The AS-Tool:

A decision supporting tool for choosing an accomodation plan, in order to implement the new ways of working.

Using computer modelling to simultaneously take into account feasibility and desirability.

P5 Presentation

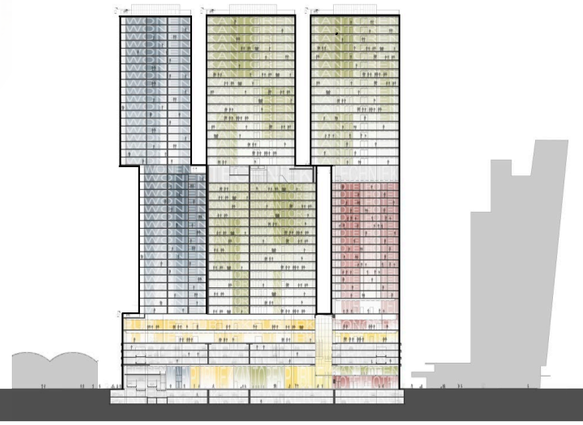
Student name: Bart Pols
Student number: 1524240

Date: 1-7-2015

Graduation lab: Aligning real estate demand and supply
First mentor: Dr. Ir. R. Binnekamp
Second mentor: Dr. Ir. D.J.M. van der Voordt
Board of examiners delegate: Dr. N.E.T. Nieboer

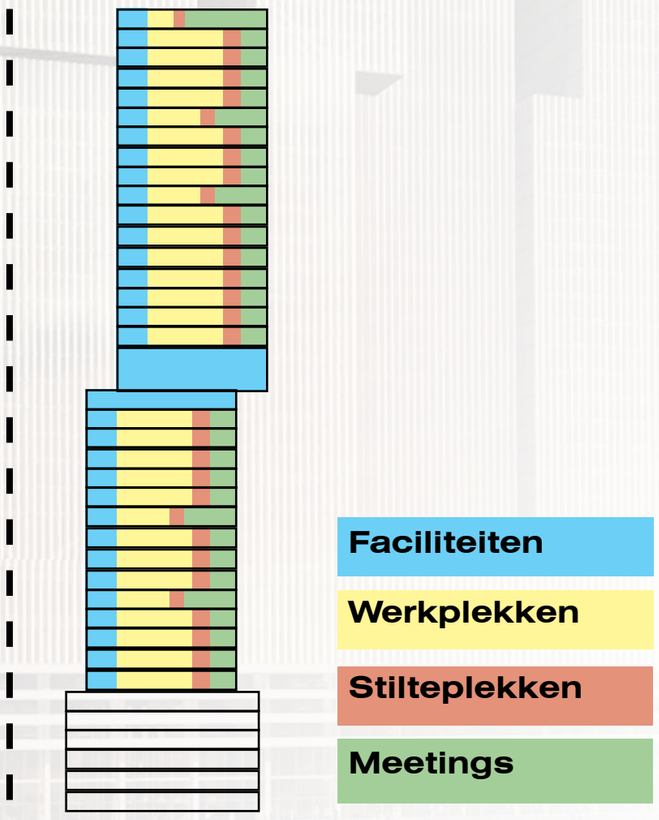
Introduction (1/4).

* Research topic is “The New Ways of Working”.
* Implementation differs per organization.
* To support implementation, decision supporting tools exist.
  - *HK Model.*
  - *PACT Model.*



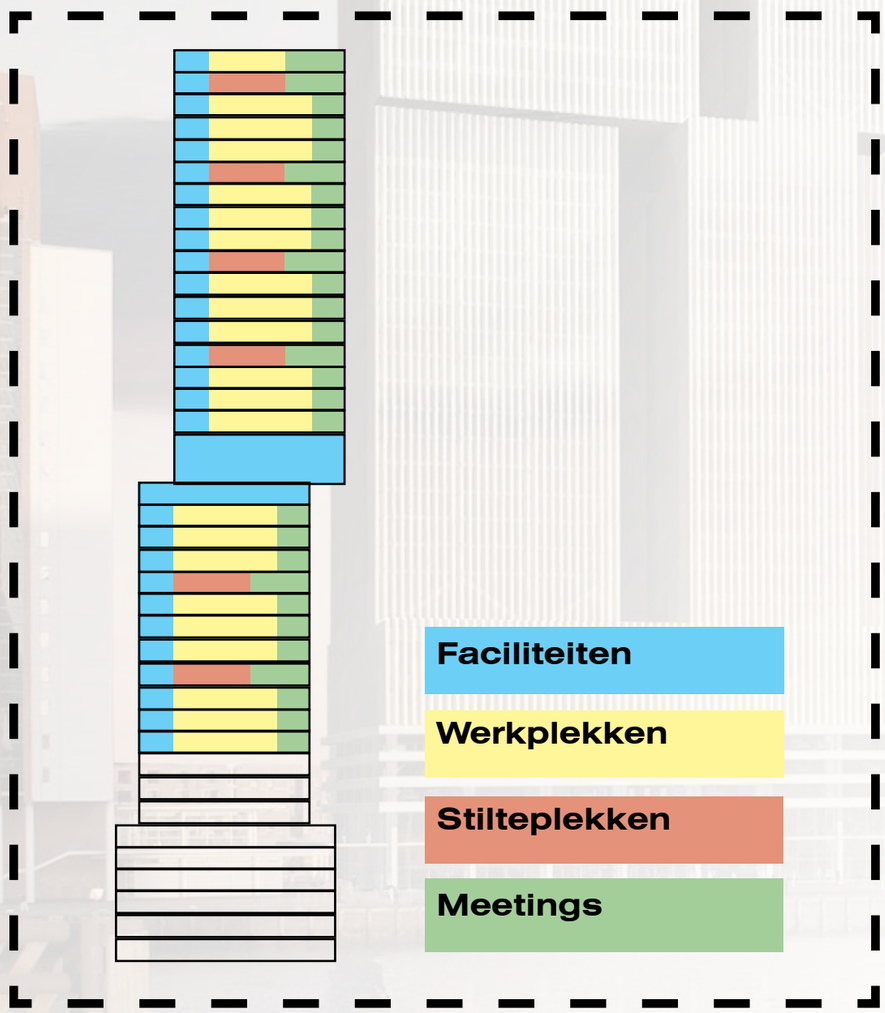
Introduction (2/4).

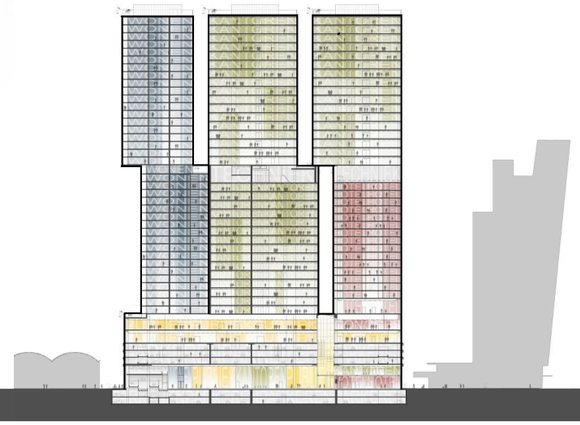
* Case: Municipality of Rotterdam in “De Rotterdam”.



Introduction (3/4).

* In my point of view: “better” solutions exists.





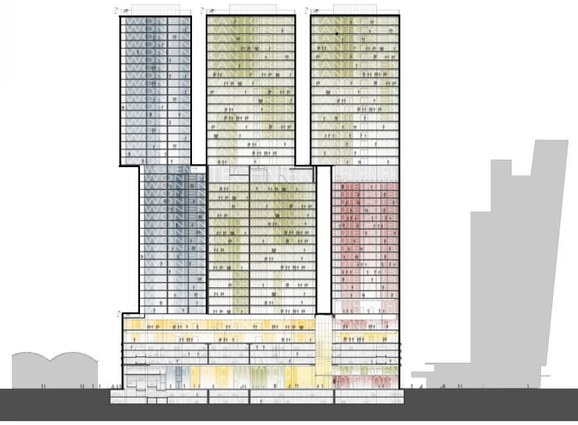
Introduction (4/4).

* Based on this observation, the goal for this study is to construct a tool which can:

  - *Support the accommodation decision making process.*

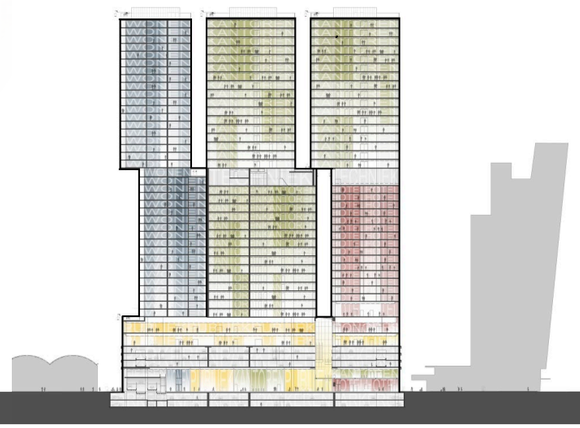
  - *Provide the best real estate solution.*

  - *Provide transparancy in a project's constraints & objectives.*

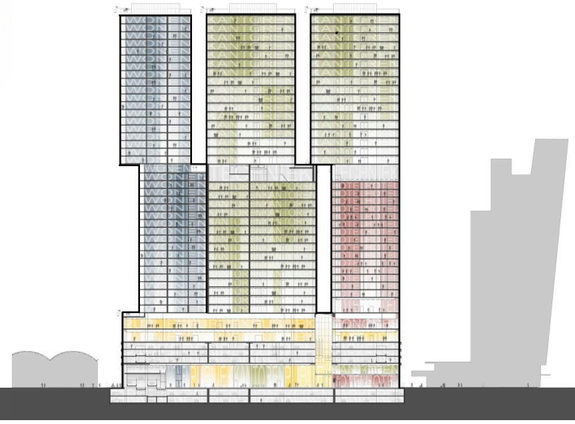


Presentation structure.

* Research structure.
* Real estate management literature.
* Operations research literature.
* Case description.
* Process.
* Product.
* Conclusion.



Research structure.

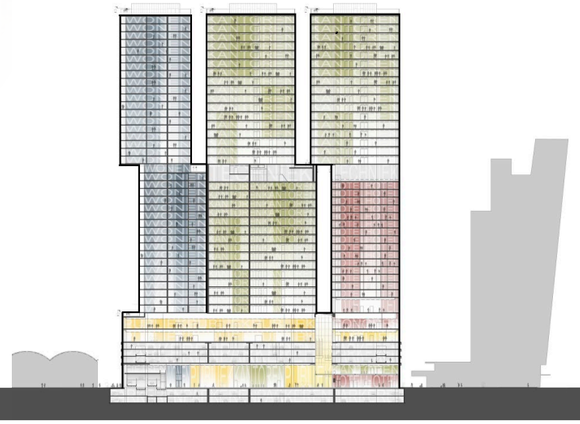


Problem statement.

* The tools available for organizations to support choosing an accommodation plan for implementing the new ways of working, fail to simultatiously take into account feasibility and desirability.

- *Feasibility within stakeholder constraints and the real estate object limitations.*

- *Desirability of involved stakeholders calculated by preference measurement.*

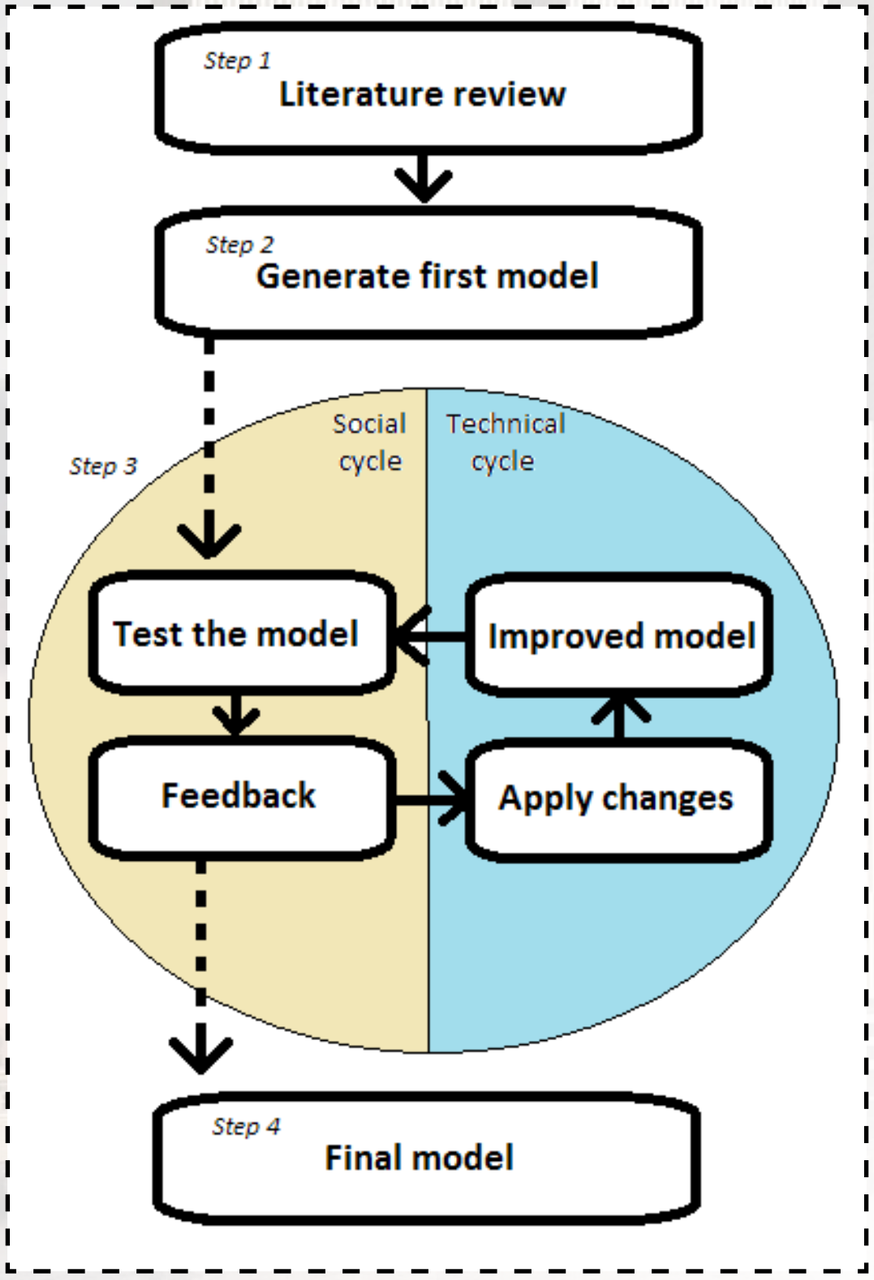


Research question.

* How can a tool be developed to support organizations in choosing an accomodation plan to implement the new ways of working, while simultaniously taking into account feasibility and desirability?

  - *What are the demands of the stakeholders?*
  - *What are the constraints of the real estate object?*
  - *What are the criteria of the stakeholders?*

Study design.



Scientific context.

* Real estate management:

  - *“Added value” of real estate: aligning demand and supply.*
  - *New ways of working for real estate.*
  - *Translating stakeholder criteria.*

* Design and decision modelling:

  - *OR study, based on mathematical modelling*
  - *Using exisiting optimization techniques.*
  - *Using exisiting preference measurement.*

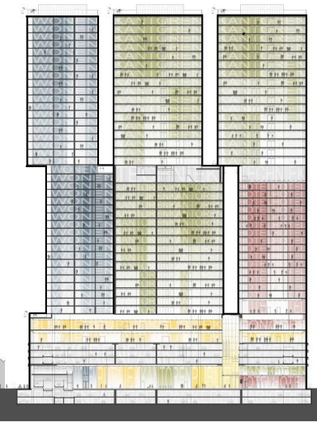
OR Modeling.

* Main equation $U = f(X_i, Y_i)$.

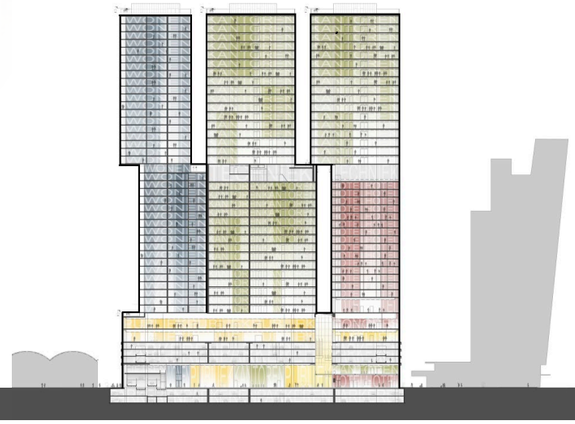
  - *U is the utility of the system performance, model searches for the highest possible U.*

  - *X are the controlled variables, which the model changes in order to optimize U*

  - *Y are the uncontrolled variables, which the model has to take into account while calculation the optimized U*

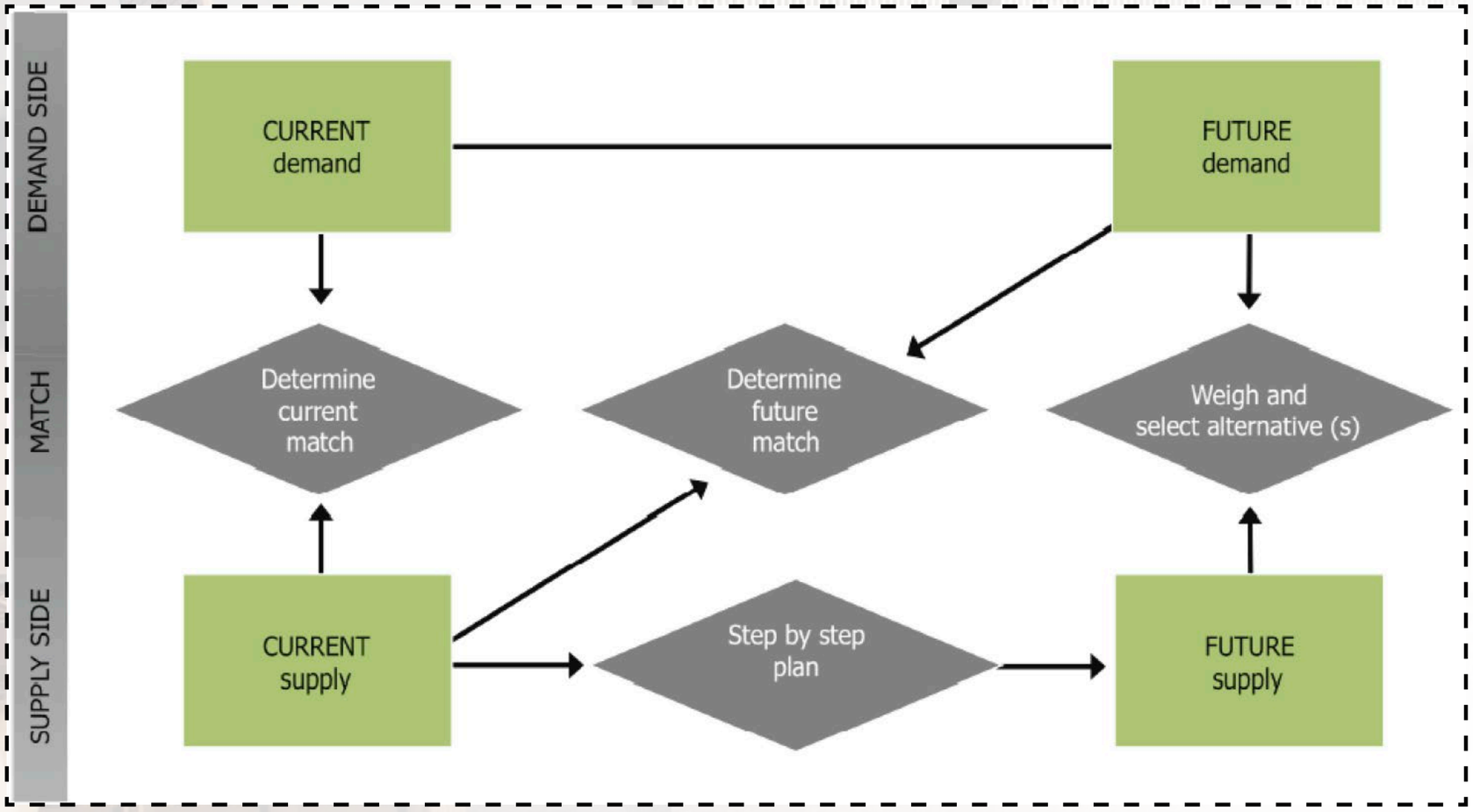


Real Estate management.



DAS-Frame.

* This research provides a method for the third step of the DAS-frame: weight and select elternatives.



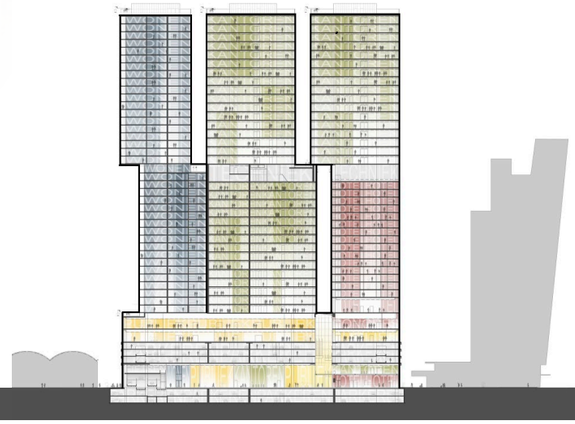
New ways of working (1/2).

* Main subject “New Ways of Working”:

  - *No standard of implementation.*

  - *Renewal of physical working environment, organization structure and culture, management style, mentality of employee & employer.*

- *New RE demands: flexible locations, updated IT, professional and information environment.*



New ways of working (2/2).

* Reasons for implementing “New Ways of Working”:

  - *Wishes of the employee: cultural change where employee want to have more to say about subjects like working time and location.*

  - *Benefits the employer: decreased accommodation costs because of flexible workstations, flexfactor, working at home.*

Existing models.

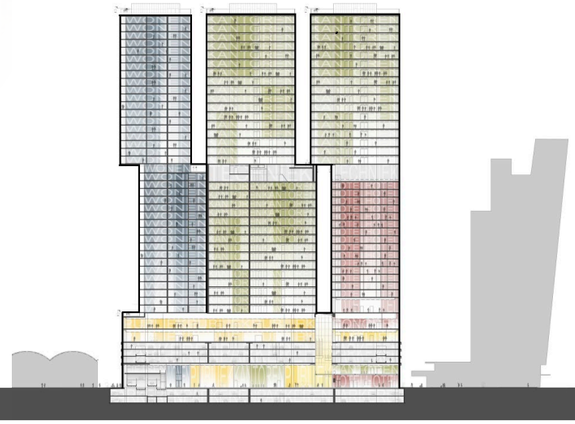
* HK Model (huisvestingskeuze model):

  - *Process oriented, placed in a cyclic process.*
  - *Returning the best conceptual choices.*
  - *Qualitative approach, focus on stakeholder wishes.*

* PACT Model (plekken en activiteiten model):

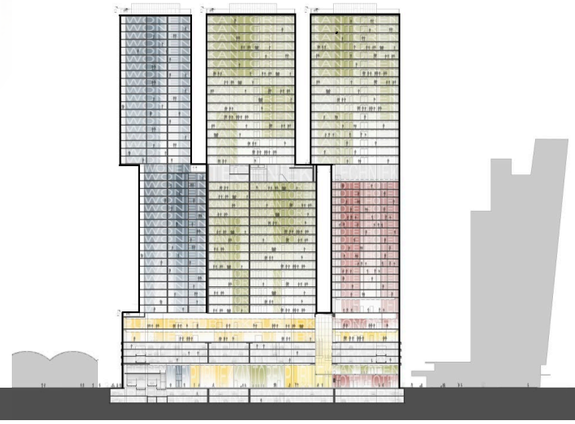
  - *Calculation tool, optimizing implementation of workstations.*
  - *Quantitative approach, focus on activity profile.*

OPERATIONS RESEARCH.

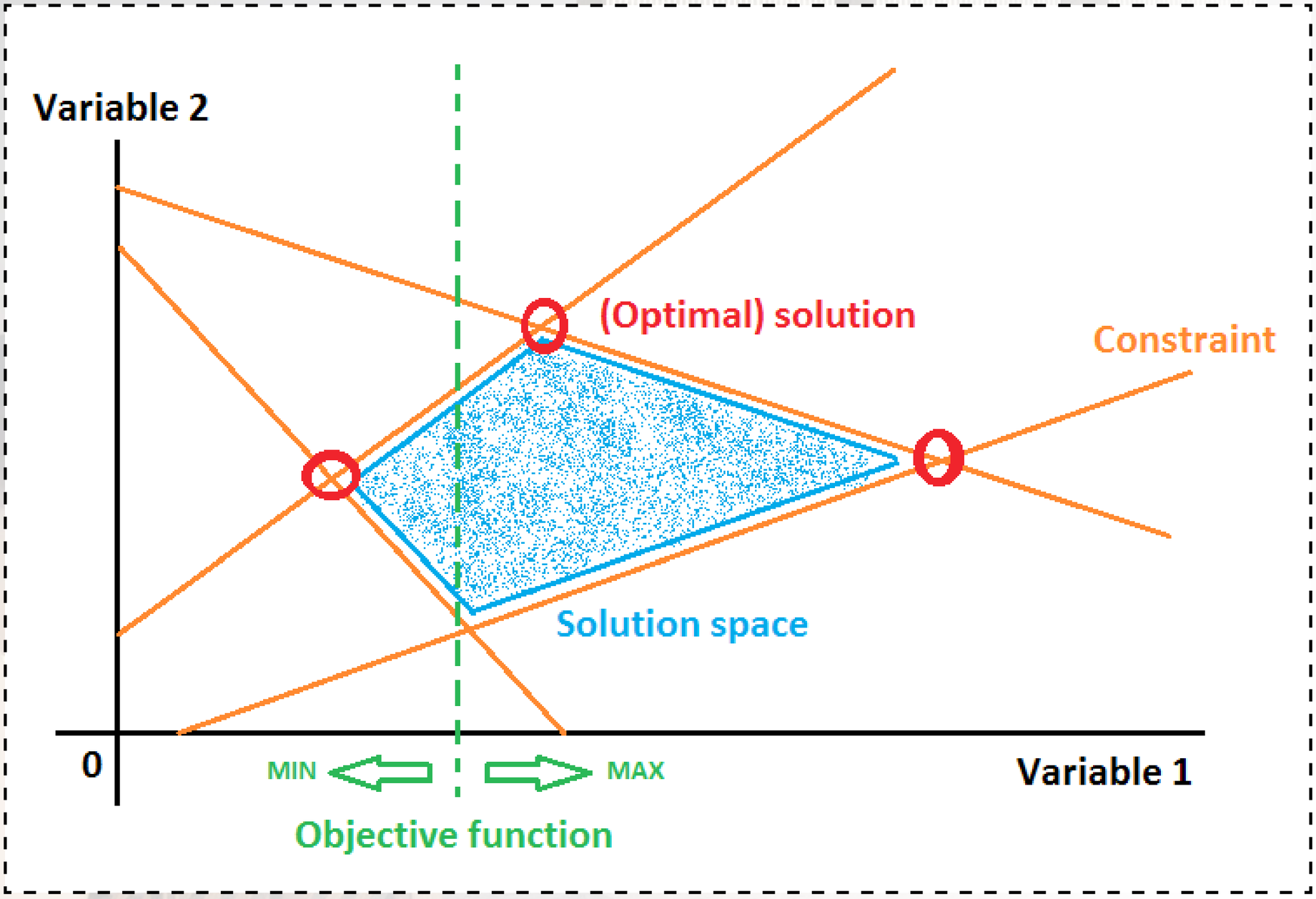


Feasibility (1/3).

* Using Linear Programming, elements within a LP model are:
  - *Constraints, which define the solution space.*
  - *Solution space, which contains all allowed solutions and thereby defines the feasibility.*
  - *Objective function, used to find the optimal solution within the solution space.*
  - *Solution.*

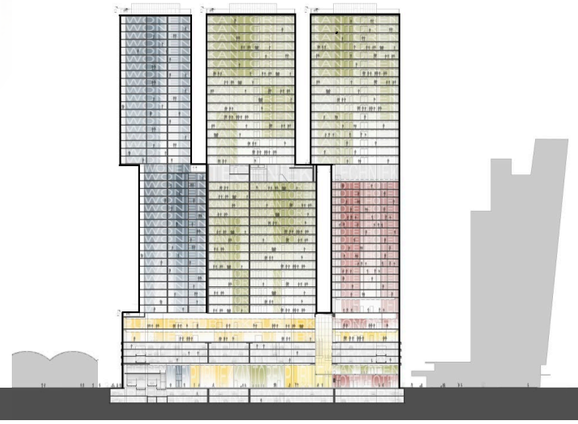


Feasibility (2/3).



Feasibility (3/3).

* For an OR project, the elements are related the empirical notions.
  - *Constraints: building properties & stakeholder demands*
  - *Solution space: the design space*
  - *Objective function: the dominant design criterion*
  - *Solution: a design*



DESIRABILITY.

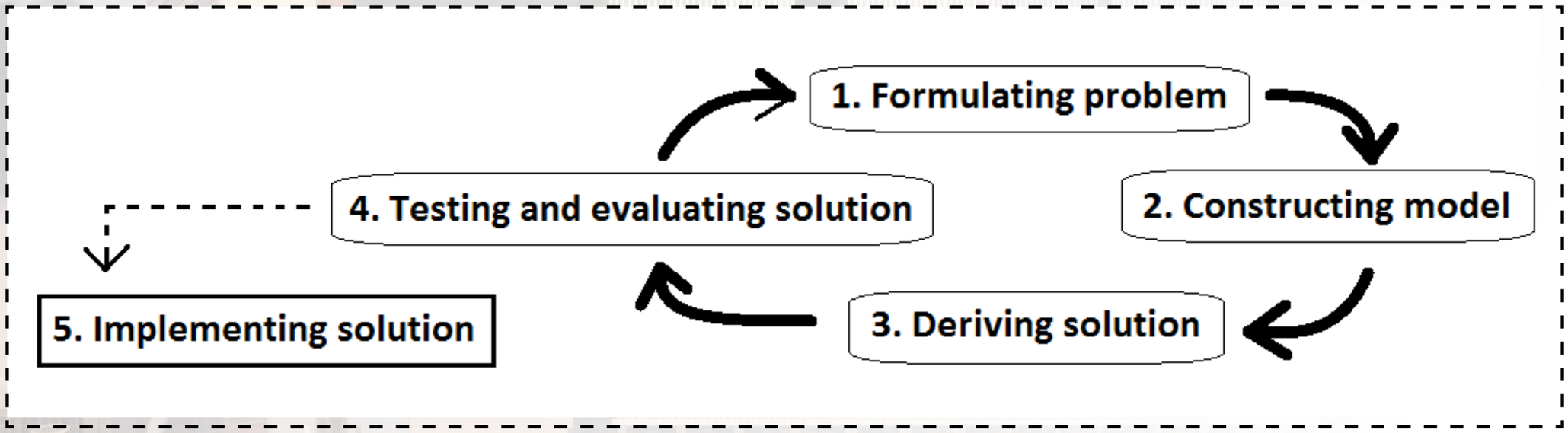
* Using preference measurement, to test the optimized solutions to other stakeholders criteria, and find the most desirable solution.

* Procedure of preference measurement:

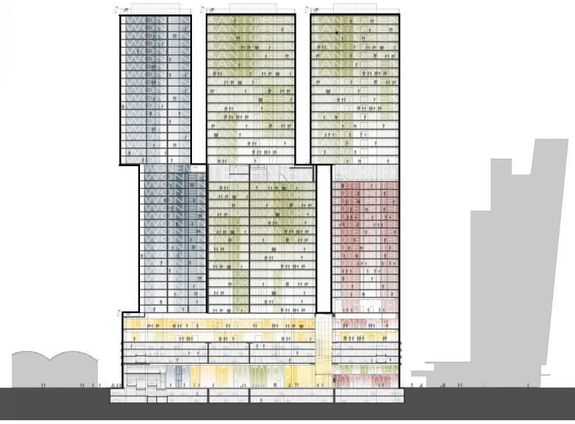
- *Specify the alternatives.*
- *Specify the decisions maker's criteria tree.*
- *Rate the decision maker's preference for each alternative against each leaf criterion*
- *To each leaf criterion, assign the weight.*
- *Yield an overall preference scale.*

Process orientation.

* The combination of LP modelling and preference measurement is a process oriented technique, following the 5 main steps of OR.

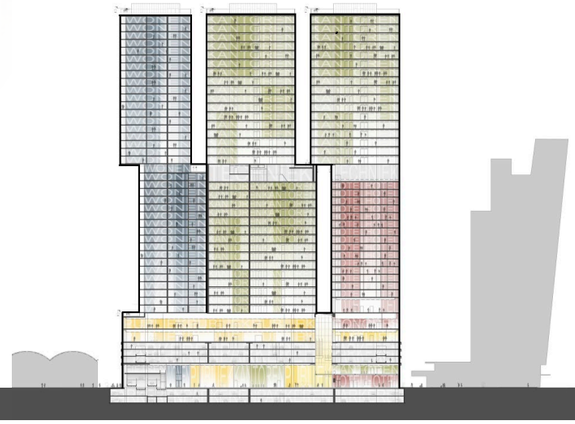


Case description.

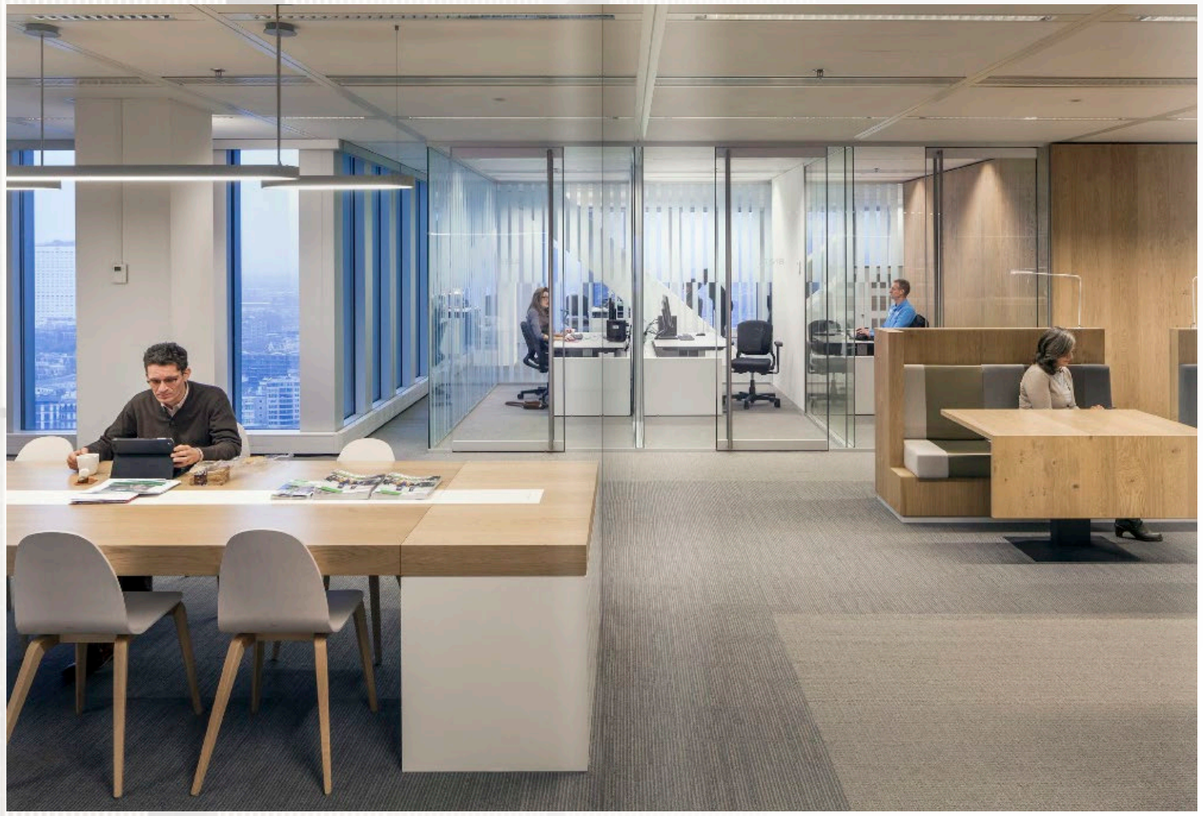


Introduction.

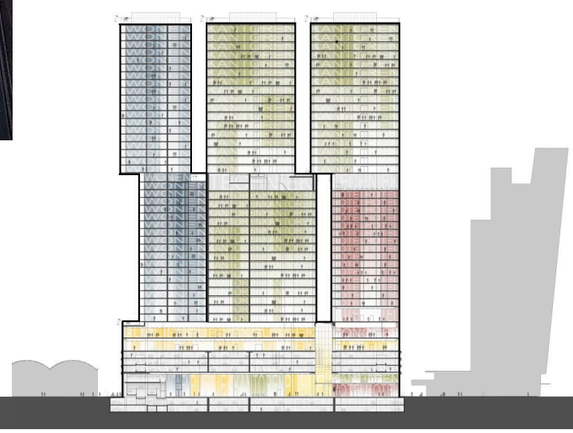
* Business case of Municipality of Rotterdam.
* Carried out over years 2011 - 2015.
* Rehousing from 27 different locations to 4:
  - *Het Stadhuis*
  - *Het kantoor aan de Librijesteeg*
  - *De Rotterdam*
  - *Het Stadskantoor (Timmerhuis)*



Impressions (1/2).



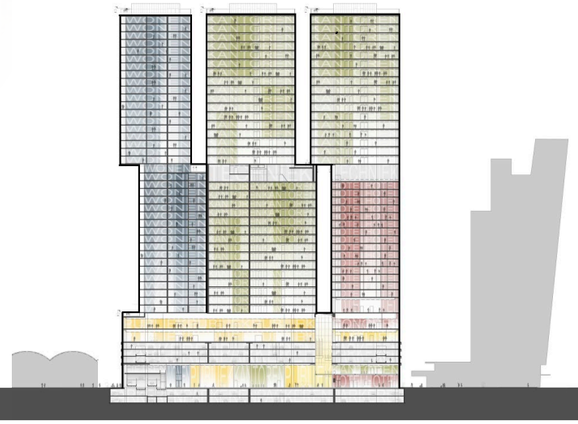
Impressions (2/2).



Stakeholders.

* Interviews with 7 different stakeholders.
  - *IT Services.*
  - *Asset manager.*
  - *Facility management.*
  - *Project controller.*
  - *New ways of working.*
  - *Real estate developer.*
  - *Design concept.*

* Stakeholders had goals and constraints.

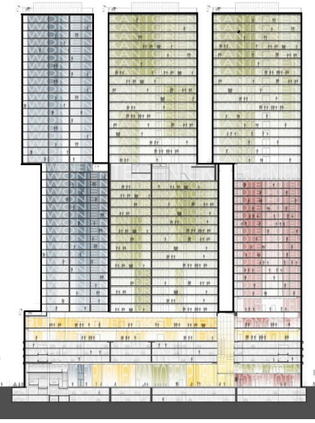


Modelling elements (1/2).

* Based on program of requirements, interviews and other documents.

* Activity profile of 7 activities.

- *Individual general*
- *Individual concentrated*
- *Cooperative work (max 4p)*
- *Meeting general*
- *Meeting brainstorm*
- *Small meeting (max 4p)*
- *Knowledge sharing (12p+)*



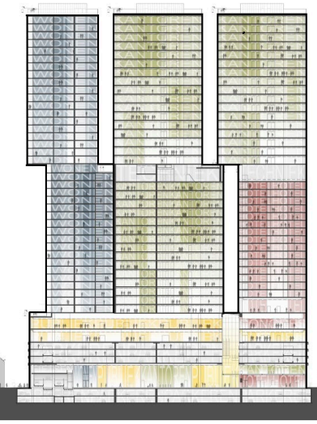
Modelling elements (2/2).

* Related to activity profile are 18 working/meeting elements, 10 facility elements and 16 special elements.

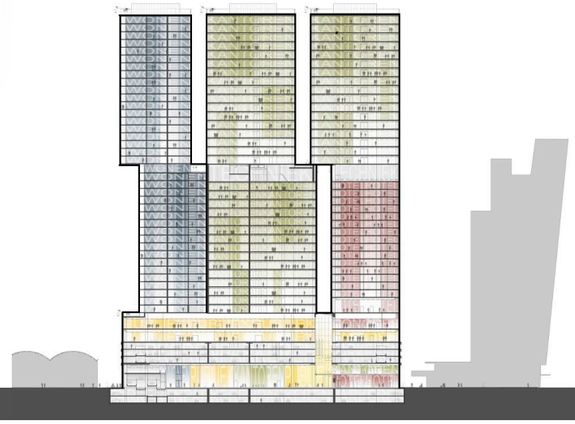
* Building constraints include size of floors, suitibility and fire safety and installation restrictions.

* Stakeholder constraints include the mix of functions, openness and activity profile itself.

* Financial constraints include facility costs, realizations costs and rental costs.



Process.



First technical cycle.

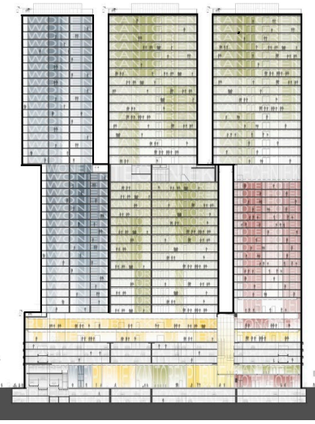
* Based on literature research, an initial LP model was created for the project, which included:

  - *Intigration of the different floors of the building, including size, suitability and minimum amount of facilities.*
  - *Activity based elements, to define the activity support in the model.*
  - *Data on the required facilities.*
  - *Estimation of financial constraints.*

First social cycle.

* The next step of the process was to conduct interviews with the involved stakeholders, to gain more insights in constraints and objectives.

- *IT Services* *(Jaap Donkervoort)*
- *Asset manager* *(Marting Knijnenburg)*
- *Facility management* *(Peter Klaver)*
- *Project controller* *(Arie van Vliet)*
- *New Ways of Working* *(Odette de Koning)*
- *Real Estate Developer* *(Leon Wielaard)*
- *Design concept* *(John Smeets)*



Second technical cycle.

* Results of the interviews, and additional aquired documents, provided data to elaborate the initial model.

  - *Program of requirements, defining detailed facilities, specials, actual activity profile, actual chosen elements.*
  - *Detailed floor plans of the real estate object.*
  - *Fire safety and installation constraints.*
  - *Facility costs and rental costs.*

Second social cycle.

* With the completed model, 4 allowed solutions were generated, optimized for a different objectives.

* During the workshop, the stakeholders defined criteria to rate the alternatives.

* The 4 solutions were:

  - *Strategy 1: function mix on each floor.*
  - *Strategy 2: function mix for the whole building.*
  - *Strategy 3: saving space.*
  - *Strategy 4: additional workstations.*

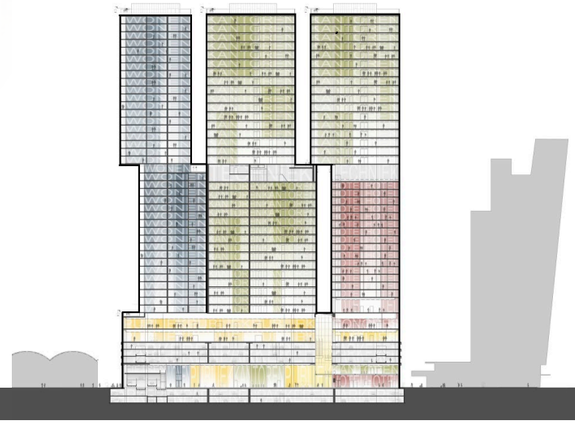
Workshop outcome.

Stakeholder & criteria	STR 1	STR 2	STR 3	STR 4
Stakeholder: project manager				
- *Financial (realization)*	*80*	*100*	*100*	*0*
- *Flexibility in space*	*80*	*100*	*25*	*0*
- *Monitoring abilities*	*70*	*100*	*0*	*25*
- *Number and choice of workstations*	*50*	*75*	*0*	*100*
Stakeholder: new ways of working				
- *Supporting current culture*	*100*	*50*	*0*	*25*
- *Supporting future culture*	*50*	*100*	*75*	*0*
- *Providing the right type of stations for activities*	*100*	*100*	*0*	*60*
- *Amount of FTE to be stationed*	*100*	*100*	*75*	*0*
Stakeholder: asset manager				
- *Financial (operating costs)*	*0*	*50*	*75*	*100*
- *Ability to adjust flex norm*	*75*	*75*	*0*	*100*
Stakeholder: facility management				
- Supporting the function mix concept	100	75	20	0
Stakeholder: design concept				
- Diversity in activity close by (user friendliness)	100	70	40	0
- Supporting the activity changing concept	70	100	30	0

Third technical cycle.

* Short technical cycle to include facility and rental costs.

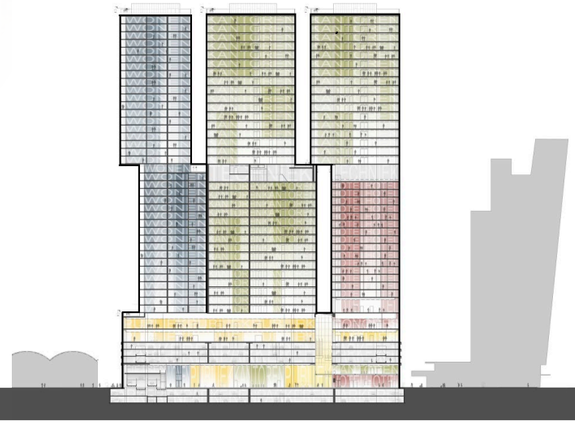
* Small changes to layout of model, most importantly the output sheet for the client.



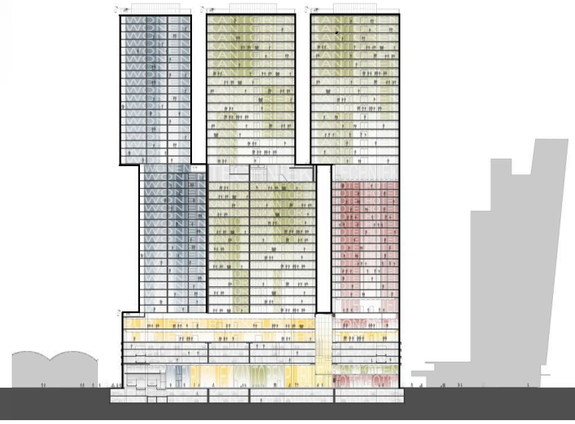
Third social cycle.

* The model was used to generate a new design solution, taking into account the preferences of the second social cyle (workshop results).

* An evaluation with the stakeholders regarding the utilization potential of the model, and the new generated solution.



PRODUCT.

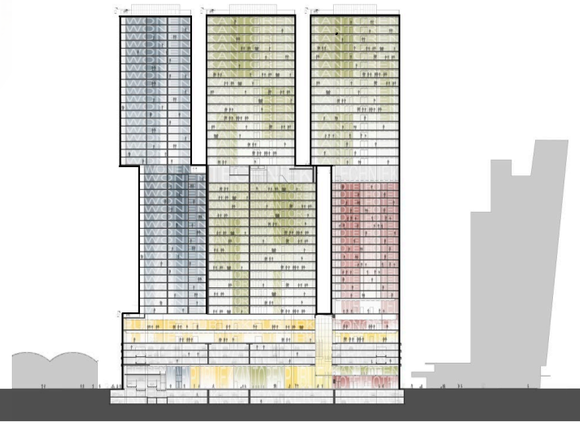


Model overview.

* The input sheet of the model is where the user can specify the constraints in a clear way.

* The model sheet is used for calculations, and should not be presented to clients.

* The output sheet gathers the important data of the model in a presentable and understandable format.



Input sheet (1/2).

* The client can modify constraints based on the 6 different categories:
  - *Organization & activity.*
  - *Building restrictions.*
  - *Working & meeting stations*
  - *Facilities*
  - *Specials*
  - *Financial*

* Additional constraints can be added by the programmer

Input sheet (2/2).

Organization & Activity

Organization					
Total number of employees (FTE)	2800				
Flex factor	0,7				
Total number of workstations	1960				
Activity profile					
Individual general	59%	=	1156	Workstations places	
Individual concentrated	29%	=	568	Workstations places	
Cooperative work	12%	=	235	Workstations places	
Small meeting for 4 persons	2%	=	39	Meeting stations places	
Meeting general / brainstorm	5%	=	98	Meeting stations places	

Building Restrictions

Size, Allowed & Suitability of elements

	Size of floor in m2		Allowed FTE per floor (by installations)		Open flexible workstation	Halfopen flexible workstation	Open workstation	halfopen workstation	Concentration workstation
Floor 7	1337		79		1	1	1	1	1
Floor 8	1337		79		1	1	1	1	1
Floor 9	1337		79		1	1	1	1	1
Floor 10	1337		79		1	1	1	1	1
Floor 11	1337		79		1	1	1	1	1
Floor 12	1337		79		1	1	1	1	1
Floor 13	1337		79		1	1	1	1	1
Floor 14	1337		79		1	1	1	1	1
Floor 15	1337		79		1	1	1	1	1
Floor 16	1337		79		1	1	1	1	1
Floor 17	1337		79		1	1	1	1	1

Model sheet (1/2).

* An adjustable matrix between floors and elements defines the chosen solution.

* 2000 lines of constraints represent the set constraints in the input sheet.

* Using Excels “SUMPRODUCT” function, and the “What’s Best” Plugin to create large scale LP models.

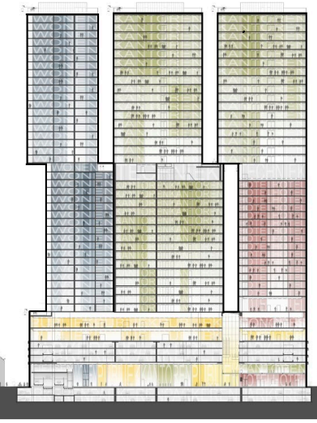
Model sheet (2/2).

Calculation model

Category	Individual general				Individual concentrated			Cooperative work			Small meeting for 4 persons		
Endogenous variables	Open flexible workstation	Halfopen flexible workstation	Open workstation	Halfopen workstation	Halfopen workstation	Concentration workstation	Closed workstation for 2 persons	Halfopen flexible workstation	Closed workstation for 2 persons	Closed workstation for 4 persons	Halfopen meeting for 4 persons	Halfopen meeting for 6 persons	Closed meetings for 6 persons
Outcome floor 7	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 8	0	0	0	0	79	0	0	0	0	0	0	0	0
Outcome floor 9	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 10	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 11	0	0	0	0	79	0	0	0	0	0	0	0	0
Outcome floor 12	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 13	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 14	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 15	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 16	79	0	0	0	0	0	0	0	0	0	0	0	0
Outcome floor 17	0	0	0	0	79	0	0	0	0	0	0	0	0

Organization & Activity

Amount of stations for activities																					MIN		
MIN Individual general	1	1	1	1																	1156	<=	1157
MIN Individual concentrated					1	1	2														568	<=	569
MIN Cooperative work								1	2	4											235	<=	236
MIN Small meeting for 4 persons											0	0	0								39	Not <=	0
MIN Meeting general / brainstorm														0	0	0	0	0			98	Not <=	0



Output sheet (1/2).

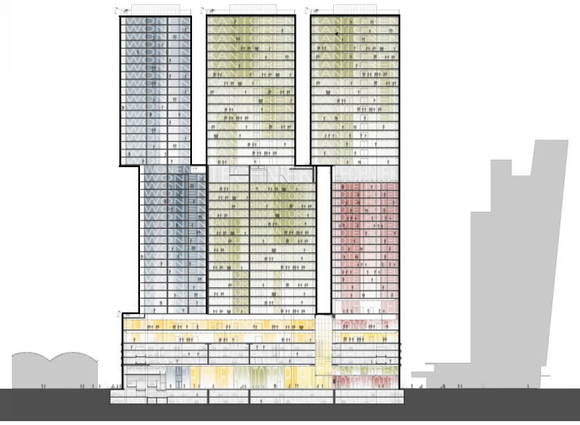
* Provides an overview of the generated solution.

  - *Total of used elements, size and % of total size.*

  - *Detailed overview of elements per floor.*

  - *Results regarding all objective functions.*

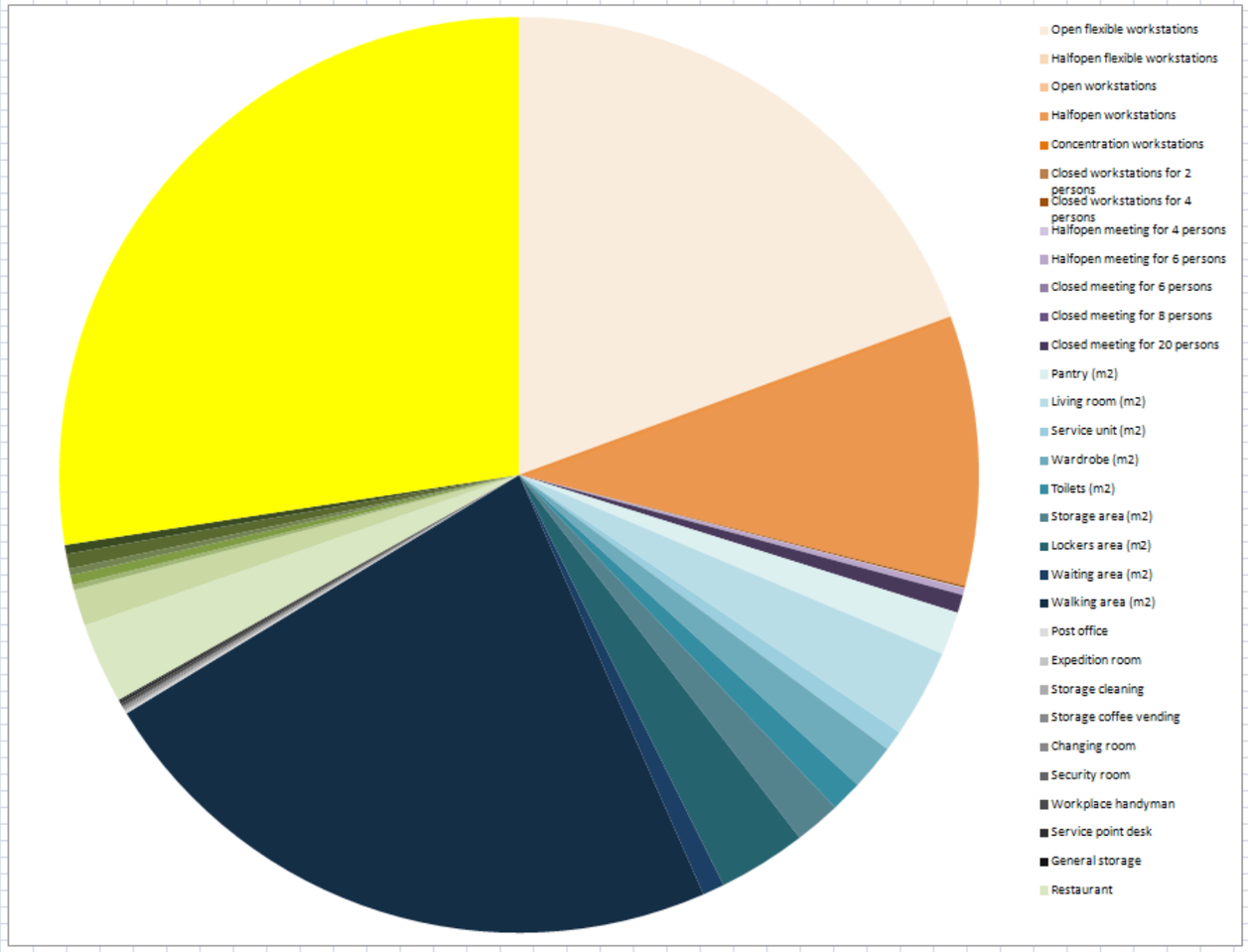
  - *Division of chosen elements in pie-chart format.*



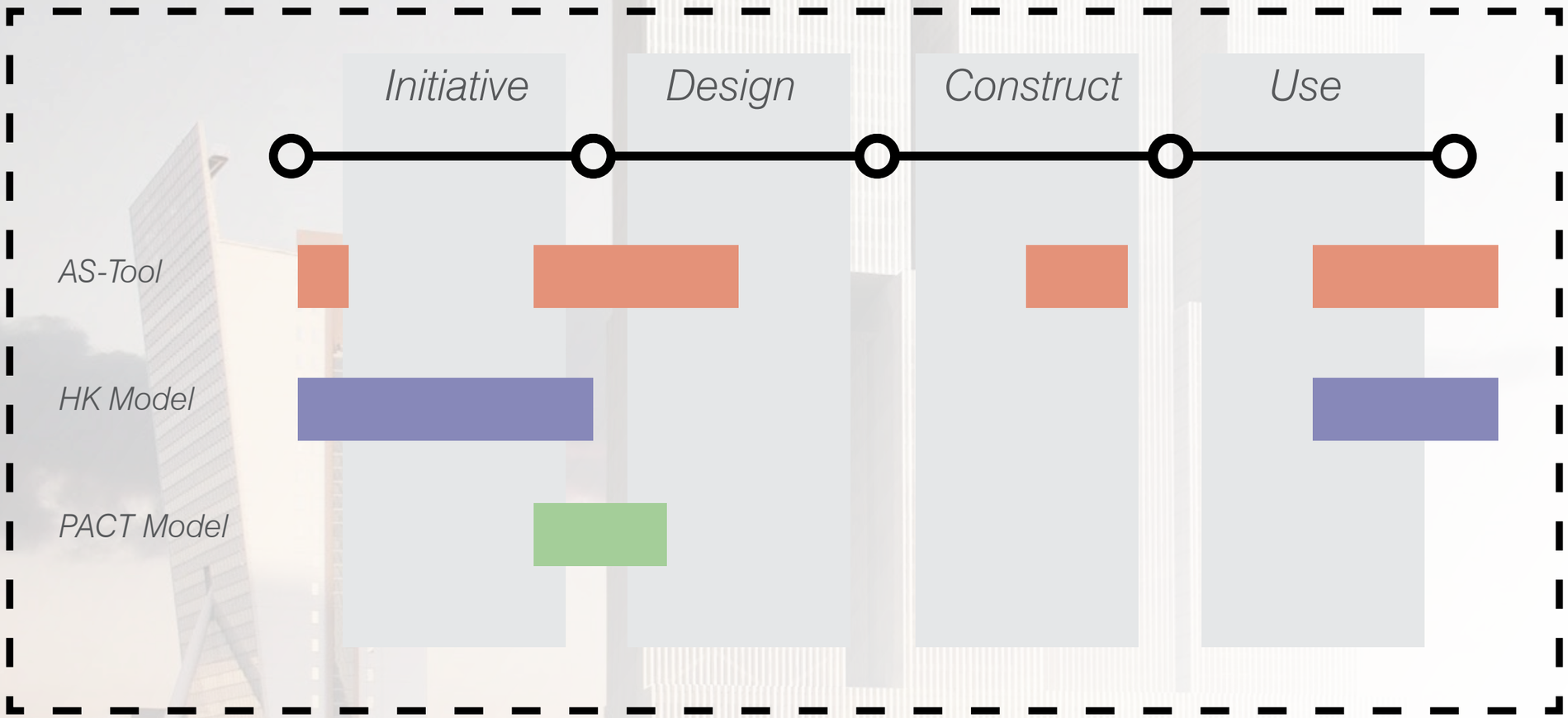
Output sheet (2/2).

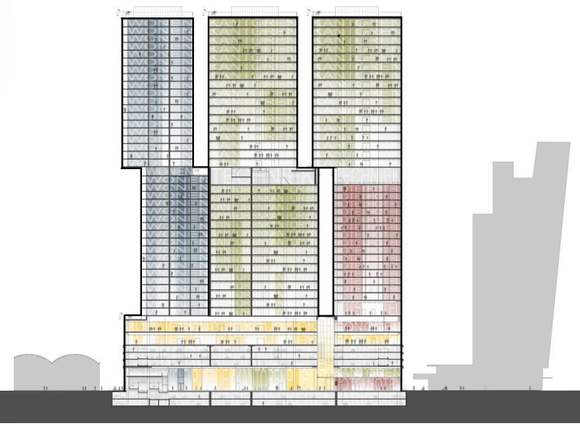
Overall design summary

Overall size (m2)	40329	100%	
Used space (m2)	29675	74%	
Objective function results			
Final realizations costs	20.659.200		
Final space usage	29675		
Final amount of workstations	1962		
Work & Meeting	**Units**	**Size (m2)**	**% of overall size**
Open flexible workstations	1157	7521	18,6%
Halfopen flexible workstations	0	0	0,0%
Open workstations	0	0	0,0%
Halfopen workstations	569	3699	9,2%
Concentration workstations	0	0	0,0%
Closed workstations for 2 persons	0	0	0,0%
Closed workstations for 4 persons	1	26	0,1%
Halfopen meeting for 4 persons	1	10	0,0%
Halfopen meeting for 6 persons	6	90	0,2%
Closed meeting for 6 persons	0	0	0,0%
Closed meeting for 8 persons	0	0	0,0%
Closed meeting for 20 persons	5	250	0,6%
Facilities	**Units**	**Size (m2)**	**% of overall size**
Pantry (m2)	589	589	1,5%
Living room (m2)	1209	1209	3,0%
Service unit (m2)	279	279	0,7%
Wardrobe (m2)	627	627	1,6%
Toilets (m2)	429	429	1,1%
Storage area (m2)	627	627	1,6%
Lockers area (m2)	1209	1209	3,0%
Waiting area (m2)	297	297	0,7%
Walking area (m2)	8871	8871	22,0%
Fat client computers	0		
Specials	**Units**	**Size (m2)**	**% of overall size**
Post office	1	19	0,0%
Expedition room	1	19	0,0%
Storage cleaning	1	19	0,0%
Storage coffee vending	1	19	0,0%
Changing room	1	19	0,0%
Security room	1	19	0,0%
Workplace handyman	1	39	0,1%
Service point desk	1	39	0,1%
General storage	1	19	0,0%
Restaurant	1	1104	2,7%
Coffee corner	1	500	1,2%
Medical ward	1	68	0,2%
Shower room	1	137	0,3%
Medium conference (12 persons)	3	90	0,2%
Large conference (20 persons)	4	200	0,5%
Large conference (50 persons)	1	125	0,3%
Unused space (m2)	10654	10654	26,4%

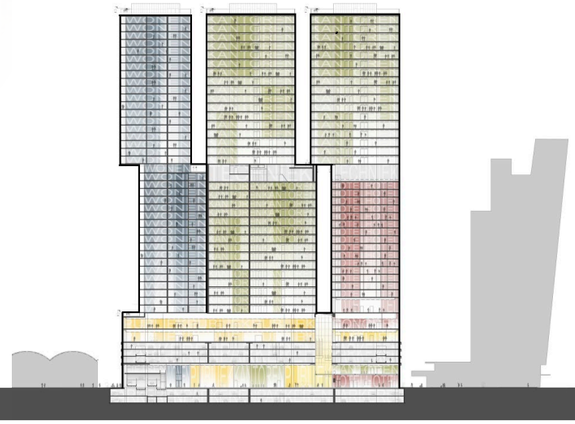


Place in the process.





Conclusion.



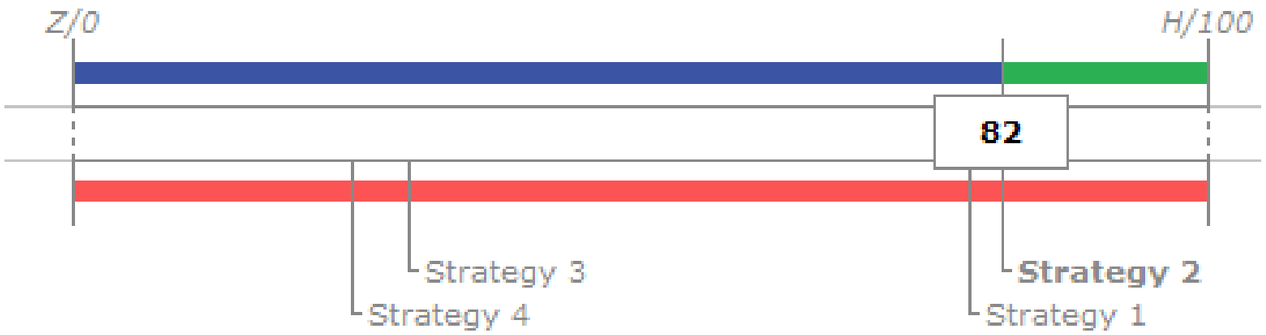
Workshop results (1/2).

* Using TETRA SDM to proces test results.

Stakeholder & criteria	STR 1	STR 2	STR 3	STR 4
Stakeholder: project manager				
- *Financial (realization)*	*80*	*100*	*100*	*0*
- *Flexibility in space*	*80*	*100*	*25*	*0*
- *Monitoring abilities*	*70*	*100*	*0*	*25*
- *Number and choice of workstations*	*50*	*75*	*0*	*100*
Stakeholder: new ways of working				
- *Supporting current culture*	*100*	*50*	*0*	*25*
- *Supporting future culture*	*50*	*100*	*75*	*0*
- *Providing the right type of stations for activities*	*100*	*100*	*0*	*60*
- *Amount of FTE to be stationed*	*100*	*100*	*75*	*0*
Stakeholder: asset manager				
- *Financial (operating costs)*	*0*	*50*	*75*	*100*
- *Ability to adjust flex norm*	*75*	*75*	*0*	*100*
Stakeholder: facility management				
- Supporting the function mix concept	100	75	20	0
Stakeholder: design concept				
- Diversity in activity close by (user friendliness)	100	70	40	0
- Supporting the activity changing concept	70	100	30	0

Workshop results (2/2).

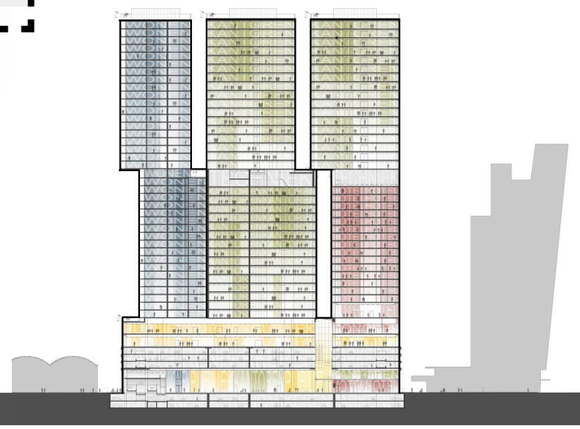
Solution



Alternative	Solution
Strategy 1	79.225
Strategy 2	**81.929**
Strategy 3	29.820
Strategy 4	24.781

Solver Progress

Generating Weights...
Solving...
Solution Complete.



Conclusion social cycles.

* Strategy 2 is the most desired solution, but strategy 1 represents the actual chosen strategy.
  - *The organizational culture does not allow strategy 2 to be implemented at the moment.*

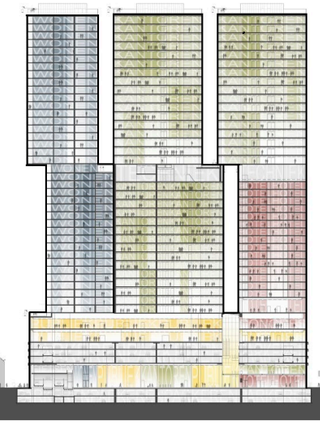
* The alternative of the third social cycle was prefered over the 4 workshop alternatives, because it has implemented the positive aspects of the previous 4 alternatives as constraints.

Conclusion study.

* The research question was: How can a tool be developed to support organizations in choosing an accomodation plan to implement the new ways of working, while simultaniously taking into account feasibility and desirability?

* Feasibility is taken into account by quantifying stakeholder demands and building properties.

* Desirability is taken into account by use of preference measurement.



Product reflection.

* Completeness of data: difficult because of quantifying demands, and sensitivity of numbers.

* Validity of results: influenced by assumptions and not including all existing soft constraints.

* Scientific relevance: method for DAS-frame step and the creation of a new modelling method.

* Utilization potential is high because of inductive structure of the model.

QUESTIONS ?