enters AutoCad and Excel.
The element AutoCad of KOM bi1

In AutoCad files are loaded that correspond with the study area:
- A .shp file (shape file) with geometrical information;
- An aerial photograph (This photograph is obtained from i.e. Bing maps www.bing.com).

The aerial photograph is put in a layer (in AutoCad) under the layer with shape files. The dimensions of the aerial photograph are adjusted until the aerial photograph corresponds with the areas of the layer with the shape files.

The shape files are geometric objects. These shape files have to be transformed into polygons to make them suitable for further processing. A polygon is a figure that is bounded by a closed path or circuit, composed of a finite sequence of straight line segments. These line segments are also called poly lines.

**Figure 5.6. Reticulation AutoCad**

The action to convert a shape file into a polygon is as follows:
- Select the shapefile in AutoCad;
- Go to the menu Modify;
- In the menu modify one has to choose for Object → Poly line → Explode.

By selecting Explode, the shapefile is converted into a polygon that is built up out of poly lines.

Next step is to export these poly lines to Excel:
- Exporting the poly lines from AutoCad to excel is realized with a macro that is written by the TU Delft (i.e. Mr. P. Barendse MSc.). This macro has to be considered a black box. 'The output of the macro is constructed out of all the poly lines that are not in a frozen layer of AutoCad. With this macro all the necessary zones will be exported to Excel.'
The element Excel of KOM bi1

In Excel the Sheet 'AC2XLMap' is made.

In this sheet every polygon is numerically saved with:
- A unique label to name the polygon;
- The smallest and largest x,y coordinate of the polygon;
- The amount of poly lines the polygon is constructed with;
- The x,y coordinate of the starting point of the poly line.

Figure 5.6. Reticulation Excel

The numerical polygon is converted into a 'free form' with a macro (black box). These free forms are built in a new sheet. The free forms are constructed with the poly line information out of AC2XL.
The input of KOM bi2 consists of geometric specifications of the search area (output KOM bi1) and numerical constraints given by stakeholders. The input of the numerical constraints is an interactive part of the user of the simulation instrument.

The before mentioned inputs are optimized in LP-model1 (black box). If the optimization is not possible it will be necessary to adjust the input. The input can be changed by altering the numerical constraints or to go back to KOM bi1 and adjust the search area. Adjusting the search area will result in a different geometric specifications input.

The output of KOM bi2 is an optimization of surfaces for functions in the search area within the constraints. These optimization values are an input for KOM a.
The input of KOM\(a\) consists of geometric specifications of the search area (output KOM\(b\)i1), optimized values of surfaces for functions in the search area within the constraints (output KOM\(b\)i2) and preferences of allocation for functions in the search area. The input of the preferences of allocation is an interactive part of the user of the simulation instrument.

The before mentioned (processed) inputs are optimized in LP-model\(2\) (black box). If the optimization is not satisfactory, it will be necessary to adjust the input. The input can be changed by altering the preferences of allocation for functions in the search area in KOM\(a\) or to go back to KOM\(b\)i1 (adjust the search area) or KOM\(b\)i2 (adjust the constraints).

The output of KOM\(a\) is an optimized allocation of functions in the search area within the constraints.
5.3 Learning with the Simulation Game Box

The first tests with the Simulation Game Box are promising. People, having watched a presentation of the tool or having played the game, are enthusiastic.

In the game situation the players are forced to steer on variables in different phases of an infrastructural project.

![Figure 5.9. The Kolb learning cycle](image)

The game session is being led by an instructor. The game session starts with playing the game. Concrete experience is a learning experience. People are playing in the simulation instrument and try out things in that reality.

A game round has been played. An evaluation of the game starts. This is led by the instructor with the players. With the players is analyzed what choices have been made and what effects these had (mirror). Besides it evaluated what the players were experiencing.

Formation of concepts of theory is responding to the observations and reflections. It is formulating an abstract concept of what has happened and how to act on that. It examines how the experiences and reflections related to this one act also correspond with the findings previously gained. Is there a thread in the story? Is there a general statement to be decided on? A hypothesis is formulated and will be tested in the future (window).

The implications of concepts in are tested by playing the game again or playing a new round in the game. One has to make decisions that are based upon the new concepts. A Kolb learning cycle has been completed. Awareness will have been gained.
FURTHER DESIGN WORK
Simulation game for stakeholder managers

SOURCES

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The Infrastructural Decision Room - KOM
‘A Game Simulation Instrument for Group Decision Making in Infrastructural projects’

APPENDIX

Real Estate & Housing - Urban Area Development
Faculty of Architecture, Urbanism & Building Sciences
Delft University of Technology
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The Infrastructural Decision Room - KOM
‘A Game Simulation Instrument for Group Decision Making in Infrastructural projects’

De Waternorm
Real Estate & Housing - Urban Area Development
Faculty of Architecture, Urbanism & Building Sciences
Delft University of Technology
Inhoudsopgave

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1. Introductie

Rijksweg A13/16 Rotterdam

‘…Op de A13 bij Overschie en op de A20 tussen het Kleinpolderplein en het Terbregseplein staan vrijwel dagelijks files. Ook op wegen die daarop aansluiten is het erg druk. Op diverse plaatsen langs de twee snelwegen en de aansluitende wegen is veel geluidshinder en luchtvervuiling. Het project Rijksweg 13/16 Rotterdam zoekt oplossingen voor deze problemen. Bij dit project gaat het om de aanleg van een nieuwe wegverbinding Rijksweg 13/16 tussen de A13 (ten noorden van Overschie) en de A16 (knooppunt Terbregseplein).

Figuur 1.1

De doelstelling van het project Rijksweg 13/16 Rotterdam luidt in algemene termen: Het creëren van een realistische oplossing die de gesignaleerde problemen op het gebied van de verkeersafwikkeling en de leefbaarheid op de A13 bij Overschie en de A20 tussen het Kleinpolderplein en het Terbregseplein, alsmede op het onderliggend wegennet, wegneemt / verkleint…’

(Samenvatting Trajectnota/MER Rijksweg 13/16 Rotterdam, Rijkswaterstaat, augustus 2009)

Integrale gebiedsontwikkeling

Het creëren van een realistische oplossing betekent dat de rijksweg wordt ingepast in de omgeving; dat er rekening wordt gehouden met wensen en eisen van de omgeving. De aanleg van de Rijksweg A13/ A16 betreft dus niet alleen de aanleg van een aantal kilometer rijksweg, maar betreft de ontwikkeling van een aantal vierkante kilometers gebied.

KOM

Met de spelomgeving KOM kan inzicht worden gekregen in actoren en factoren die meespelen in complexe integrale gebiedsontwikkeling.
2. De beslis-/spelsituatie

Voor de inpassing van wegtracée Tr in gebied Ge is een eerste stedenbouwkundig/ruimtelijk ontwerp gemaakt. In dit ontwerp is aangegeven:
- Waar het tracée komt te liggen;
- Welke gebieden (zones) hier direct hinder van ondervinden;
- Welke plekken (zones) welke nieuwe functies krijgen.

Dit laatste is nodig omdat door dit nieuwe wegtracée een aantal bestaande functies verplaatst moet worden. Ook is de aanleg van de weg reden om een aantal nieuwe functies in gebied Tr te realiseren. Dit heeft als consequentie dat bepaalde bestaande functies weg moeten. Dit is in een kaartbeeld vastgelegd en is met een rekenmodel uitgerekend. Resultaat: een voorlopig ontwerp in de planstudiefase.

Voorlopig ontwerp

Het voorlopig ontwerp in de planstudiefase van de A13/ A16 is opgebouwd met de randvoorwaarden dat:
- het aangetaste oppervlakte van de functie agrarisch met minimaal 300 ha. moet worden gecompenseerd;
- het totale oppervlakte van de functie wonen met maximaal 50 ha. mag afnemen;
- de functies wonen, kantoren en water extra gevoelig zijn voor invloeden (geluidsoverlast, hoge waarden fijnstof e.d.) van de weg;
- binnen de gestelde randvoorwaarden een zo groot mogelijk oppervlakte voor de functie wonen moet gerealiseerd in het zoekgebied.

Dit voorlopig ontwerp wordt in KOM geregistreerd zoals weergegeven in figuur 3.1

Echter, op het moment dat dit voorlopig ontwerp in de planstudiefase wordt besproken, wordt duidelijk dat een waternorm niet is meegenomen in de uitwerking van dit voorlopig ontwerp. De waternorm (20 ha.), die in het ontwerp moet worden ingepast, is gesteld door de Hoogheemraadschappen van Delfland en Schieland & Krimpenerwaard.
Om de speler van het spel kennis te laten maken met de spelomgeving KOM, dient eerst het voorlopig ontwerp te worden gereconstrueerd zoals weergegeven in figuur 3.1

3. Instructie: Opstellen van het spelbord

De planstudiefase voor de aanleg A13/ A16 heeft een voorlopig ontwerp opgeleverd. De volgende handelingen vormen de opstelling van dat ontwerp.

KOM bi1.xls

1. Klik op [Zoekgeb. Minimaal].
Het spelbord is met deze handeling gereset en klaar voor een nieuwe opstelling.

2. Selecteer de 3 rood omlijnde zones die aangegeven zijn in de circel van figuur 4.1

Deze rood omlijnde zones vormen het toegevoegd zoekgebied.
Het rood omlijnde gebied vormt samen met het witte gebied het totale zoekgebied.

3. Klik op [optimalisatiemodel]
Het venster KOMbi2.xls wordt nu actief

KOM bi2.xls
De randvoorwaarden voor het ontwerp moeten numeriek worden ingevoerd.
Volg onderstaande beschrijving met behulp van figuur 4.2.
1. Het spelbord moet een naam hebben. 
Vul in: Waternorm bij ‘Omschrijving variant’

2. De functies kantoren, water en wonen zijn gevoelig. 
Vul in: 1 bij ‘Gevoelig’ voor deze functies. 
Deze cellen worden nu rood

3. De aantasting van de functie agrarisch moet met minimaal 300 ha. worden gecompenseerd. 
Vul in: 300 bij compensatie min.

4. De functie wonen mag hooguit met 50 ha. afnemen. 
Vul in: 50 bij inkrimping max.

5. De functie wonen wordt bij de optimalisatie gemaximaliseerd. 
Vul in: 1 bij optimaliseer 
(Deze cel wordt nu geel)

6. Klik op [Opslaan gegevens] 
De ingevoerde randvoorwaarden zijn opgeslagen.

7. Klik op [Optimaliseer] 
Het model worden geoptimaliseerd op basis van de randvoorwaarden. 
De waarden van de optimalisatie zijn zichtbaar in de tabel.

Merk op: 
De functie agrarisch gebied krijgt 661 ha. in het zoekgebied. 
De functie wonen krijgt 66 ha. in het zoekgebied.

De waarden uit de tabel vormen nu een variant. Deze variant is nu automatisch wegeschreven en kan nu ook worden gebruikt in het onderdeel KOMa.xls van de simulator.

8. Klik op [NaarAllocatiemodel KOMa] 
Het venster KOMa.xls wordt nu actief.

KOMa.xls
De toewijzing van functies agrarisch gebied en wonen aan de zones van het voorlopig ontwerp vindt plaats in KOMa.xls. De waarden moeten eerst uit KOMbi2.xls in KOMa.xls worden geladen.

1. Activeer het [dropdown-menu] bij 'Invoer voorkeuren'.
Selecteer de weggeschreven variant: Waternorm

Figuur 4.3 is nu geladen

Merk op:
Het witte gebied is het totale zoekgebied.
Het toegevoegd zoekgebied is het zoekgebied dat niet gevoelig is.
De nummering van de zones is gekleurd. De kleur verwijst naar de huidige functie van de betreffende zone.

De waarden uit KOMbi2.xls zijn nu in KOMa.xls geladen.

Merk op:
De functies kantoren, water en wonen zijn in de legenda rood omlijnd. Dit zijn de gevoelige functies.

Merk op:
Het te realiseren programma van de functie agrarisch gebied is 661 ha. Er is echter nog geen mogelijke lokatie voor de functie aangewezen → tekort 661
Het te realiseren programma van de functie wonen is 66 ha. Er is echter nog geen mogelijke lokatie voor de functie aangewezen → tekort 66
Voor de functie agrarisch gebied moeten geschikte zones in het zoekgebied worden aangewezen, zodat minimaal het gewenste programma wordt gerealiseerd. Vervolgens moet dit voor de functie wonen plaatsvinden.

2. Klik op [Invoer voorkeuren] waarbij <per functie> is geselecteerd. Linksonder op het scherm staat de tabel met de functies van de simulator. De [INPUT] modus van de simulator is daar nu zichtbaar. De simulator is gereed om een functie aan een zone toe te wijzen.

3. Klik op Agrarisch
De functie agrarisch gebied is actief. De voorkeur voor één of meer zones voor deze functie kan nu worden aangegeven.

4. Klik op [Voorkeuren alle zones] waarbij <overal>, <gewicht 1> en <Verberg huidige> is geselecteerd.
Het volledige zoekgebied (910 ha.) is groen geworden en hiermee aangewezen als geschikt gebied om het programma van de functie agrarisch gebied (661 ha.) te realiseren.

5. Klik op Wonen
De functie wonen is actief. De voorkeur voor één of meer zones voor deze functie kan nu worden aangegeven.

6. Klik in de stedenbouwkundige kaart op de zones [9], [12], [15]
De zones [9], [12], [15] kleuren rood en zijn hiermee aangewezen als geschikt gebied om het programma van de functie wonen te realiseren.

Merk op:
De overige zones zijn niet geschikt voor de functie wonen. De functie wonen is een gevoelige zone en om die reden alleen te realiseren in de zones [9], [12], [15]

De oplossingsgebieden voor de functie agrarisch gebied en de functie wonen hebben minimaal de grootte van het te realiseren programma. De overige functies worden bij deze optimalisatie buiten beschouwing gelaten. Een optimalisatie kan nu plaatsvinden op basis van een maximalisatie van de functie wonen.

De optimalisatie heeft plaatsgevonden en de toewijzing van de functies is zoals weergeven in figuur 4.4.
Merk op:
Het volledige programma agrarisch gebied is gerealiseerd. Dit zijn de groene zones in het zoekgebied.
Het volledige programma wonen is gerealiseerd. Dit zijn de rode zones in het zoekgebied.

Merk op:
Een aantal zones in het zoekgebied is wit. Deze gebieden zijn niet gebruikt voor de optimalisatie en zijn niet van functie gewijzigd.

8. Selecteer <Verberg huidige>

9. Klik op [Uitvoer] waarbij <Per Zone> is geselecteerd
Merk op:
De witte zones uit figuur 4.4 hebben in figuur 4.5 de kleur gekregen die correspondeert met de huidige functie van de betreffende zones.

Het speelbord is gereed.
Het speelbord bestaat uit de onderdelen KOMbi1.xls, KOMbi2.xls en KOMa.xls
Het speelbord vertegenwoordigt een voorlopig ontwerp dat voldoet aan de wensen en eisen van partijen die worden aangetast door de aanleg van de weg.
Het voorlopig ontwerp heeft zich uiteraard beperkt tot het gedefinieerde zoekgebied.
Echter...
4. Het beslis/ spelprobleem van de Waternorm

In deze voorlopige ontwerp situatie krijgt de omgevingmanager de volgende vraag op te lossen: Hoe kan 20 ha. water in het gebied gerealiseerd worden?
Het voorlopig ontwerp moet daarvoor aanpast/ veranderd worden.

Toelichting op de opgave:

Het voorlopig ontwerp voldoet aan de wensen en eisen van partijen die worden aangetast door de aanleg van de weg. Echter, de Hoogheemraadschappen Delfland en Schieland & Krimpenerwaard stellen voor dit project een waternorm. Deze waternorm is gesteld op 20 ha. oppervlaktewater uitbreiding voor het totale studiegebied. Dit aan te leggen oppervlaktewater wordt aangemerkt als een gevoelige functie.

Het is de wens om aan deze waternorm te voldoen binnen het zoekgebied van het voorgenoemde voorlopig ontwerp.
5. Het spel: de Waternorm

De uitbreiding oppervlaktewater wordt aangemerkt als een gevoelige functie. De zones die aangewezen kunnen worden om voor dit oppervlaktewater in aanmerking te komen zijn daardoor beperkt.

U kunt nu in de kaart kiezen uit 3 mogelijkheden voor de realisatie van 20 ha. oppervlaktewater: De 3 mogelijke zones zijn in figuur 6.1 omcirkeld.

- Mogelijkheid 1: Zone [9] met de huidige functie Agrarisch
- Mogelijkheid 2: Zone [12] met de huidige functie Industrie
- Mogelijkheid 3: Zone [15] met de huidige functie Wonen

Voordat U kiest, informeert u zich eerst over de kenmerken van deze mogelijkheden: Koopprijs, milieu situatie, huidige functie e.d.

Deze informatie krijgt u te zien door eerst linksonder in het scherm op te klikken en vervolgens op de genoemde zones te klikken. De informatie die hiermee wordt opgeroepen helpt u bij het maken van een keuze omtrent de toewijzing van de water functie aan een zone.

Opdracht:
Welke zone is meest geschikt om het oppervlaktewater van 20 ha. te realiseren?

Geef aan waar u de 20 ha. wil realiseren
Om 20 ha. oppervlaktewater te realiseren wordt eerst in het model vastgelegd. Deze 20 ha. is een uitbreiding van de huidige wateroppervlakte.

1. Klik op de knop [Optimalisatie model]
Het venster KOMbi2.xls wordt nu actief

2. De waternorm is 20 ha.
Vul in [Uitbreiding Min.]: 20
Vul in [Uitbreiding Max.]: 20

**Merk op:**
De ingevulde waarden bepalen nu dat er minimaal en maximaal 20 ha. oppervlaktewater moet worden toegevoegd aan het zoekgebied.

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**Opdracht:**
De oplossingsruimte in het voorlopig ontwerp is niet groot genoeg om het water toe te voegen. Welke beslissing(en) moet(en) worden gemaakt om het model oplosbaar te maken?

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**Opdracht:**
De de handelingen om deze nummerieke aanpassingen op een juiste manier te verwerken staan beschreven in ⇒ 4. Instructie: Opstellen van het spelbord § KOMbi2.xls, punt 6. t/m 8. (pg. 8)

**De methode om de nieuwe varianten op een juiste manier in het gebied een plek te geven staan beschreven in ⇒ 4. Instructie: Opstellen van het spelbord § KOMa.xls, punt 1. t/m 9. (pg. 8 – 11)
Opdracht:
Er kan niet worden voldaan aan de wens om de waternorm in het huidige zoekgebied te realiseren.
Welke beslissing(en) moet(en) worden gemaakt om het model oplosbaar te maken?

U kunt kiezen uit 2 mogelijkheden:

- Helaas, de waternorm kan niet gerealiseerd worden;
- Zoeken naar andere mogelijkheden, in andere dan de eerder aangegeven 3 zones, waardoor het water kan worden gerealiseerd.

Bij de 2e mogelijkheid zijn verschillende varianten mogelijk:

- Het zoekgebied groter maken;
- Het water toch in de gevoelige zone realiseren.
Aantekeningen
Map - Current functions
Map – Instructions Interfaces
1. Study area
2. Selected zone (red border) is added search area
3. Unselected zone (black border)
4. Impact area
5. Road alignment
6. Information field on surfaces
7. Choose zone selection [None] or [All]
8. Load map
9. Choose surface information zones [Show] or [Hide]
10. Go to optimization model – KOMbi2
11. Legend
12. Change size of the map
13. Choose language [English] or [Dutch]
14. Change visibility of satellite image
15. Choose visibility Excel [Hide] or [Show]
16. Entry field to name variant
17. Functions with sensitivity [0 = No] and [1 = Yes]
18. Information per function on surfaces affected:
   • Study area
   • Space use of road
   • Impact area of road
   • Area to obtain in favor of road
   • Not affected area
   • Total search area:
     - Added search area
     - Impact area of road
     - Replaceable area
19. Totals of information on surfaces
20. Entry fields for constraints:
   • Compensation function minimal
   • Compensation function maximal
   • Decrease function minimal
   • Decrease function maximal
   • Increase function minimal
   • Increase function maximal
21. Information per function on surfaces needed:
   • Added search area
   • Search area minimal
   • Search area maximal
   • Remarks (optional)
22. Totals of information on surfaces needed
23. Optimized surfaces assigned to functions
24. Total surface of optimized surfaces
25. Maximize function surface [0 = No] and [1 = Yes]
26. Go to:
   • Adjust search area – KOMbi1
   • Allocation model – KOMa1
27. Select previously saved variant
28. Save current variant
29. Check if calculation is possible
30. Optimize
31. Information field on modus KOMa1
32. Load preferences and activate entry modus
   • Per zone
   • Per function
33. Selecting preference zones [None] or [All]
   • Overview of chosen preference for zones
   • Weight of preference [1 = possible] or [2 = strong desire]
   • Current situation of zone [Show] or [Hide]
34. Highlighted color is representing current function
35. Click [question mark] and zone for information
36. Modus [Input] or [Output] – Select function for input
37. Start values functions and progress assigning preferences
38. Optimize allocation of functions to zones
39. Results after allocation optimization of functions to zones
40. Visualization of output per [Zone] or [Function]
41. Go to:
   • Adjust search area – KOMbi1
   • Optimization model – KOMbi2
42. Information field on surface and function of a zone
43. Click to view additional information on zone
44. Selecting the function name turns it green – the highest preference is now given to this selected function
45. The function name is red – This function is not possible to allocate in this zone under the current conditions
46. Preference setting [0 = No preference] or [1 = possible preference] or [2 = strong preference]
47. Solution space [red = insufficient] or [black = sufficient]
Preliminary Design Game
Watertoets

Het zoekgebied
Het zoekgebied is wit en beslaat ook het invloedsgebied van de weg. Het gearceerde gebied valt buiten het zoekgebied.

Startpunt van de situatie
De Watertoets van de Hoogheemraadschappen (Delfland en Schielanden Krimpenerwaard) is 350 m² oppervlaktewater per gerealiseerde ha asfalt. Deze norm moet minimaal worden gerealiseerd.
Het oppervlakte asfalt bedraagt : X ha
Delen van de weg die getunneld worden aangelegd worden niet meegerekend voor deze norm.

Uitdaging
Voldoen aan de Watertoets.

Hoofdvraag
Hoe moet aan deze norm worden voldaan?
Variant Watertoets 1

Een deel van het de weg wordt getunneld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd verkleind. Er blijft meer oppervlakte over om toe te wijzen aan de andere functies, zoals wonen. De kosten voor het tunnelen van de weg zijn hoog. Het afwerkingsniveau van de andere functies (zoals wonen en park) wordt, door de hoge kosten van de tunnel, laag.

Echter, de gemeente Rotterdam wil dat leefbaarheid in nieuwe woonwijken hoog is. Dit vertalen zij o.a. in een afwerkingsniveau van buitenruimten die gemiddeld tot hoog is.

Wat moet er gebeuren?
- Het afwerkingsniveau van functies aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat de kosten door een groter gebied worden gedragen? (Ontgrenzen)
- Minder tunnelen zodat de kosten van de weg lager worden? (Plan aanpasen)
Variant Watertoets 2

De weg wordt volledig op het maaiveld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd maximaal. De gestelde woonnorm kan hierdoor niet in het resterende zoekgebied worden gerealiseerd.

Wat moet er gebeuren?
- Een deel van de weg tunnelen, zodat de hoeveelheid oppervlaktewater verkleind om ruimte te maken voor woningbouw? (Plan aanpassen)
- De woonnorm aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat andere functies kunnen wijken voor woningen? (Ontgrenzen)
Het afwerkingsniveau van woonfuncties wordt aangepast. (Onderhandelen)

Wat wordt onderhandeld?
Echter, de gemeente Rotterdam wil dat leefbaarheid in nieuwe woonwijken hoog is. Dit vertalen zij o.a. in een afwerkingsniveau van buitenruimten die gemiddeld tot hoog is.

Een deel van het de weg wordt getunneld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd verkleind. Er blijft meer oppervlakte over om toe te wijzen aan de andere functies, zoals wonen. De kosten voor het tunnelen van de weg zijn hoog. Het afwerkingsniveau van de andere functies (zoals wonen en park) wordt, door de hoge kosten van de tunnel, laag.

Echter, de gemeente Rotterdam wil dat leefbaarheid in nieuwe woonwijken hoog is. Dit vertalen zij o.a. in een afwerkingsniveau van buitenruimten die gemiddeld tot hoog is.

Wat moet er gebeuren?
Variant Watertoets 1.b

Het zoekgebied wordt (Ontgrenzen)
Een deel van het de weg wordt getunneld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd verkleind. Er blijft meer oppervlakte over om toe te wijzen aan de andere functies, zoals wonen. De kosten voor het tunnelen van de weg zijn hoog. Het afwerkingsniveau van de andere functies (zoals wonen en park) wordt, door de hoge kosten van de tunnel, laag.

Echter, de gemeente Rotterdam wil dat leefbaarheid in nieuwe woonwijken hoog is. Dit vertalen zij o.a. in een afwerkingsniveau van buitenruimten die gemiddeld tot hoog is.

Wat moet er gebeuren?
- Het afwerkingsniveau van functies aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat de kosten door een groter gebied worden gedragen? (Ontgrenzen)
- Minder tunnelen zodat de kosten van de weg lager worden? (Plan aanpasen)
Variant Watertoets 1.c

Een deel van het de weg wordt getunneld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd verkleind. Er blijft meer oppervlakte over om toe te wijzen aan de andere functies, zoals wonen. De kosten voor het tunnelen van de weg zijn hoog. Het afwerkingsniveau van de andere functies (zoals wonen en park) wordt, door de hoge kosten van de tunnel, laag.

Echter, de gemeente Rotterdam wil dat leefbaarheid in nieuwe woonwijken hoog is. Dit vertalen zij o.a. in een afwerkingsniveau van buitenruimten die gemiddeld tot hoog is.

Wat moet er gebeuren?
- Het afwerkingsniveau van functies aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat de kosten door een groter gebied worden gedragen? (Ontgrenzen)
- Minder tunnelen zodat de kosten van de weg lager worden? (Plan aanpasen)
Variant Watertoets 2.a

Een deel van de weg tunnelen (Plan aanpassen)

Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd maximaal. De gestelde woonnorm kan hierdoor niet in het resterende zoekgebied worden gerealiseerd.

Wat moet er gebeuren?

- Een deel van de weg tunnelen, zodat de hoeveelheid oppervlaktewater verkleind om ruimte te maken voor woningbouw? (Plan aanpassen)
- De woonnorm aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat andere functies kunnen wijken voor woningen? (Ontgrenzen)
Variant Watertoets 2.b

De woonnorm wordt aangepast (Onderhandelen)
Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd maximaal. De gestelde woonnorm kan hierdoor niet in het resterende zoekgebied worden gerealiseerd.

Wat moet er gebeuren?
- Een deel van de weg tunnelen, zodat de hoeveelheid oppervlaktewater verkleind om ruimte te maken voor woningbouw? (Plan aanpassen)
- De woonnorm aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat andere functies kunnen wijken voor woningen? (Ontgrenzen)
Variant Watertoets 2.c

De weg wordt volledig op het maaiveld aangelegd. Hierdoor is de hoeveelheid oppervlakte water dat moet worden gerealiseerd maximaal. De gestelde woonnorm kan hierdoor niet in het resterende zoekgebied worden gerealiseerd.

Wat moet er gebeuren?

- Een deel van de weg tunnelen, zodat de hoeveelheid oppervlaktewater verkleind om ruimte te maken voor woningbouw? (Plan aanpassen)
- De woonnorm aanpassen? (Onderhandelen)
- Het zoekgebied vergroten zodat andere functies kunnen wijken voor woningen? (Ontgrenzen)