

aE lab 01/06

Graduation **architectural engineering lab**

SOFIA CARDENAS

on a shortlist of the world's ten most talented architecture students!

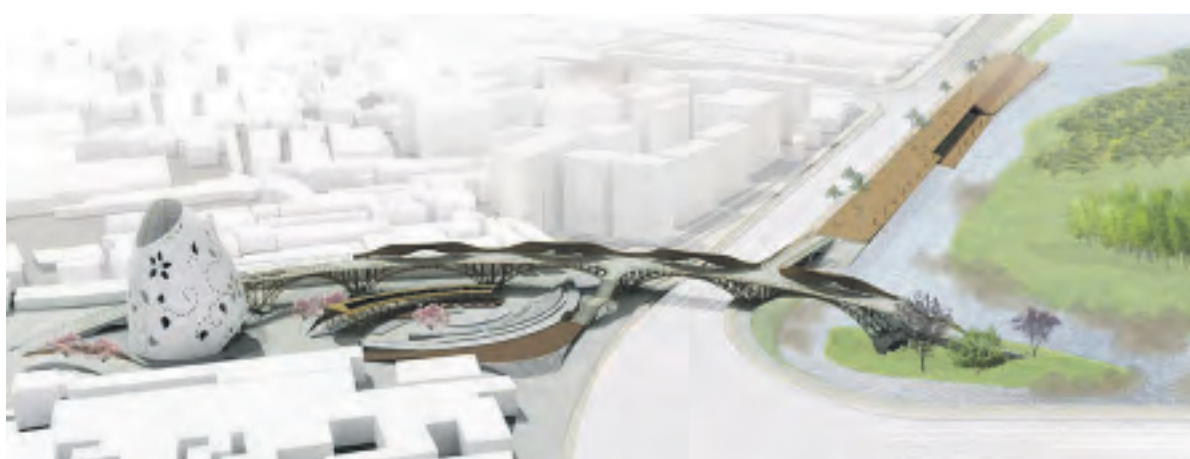
page 2
Introduction aE

page 3 -5
lab 01 Prins Claus square The Hague

page 6-11
lab 02 and 04 RDM Rotterdam

page 12-14
lab 03 and 05 Eastwards Haarlem

page 16
master Program aE and Building Technology



SOFÍA CÁRDENAS – AE LAB TU DELFT, THE NETHERLANDS

A SUSTAINABLE BUSINESS HUB, DHARAVI MUMBAI

In Dharavi, a densely populated area in the heart of Mumbai trapped in the circle of poverty and the informality of a progressing industry, a desired future vision is formulated. The result is the introduction of new elements as generators to provoke predetermined changes (Urban acupuncture). The first intervention is a node that will introduce quality to the area and connect Dharavi to unused economic potential. The concept of this project, which is divided into three key phases, is to organize the lucrative artisanal occupations to make them accessible to external users.

The macro phase creates reciprocity between design project and context. An intervention at the Mahim Creek and the Mithi River improves the existing environmental conditions, increasing productivity, stimulating incomes and to increase connectivity by introducing a boulevard.

The meso phase of the project establishes the design proposal. A bamboo bridge introduces consumers to the low tech icon called "Craft Tower" which works as a show room. A community centre is located on the inner flank of the bridge.

Finally, the micro phase zooms in to detail level. To understand the behaviour of the structure a structural analyses based on a parametric module was developed (GC and DIANA). To research the behaviour of the material a mechanical testing with bamboo and concrete was carried out and a prototype was build.

Tutors: Axel Kilian, Arjan van Timmeren, Elixia Guse

source ARCHITECTURAL REVIEW site 13 August 2010

aE connects architecture and engineering

aE, Architectural Engineering teaches technology driven architectural design. It offers the possibility to graduate on a thesis design with room for technical fascinations. Since September 2008 aE has conducted graduation studios based on a set location that are extremely complex, they cover design decisions of regional scale as well as design decisions on the detail level, they let us think about the quality of the built environment in terms of urban spaces, the architecture of buildings and the impact decisions have on our environment in terms of sustainability. The aE studios have resulted in twenty-five thesis designs and there are many more to come. An overview of locations assignments and designs.

aE is special in Delft architectural design

The aE MCs graduation assignment is an Architecture track program offered by the department of Building Technology. As such it offers the best of both worlds. The project has to comply with the end terms of Architecture, thus entitling the graduates to be registered as architect and an academic environment to do in-depth technical studies.

The graduation study covers a period of one year, subdivided in two semesters. The first part MSc3 consists of a thematic study writing the curriculum and the conceptual design of a building of own choice. The subject of the thematic study is chosen by the student's interest and fascination rather than determined by the aE lab organisation. In order to secure the fascination the MSc3 starts with a quick small pavilion design as a rehearsal for the MSc4 project. The pavilion design provides the context for a technical thematic study that can be extended to the MSc4. Teaching staff of the Façade Design Product Development, Climate design and Structural Design, supports the thematic study. Parallel to the thematic study the location will be inspected and analysed. The locations are a given by the lab and they are huge in size and big in problems. Think of the Prins Clausplein east of the Hague, RDM wharf in the Rotterdam docklands and East Haarlem.

Students then collaborate in making a master plan for the location, which in turn offer the context for the master thesis design.

The aE graduation may not look as the easiest, it is a powerhouse that draws your energy but it challenges and rewards. The connection with specialized technology teachers gives it a unique position in the graduation labs of the Faculty of Architecture. To get the picture first the locations are described and illustrated with thesis designs that tell the story.

aE What's in a name?

aE is short for Architectural Engineering, a notion being used in different contexts. In order to avoid confusion a short explanations may help.

aE is a chair

The Faculty of Architecture of the Delft University is organized in four departments, Building Technology being one of them. Every department has many chairs all with specific tasks in the field of research and education. Architectural Engineering is a combined chair of Prof. Thijs Asselbergs and Prof. Dr. Patrick Teuffel. Together they are responsible for teaching and research in the field of Architectural Engineering. Prof. Asselbergs with a generic background as an architect, prof. Teuffel as a specialist in light weight structures.

aE is an attitude

Architectural Engineering advocates architectural design based on and supported by the fields of structural engineering, climate design, product development, material science and computational support. In short what some say bouwkunde. In order to strengthen the relationship between architecture and technology the former chair holder Prof. Fons Verheijen has achieved to allow aE to offer a graduation lab that complies with the end terms of Architecture, thus the conditions for graduates to be registered as an architect. Prof. Kees van Weeren and Andrew Borgart have written the outlines of the aE programme based on ad hoc combinations of an aE mentor and a mentor from one of the other technical chairs of the department of Building Technology. Contrary to the traditional architecture graduation labs the aE scheme gives the student direct access to a wealth of technical

knowledge. Different students in the same lab have different specialists as second mentor. This in turn adds energy to the group and helps to cross fertilize technical knowledge from the separate fields.

aE is a master graduation lab

Architectural Engineering is the name of a graduation lab students can subscribe to. Like all architecture graduation labs it starts with a MSc3 semester, resulting in a report on a thematic study, a personal curriculum and the outlines of an architectural design as the basis for the MSc4 thesis design. The thematic study includes a design assignment of a small pavilion and an in depth study on a technical subject. A Bt specialist supervises this part in close collaboration with the first mentor.

Who is who in aE?

The first mentors of the aE graduation labs are recruited from the aE chair. Their functions may rotate.

Thijs Asselbergs:

co-chair holder and visiting critic at all aE labs;

Patrick Teuffel:

co chair holder and consultant on structural design aspects;

Elise van Dooren:

Master co-ordinator of Building Technology and the aE program;

Jan Engels:

aE MSc3 and 4 lab co-ordinator, first tutors.

Ype Cuperus:

aE MSc3 and 4, first tutor

Florian Heinzelmann,

Arjan v Timmeren,

Ulrich Knaack,

Frank Schnater,

Kees van Weeren,

Wim Kamerling,

Andy vd Dobbelsteen,

Joop Paul,

Engbert van der Zaag,

Rudi Stouffs,

Karel Vollers,

Axel Kilian,

Eric van der Ham,

Lou Nijs,

Michela Turrin,

Siebe Broersma,

Martin Tenpierik,

Herman Mooi,

Huib Plomp,

Elize Guse,

Gerard Rosbach.

They have all been or still are second mentor and or have been instrumental in making aE work.

Prins Clausplein

lab⁰¹



East of The Hague the European corridors Amsterdam – Paris and The Hague Berlin intersect in a maze of roads. It demonstrates that traffic infrastructure has become a mayor driver of shaping the built environment. Rather than rejecting the negative side effects such as air and sound pollution, traffic congestions and space occupiers we can also try to capture the positive energy and let it work for the quality of the built environment. How far fetched this may seem it triggers our design capacity, it challenges us to develop regional concepts as well as facades that line the urban space and give shelter to living and working. Some designs were located in the vicinity of the Prins Clausplein as it is, while other designs were located elsewhere. Here a master plan as a group effort is presented. It shows an intervention that aims to connect the Rijswijk and Ypenburg suburban layouts by bridging the A4 highway in different ways and places. The combined master plan offers the conditions for five thesis designs.



KARIN HOEKSTRA: TEMPLE OF MOBILITY

West of the Prins Clausplein a interchange of different types of traffic is planned. Thus it connects the local traffic to the European highways, railways and airports. The traffic flows are covered by a lightweight roofs structure, resting on truss shaped large span arcs. The building connects to its surroundings by park like landscaping. Comfort fin the semi-outdoor space was the leitmotif of shaping the interior spaces. Data were drawn from an extensive building physics study on reducing sound levels of trains, preventing uncomfortable draught and uncomfortable temperatures.

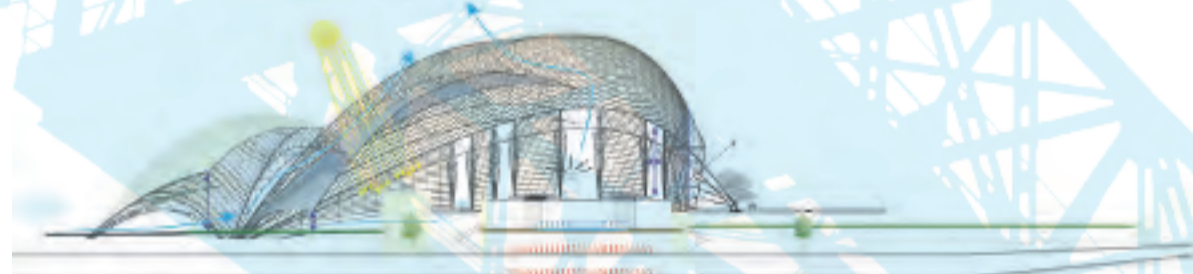
Subjects investigated were the influence of wind on the

semi out dour climate of the station building, the trade off between daylight though sunshine and trapping heat were studies as well as the choice of materials for noise insulation and absorption. Designs for traffic infrastructure are very much determined by non-negotiable

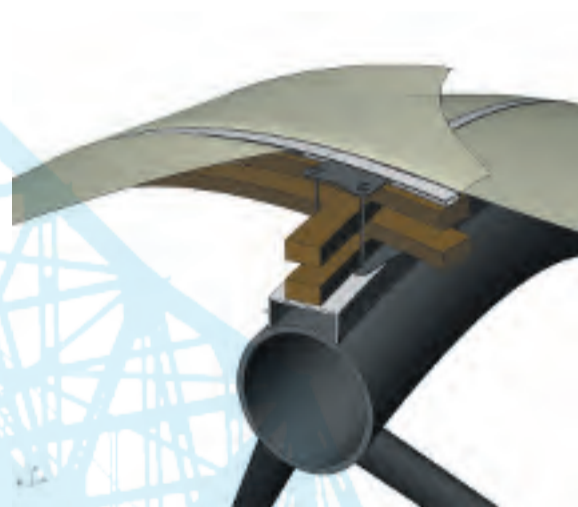
facts such as the train profiles, platform lengths to accommodate the longest possible trains, rules of physics with regard to people flows such as platform and staircase widths and so on. The organization of traffic flows is optimized on readability of the spaces. Travellers navigate through the building on sight: they can se were train

tram and bus platforms are rather than having to rely on signposting. The shape of the roof is determined by the airflow of prevailing winds, creating under pressure to reduce draft and to stimulate natural ventilation. The area in front of the station is not so much a railway square rather than a park-like urban space og green, stone timber decking and water. This combination makes the station stand out in the known typology of traffic nodes.

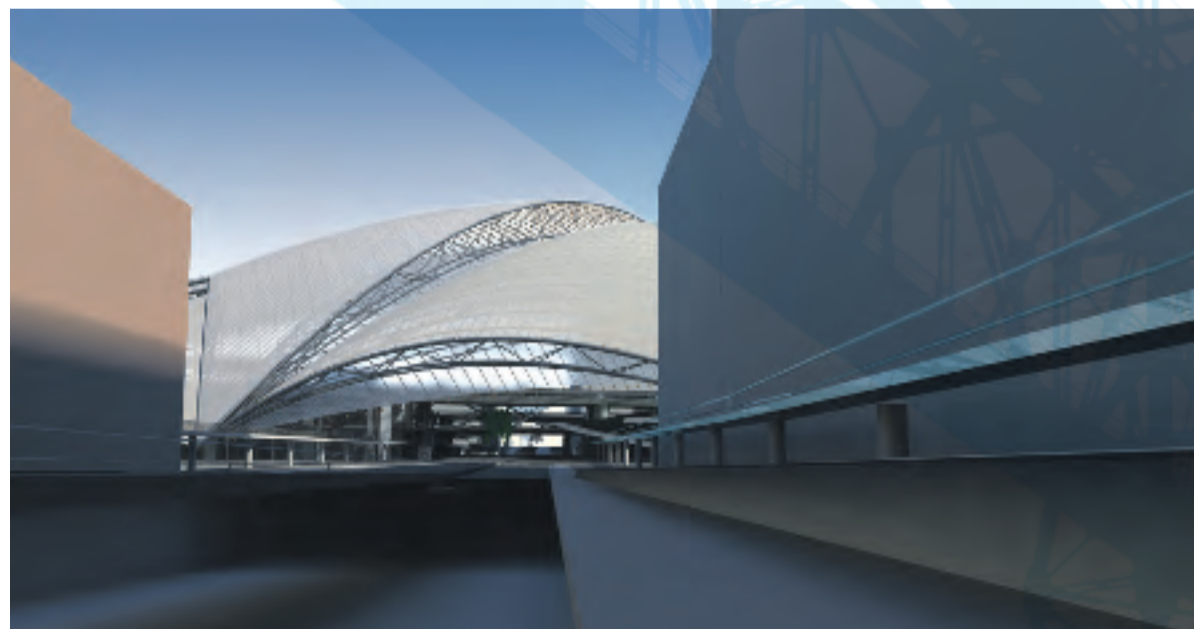
Tutors: Ype Cuperus, Patrick Teuffel, Eric van der Ham and Gerard Rosbach as an external tutor.



Roof section



Roof detail



Interior view



Interior view

WOUTER GIELEN: ARMADILLO

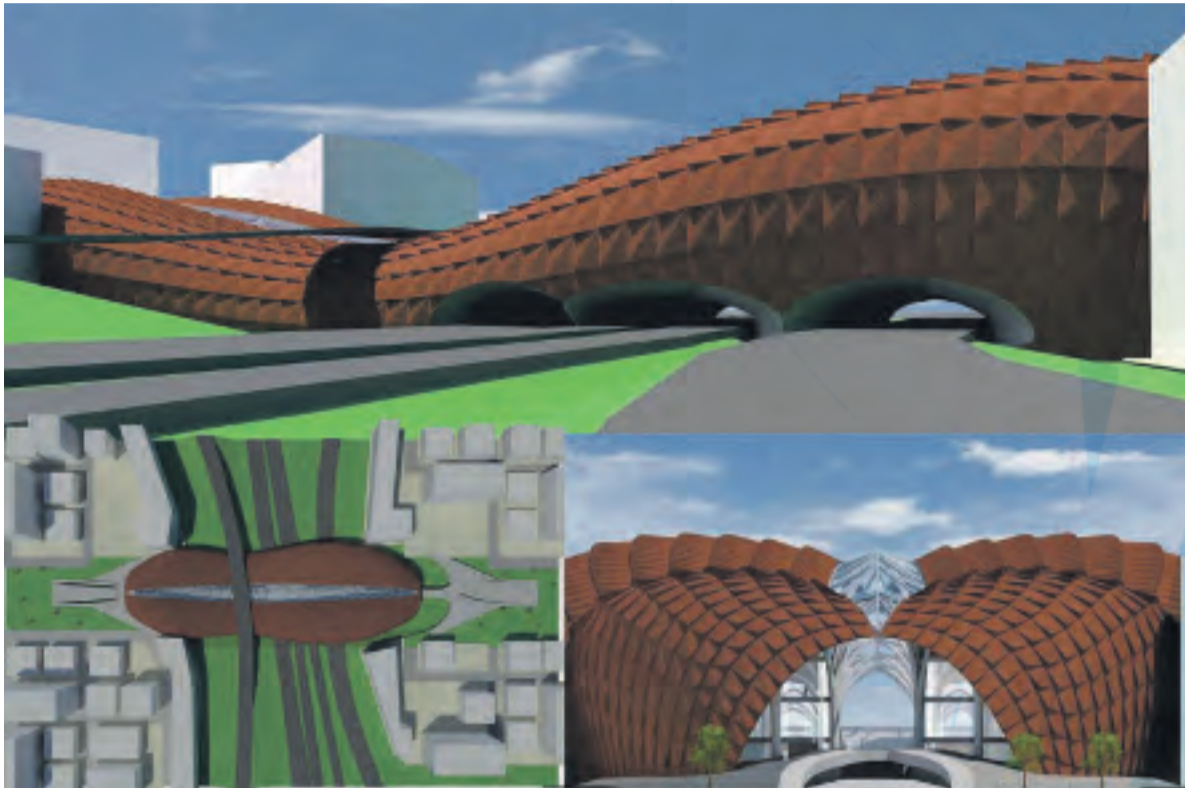
This is one of the bridge buildings that over build the A4 highway and connects Rijswijk/Voorburg with Ypenburg. The project is called Armadillo because well, it looks like a giant armadillo. The building contains retail and leisure functions that make it more than a structure to cross a road, it a destination for locals and a fuel stop for highway travellers. Its appearance makes it a landscape icon hard to miss when driving from Paris to Amsterdam. The structural design solves an exemplary problem of building design it harmonizes different design grids on different levels. The positions of roads dictate the column

positions and its resulting spans on the ground level. On the higher levels the column positions serve functional tasks and are based on architectural considerations of the spaces.

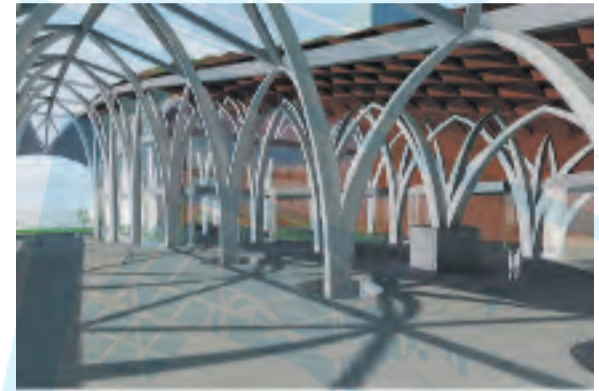
The engineering part of this project consists of an extensive study how to coordinate different construction grids. The solution was found in tree like columns with trunks of different dimensions sections with four branches under variable angles, with different lengths. A Grasshopper script was written to automate and optimize element dimensions and branch angles.

The results turned out to be more regular than anticipated and desired from the viewpoint of architectural quality. A slightly more flamboyant structure then was decided upon, however with similar coordination problems, for which the script could have been adjusted and applied. The arc like load bearing structure dominates the interior of the building where as the folded cor-ten steel façade elements follow the curved shape of the building and give it its armadillo shrub-like skin.

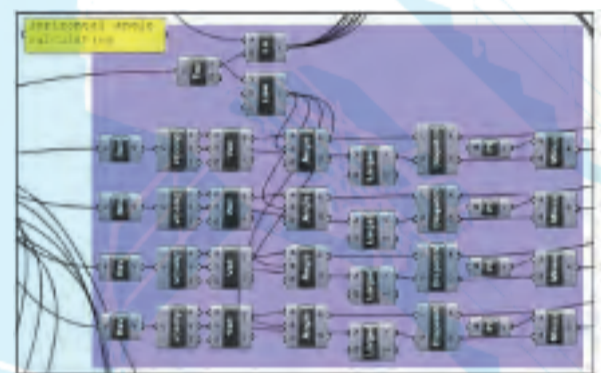
Tutors: Ype Cuperus, Joop Paul.



exterior



exterior



From report: Figure 40:
Horizontal angle calculation (4), detail of Grasshopper scripting

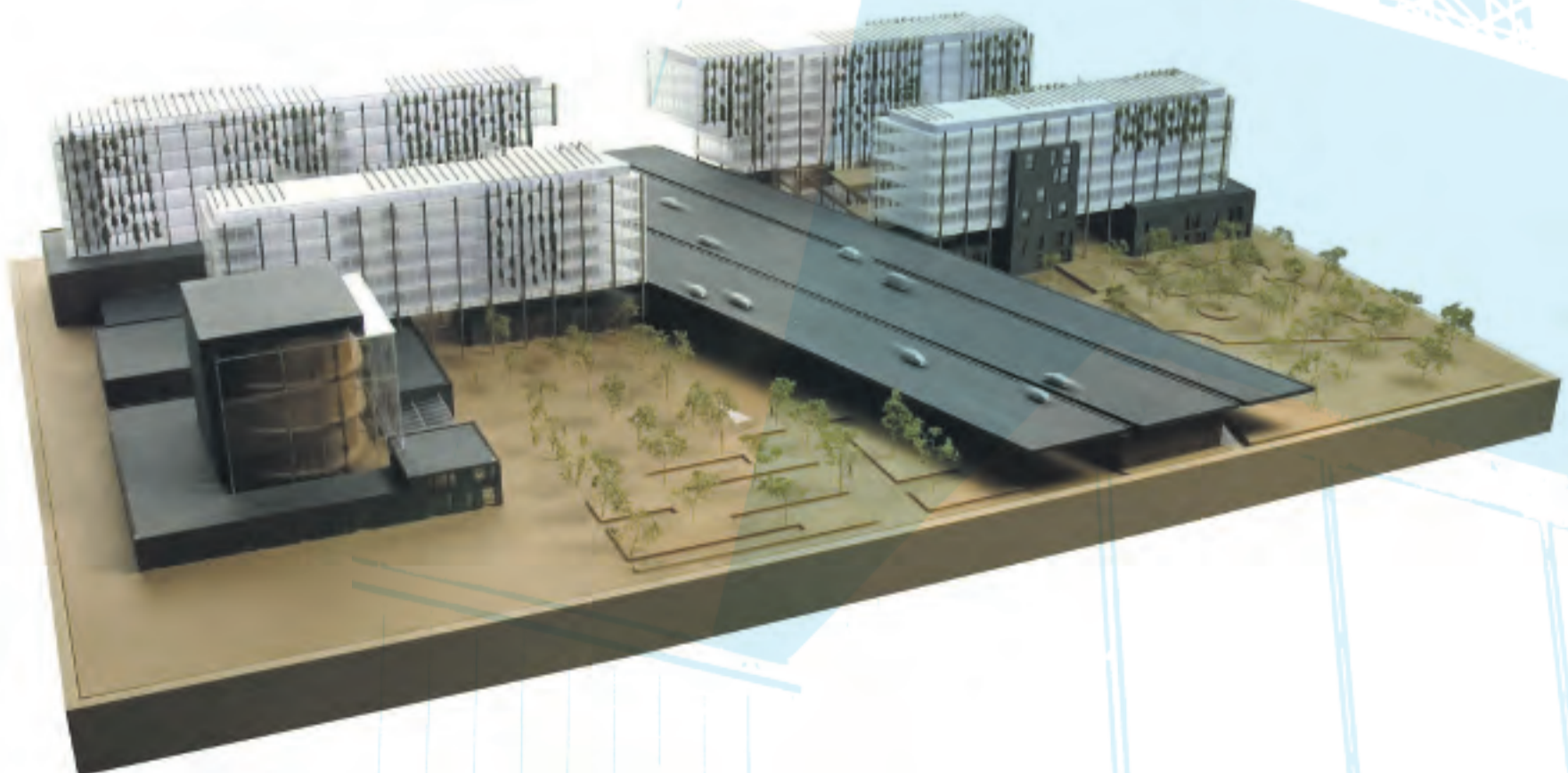
NARD BUIJS: INTERNATIONAL COURT OF JUSTICE

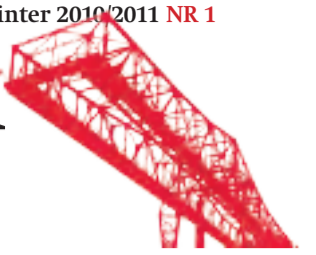
This building borders and under-passes the Utrechtse Baan, the eastern approach of The Hague. The initial idea was to create a space to be appreciated on the road level by car users. It started with the 'highway foyer' as a metaphor for arriving in The Hague. The Court of Justice demands a complex layout. It combines the separated world of the legislation, the accused, the public and the administrative staff for whom the building is its daily environment. At the same time these employees provide the user base of the urban environment. The location

seems to have contradictory specifications. Noise and fine-dust restrictions result in building free zones along highways. At the same time these are A-locations, very visible and easy to get to. The complex is built on both sides of the highway and connected by a landscaped area under the roads. Moving water and fountains compensate the traffic noise and catches some of the fine dust. The shapes and positions of the building blocks are the result of an extensive wind flow analysis in combination with the physics of fine dust.

The office wings were designed on flexible use and a noise and pollution free working environment. This has resulted in a layered façade with vertical super blinds of metal mesh covered with green that has the capacity to capture fine dust. The project is an exercise in modern planning with the international court of justice on the crossroads of Europe.

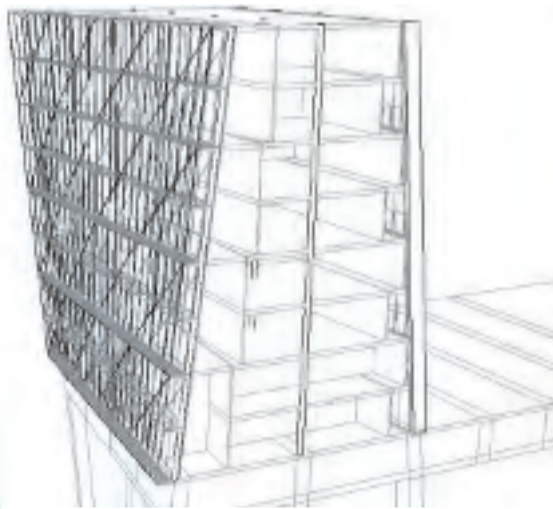
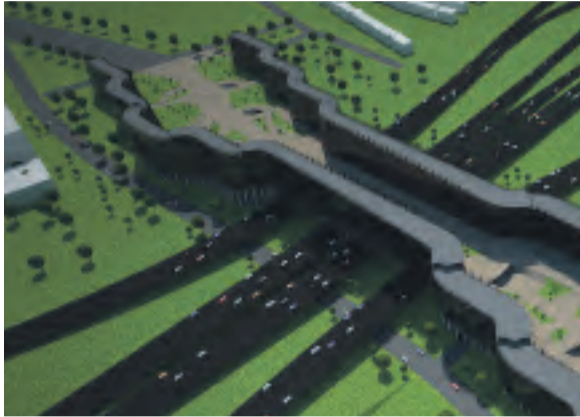
Tutors: Ype Cuperus, Eric van der Ham.





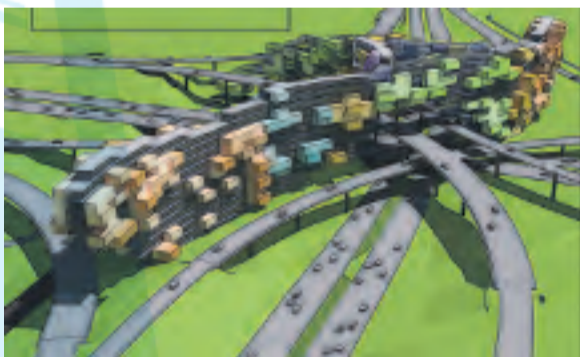
HARM SOLLIE: HEADLIGHT HOUSING

This project connects Ypenburg to Rijswijk and Voorburg. It bridges the A4 highway with a double string of residential blocks that protects and guides the way from one side to the other. The retail functions make it a destination for the dwellers on and on both sides of the bridge building. The units seem to exist despite the super structure of the building and serious round columns give an individual character to every dwelling. The double façade keeps the bad stuff out and looks double curved at first glance. At second inspections it is composed of flat surfaces ingeniously arranged with mullions tilted at different angles. Tutors: Ype Cuperus and Engbert van der Zaag.



HERMEN JANSEN: ARCHITECTURE OF CHANGE

This is a design of a residential complex west of the Prins Clausplein, bordering the Vliet canal. It is an exercise in computational design. 'Cellular automata is a computational method which can simulate the process of growth by describing a complex system by simple certain rules. The interest in architecture is the ability of cellular automata to generate patterns from organized patterns, which might be able to suggest architectural forms'. Conditions for spatial relationships and daylight access were described in design rules. The configuration of units was then optimized. Methods like these contribute to the debate of the role of the future architect. Tutors: Karel Vollers, Patrick Teuffel.



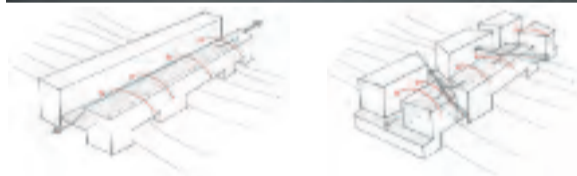
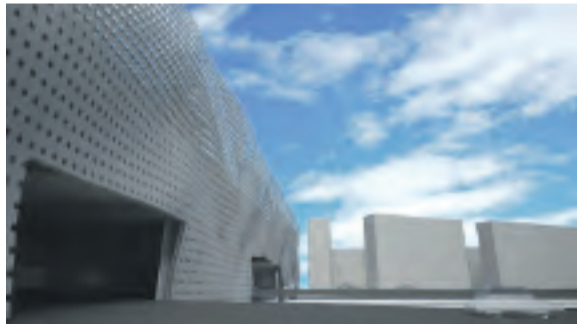
SALMAN KAHLILI: GENERATING HIGH DENSITY RESIDENTIAL HOUSING APARTMENTS

This is a design of a residential complex west of the Prins Clausplein, bordering the Vliet canal. It is an exercise in computational design. 'Cellular automata is a computational method which can simulate the process of growth by describing a complex system by simple certain rules. The interest in architecture is the ability of cellular automata to generate patterns from organized patterns, which might be able to suggest architectural forms'. Conditions for spatial relationships and daylight access were described in design rules. The configuration of units was then optimized. Methods like these contribute to the debate of the role of the future architect. Tutors: Ype Cuperus and Rudi Stouffs.



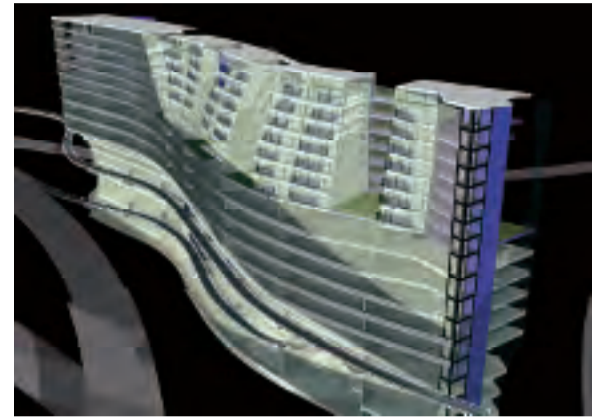
SUSANNE ROLAFF: THE LIVING BRIDGE

The wastelands around the Prins Clausplein contain unexplored qualities. This project investigates the physical challenges of wind, air and noise pollution. The results are applied in structure that over-passes the A4 creating space for retail and leisure. It is not just a bridge to cross it is a place to visit. Extensive computer simulations of different kinds of pollution as well as wind studies have resulted in guidelines for the building shape and surface and layering of the envelope of the building. Then the double curved skin was designed and detailed. This project has resulted in a method that is suitable for other buildings in similarly challenging locations. Tutors: Ype Cuperus and Eric van der Ham.



SAGAR THORA: INFRASTRUCTURE AS ART – TRANS URBANIZATION, HIGH TECH CONCRETE FOR COMPLEX BUILDING STRUCTURES

'How can modern public transit systems provide new solutions for designing functional spaces within the urban freeways, turning Infrastructure into a workable Public space? How can we transcend disruption to the landscape to reconcile infrastructure with the city? These research questions were addressed with a thesis design at the Prins Clausplein interchange. It resulted in a concrete structure of high complexity for which high performance concrete needed to be used. This was studied and calculated using computer simulations. Tutors: Karel Vollers, Kees van Weeren.



SILVANA PANIAGUA TUFINIO: ARCHITECTURAL ENGINEERING IMPROVEMENTS IN THE DESIGN PROJECTS

Silvana quotes Emmit: 'Architects, with their systematic and creative problem solving skills, are well equipped to become effective managers, but paradoxically are notorious for their lack of management ability'. This notion resulted in asking the question: 'How can the Architectural Engineering Design Process help to manage the project by minimizing uncertainties? A distinction was made between ADP, Architectonic Design Process) and AEDP, Architectural Engineering Design Process. The difference is the application of a DSS, Design Support System. Economic, management and technical considerations were part of the variables that were used to develop and test this method. It was applied on high-rise office building design in the vicinity of the Prins Clausplein. Tutors: Axel Kilian, Rudi Stouffs, Herman Mooi



NATHAN VAN ESBROECK: SILOCENTRE

Reuse, adaption and refurbishment of existing industrial buildings are important issues of our current and future design tasks. This project includes a design of the residential reuse of concrete silos as part of a redundant brewery site in Leuven, Belgium. By carving out and designing additions to the existing structure accommodation for a hotel with apartments was created. Daylight conditions, windows and the structural integrity of the existing concrete were found on the critical path of the design and gave direction to the final design. Tutors: Axel Kilian, Engbert van der Zaag.

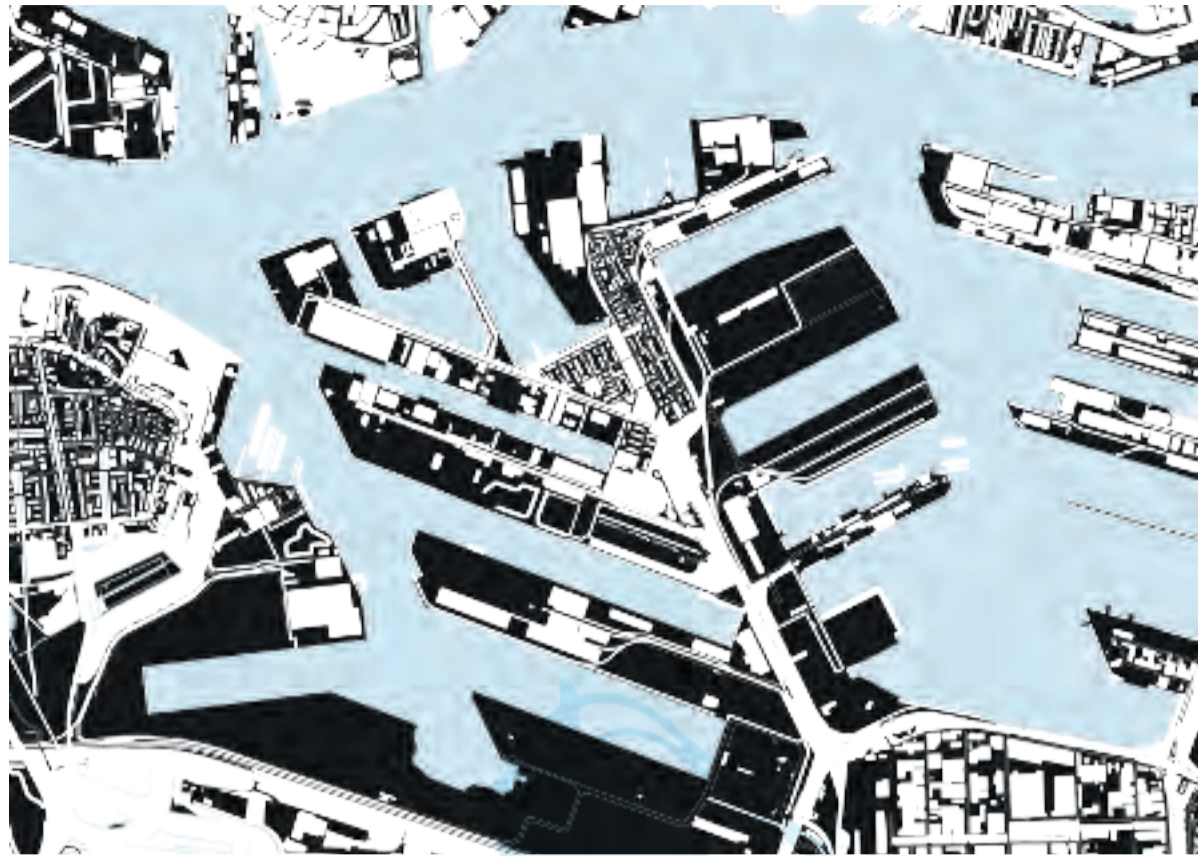


RDM

Rotterdam is the largest or at least one of the largest ports of the world. Docklands and shipyards are industrial areas by default we turn our backs to. They can be found at the edges of the cities we live in, far away in our appreciation, physically many times very close. As ship-handling moves seawards to accommodate larger ships the old shipyards have become redundant. The Rotterdam Kop van Zuid development and the Amsterdam Westerdokskade are precedents of wastelands turned into high-density housing, combined with cultural functions. However, is erasing what exists and replacing it with something new the only option? Or can the hidden beauty of the industrial landscape be captured as a start for something never done before? This is the challenge of the RDM site, which is a large redundant dry dock with adjacent halls for shipbuilding. In addition it includes the young industrial archaeology of post WWII industrial building in combination with post war housing for the labourers at the Heyplaat suburb nearby.

Some years ago the RDM-CAMPUS was developed on this site, the intention was to make it a place for RESEARCH, DESIGN AND MANUFACTURING. The RDM Innovation Dock wants to be a demonstrator of sustainable energy, water management, development of new housing concepts, etc. A place where schools and industry meet.

On this site the ten students of the AE-LAB02 realised their master-graduation projects. In their design for the area they introduced a "light rail" not only to link their projects but also to give the RDM-CAMPUS a better connection with Rotterdam Centre.



MARCO KOOPS SCIENCE CENTRE

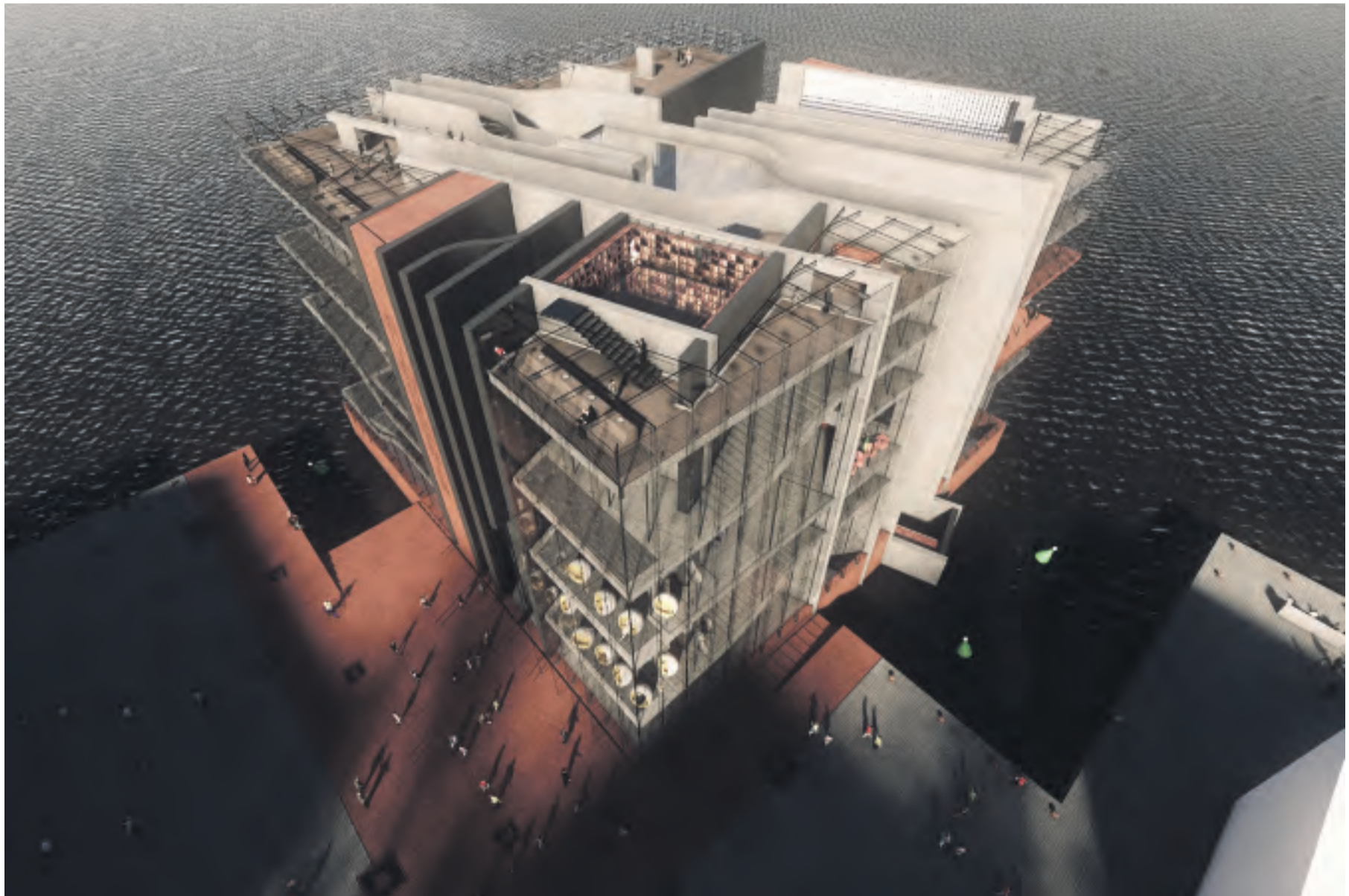
Where we normally try to keep the (heat of the) SUN, the WIND and the WATER out of our buildings Marco allowed these elements to fully penetrate his Science Centre; not only to allow the users to experience them, but also to let them play an active (and visual) roll in the energy system of the building and thereby making them part of the exhibition.

The structure of the building consists of an arrangement of vertical and horizontal "concrete slabs" that organize and define the spaces and serve as load bearing constructions. Beside that they also have specific functions. The Solar slabs are covered with sun cells; they provide energy by mosses that grow on the surface of the slab and act as natural CO2 filters. In the PCM slabs elements of Phase-Changing-Material are integrated that store and release the heat.

The water of the river Maas is cooling down the interior and acts as storage.

The building is surrounded by a multiple glass layered façade zone that reacts on summer- and winter conditions; beside that it enables the wind to reach interior spaces to provide ventilation. Using different techniques and computer programs, such as Comflow cdf-analysis (computational fluid dynamics), Ecotect and Fluent the engineering and the shaping of the architecture were balanced and the experience of the changing daylight, the dynamics of the wind and the movement of the water is fully integrated in the representation of the building.

Tutors: Jan Engels, Arjan van Timmeren



WOUTER BAK: TRANSFERIUM RDM

Inspired by the Cradle-to-Cradle philosophy, the Trias-Energetica and the fact that there is a lot to gain when we consider the energy-use, both in the production of materials, the fabrication of products and the assembling of buildings and in the "behaviour" of the building itself Wouter took in this project a low tech approach towards a high tech Transferium.

The aim was a energy-neutral building whereby the low energy demand of the well insulated hotel- and office block was applied to by the glasshouses that connect them.

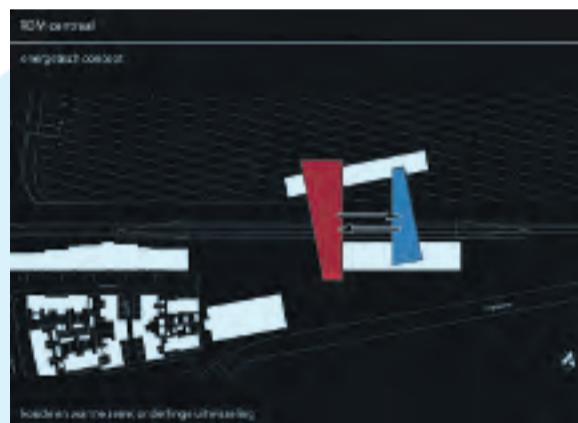
The material used for the two blocks Lenotec was chosen not only because this material is by its massive wooden structure a very good insulation but also because a small(er) scale building can be built with no extra constructive elements. All window frames are covered with shutters to completely close the volumes, both for technical, energy- and esthetical reasons.

By using the "chain method" of Antoni Gaudi the shape of the arches of the glasshouses was defined and later on manipulated. The construction of the arches was made out of Bamboo, again a material with a high ranking of sustainability.

In the Msc5 period the knowledge of this material was deepened and a technical research was set up to the possibilities of influencing the shape of the arches and the connections of the bamboo elements. Several ways of lengthening the bamboo and reinforce the connections were invented and tested.

Tutors: Jan Engels, Arjan van Timmeren

MSc4 lab 02/04



AMAR SJAUW EN WA: ECOGREEN SPORTS AND RECREATION CENTRE

The fascination of this project lies in the visualisation of (all) existing energy systems and possibilities in the architecture of the building, making it a special experience for the users and a contribution to the awareness of the energy related questions of our time.

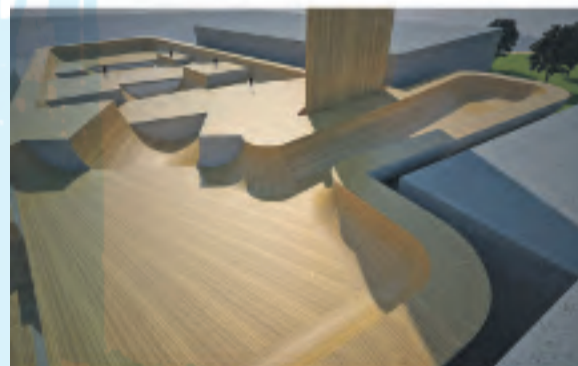
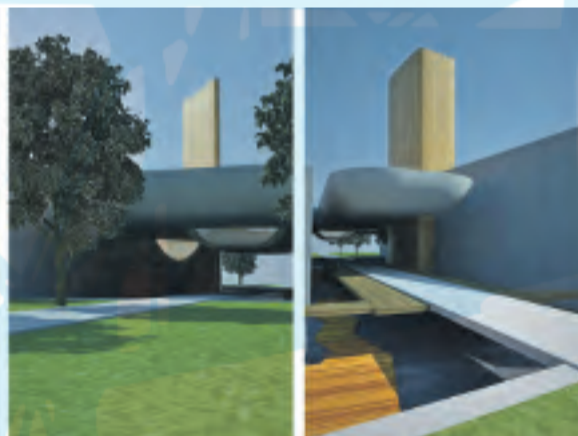
After a thorough study and inventory of all the systems that are to be used in a building program like this; water purification and control, daylight control and ventilation requirements a composition was made of volumes, interior and in-between spaces and exterior areas that could fulfil these tasks.

There is a climbing tower that acts as a chimney and generates ventilation.

The skatepark-roof collects the rainwater and creates a controlled entry to the interior of the building, where the water is mixed with the pools of helophytes.

The green covered, well insulated Sport facilities are surrounding the central meeting space where all these elements and energy flows come together to and everybody benefits of this atmosphere. Daylight is falling in from all directions creating an open and lively heart of the Centre. All roof and façade surfaces are used to harvest energy and apply it in the energy system of the building

Tutors: Jan Engels, Arjan van Timmeren

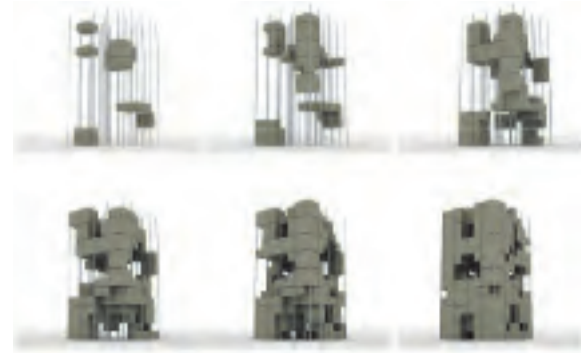
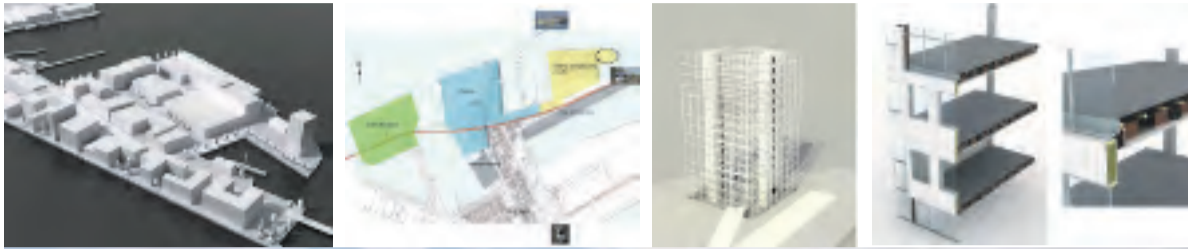


ARNOUD HERDER: TRANSFORMABLE OFFICE TOWER

In this project a specific approach of sustainability issues and the consequences of "the recession" was explored by focusing on a clearly defined, lean structure and an efficient layout in combination with a materialization that allowed the users to transform space, skin, interior and services over time.

This type of flexibility in the size of the rented space can be a selling point for starters and a new possibility for the developers. The technical implications for both the structure and the other building components has been researched to realize this new TRANSFORMABLE SYSTEM and make it a real "breeding" space.

Tutors: Jan Engels, Wim Kamerling

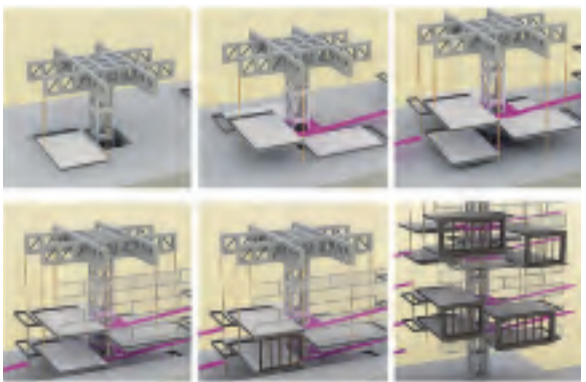
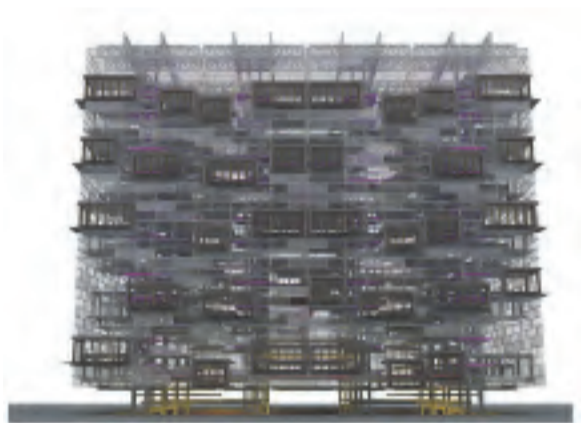
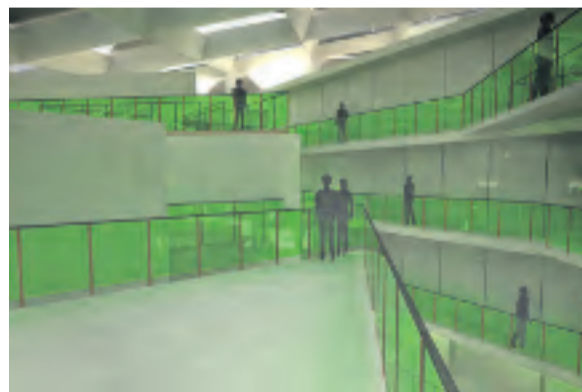
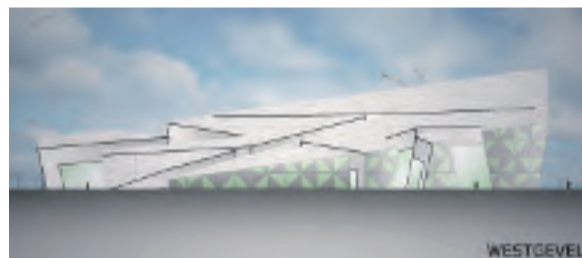


CHRISTIAN VAN GRUIJTHUIJSEN: "THE UNTURNED STONE" HOTEL AND LEISURE CENTRE

Starting from the metaphor of a broken stone on the edge of the river this project developed in the exploration of a constructional, material and spatial composition based on triangles (TANGRAM). Through the cracks in the "stone" daylight enters the building and creates a dazzling experience.

A space frame structure for both the facades and the roof defines the architectural unity. Filled with triangled window frames the daylight can also enter the interior spaces where the triangle bedrooms are the apotheosis. An other specific engineering focus was on the use of river for cooling, the use of rainwater as greywater in the building facilities and on the ventilation system.

Tutors: Jan Engels, Frank Schnater

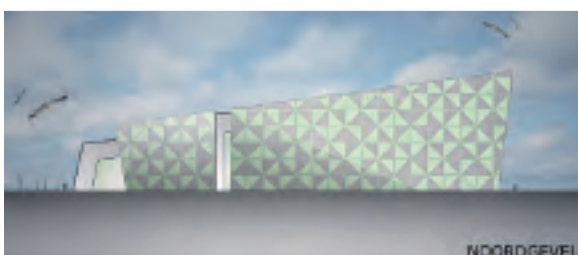


DAVE KOOMEN: INNOVATIVE OFFICE CENTRE

The realization of a deep office building (50 x 50 meter) where daylight could still fully enter and the psychological distance to the façade was acceptable was the challenge in this project.

The consequences for both the building structure as for the layout of the office spaces were explored. The search for flexible office spaces and a recognizable routing lead to an open structure. The chosen building method was worked out in relation with this; the revival of the Jack-Block system offered the solution. The image of the building shows the desired openness.

Tutors: Jan Engels, Frank Schnater



MSc4 lab^{02/04}



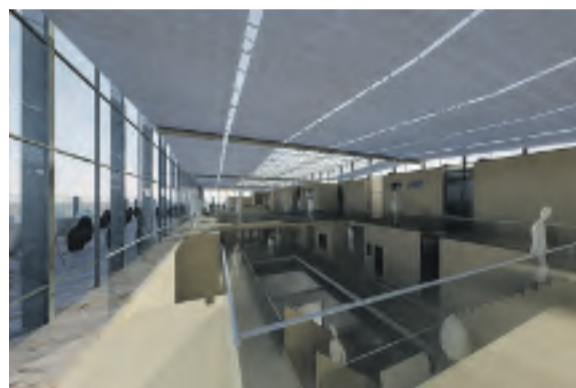
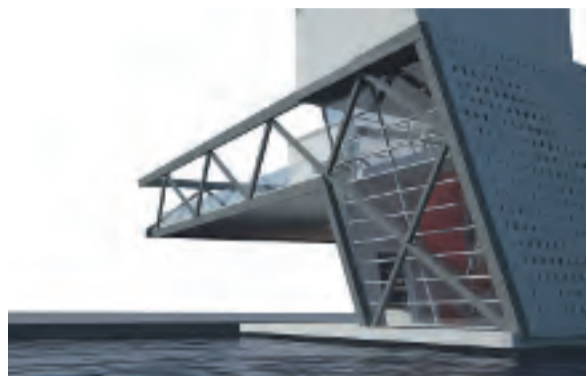
BART VAN DER BROEK; FLOATING SWIMMING POOL IN THE RIVER MAAS

The combination of the heavy volume of a swimming pool as a floating entity and a lightweight building on top of it was the starting point for this project. A lot of calculation, research and sketching was done to realize a building that was stable and elegant at the same time (and didn't look like a ship)

Different possibilities for the floating foundation were explored after which the composition of the building parts was developed and the stability of the whole structure was worked out. (Rhinceros)

In choosing carbon fiber/composite for the materialization of the upper part the architectural image was defined and had to be "invented", both in dimensions, technical possibilities and detailing.

Tutors: Jan Engels, Wim Kamerling



MARK MIN: MUSEUM ROTTERDAM HARBOR

In this proposal for a Harbor Museum the central focus was on the experience of the route through the building as a phototropic experience of the spatial qualities and the manipulation of the views on the harbor area as a part of the exhibition.

By placing the main route all along the outside of the building the collection and the images of the harbor itself are mixed; this is also where the specific materialization of the building finds its expression; the corten steel of the façade and the red color of the "inner facades" are placed in the tradition of the RDM dock.

By model studies and calculations the typology of the light was determined and implemented in the design, both to light the collection and to set out the route through the building.

Tutors: Jan Engels, Frank Schnater, Truus de Bruijn



LEON VAN OOIJEN; SMARTFORMATION

The problem of unoccupied office buildings and their energy consumption and the fact that all buildings should ultimately be "labeled" (have an energy label) was the starting point for the revitalization of an existing office block built by architect Groosman in the 70th.

Appreciation of the existing architecture, the construction and the technical possibilities, all aspects to be researched, energy goals to be reached, etc. are placed into decision schemes to balance the design decisions and to calculate the findings both in quality as in quantity.

Costs related to these adjustments are calculated to enable a balanced decision. In a complete design (architecture and engineering) the theory is tried out and proven.

Tutors: Jan Engels, Arjan van Timmeren



ARJAN KLEM: MODULAR HOUSING

By using the IFD-checklist (Industriële, Flexibele, Demonteerbare) as a starting point together with a research of all existing modular systems and their material properties a design has been made for a new system for Modular Housing. The result being a lightweight system with good acoustic and fire performance; suitable for high-rise solutions and with a materialization that combines a good comfort with a nice image and that still makes a good score on the IFD-list. Calculations of load bearing requirements, stability (during transport and after realization) were part of the project.

Tutors: Jan Engels, Wim Kamerling



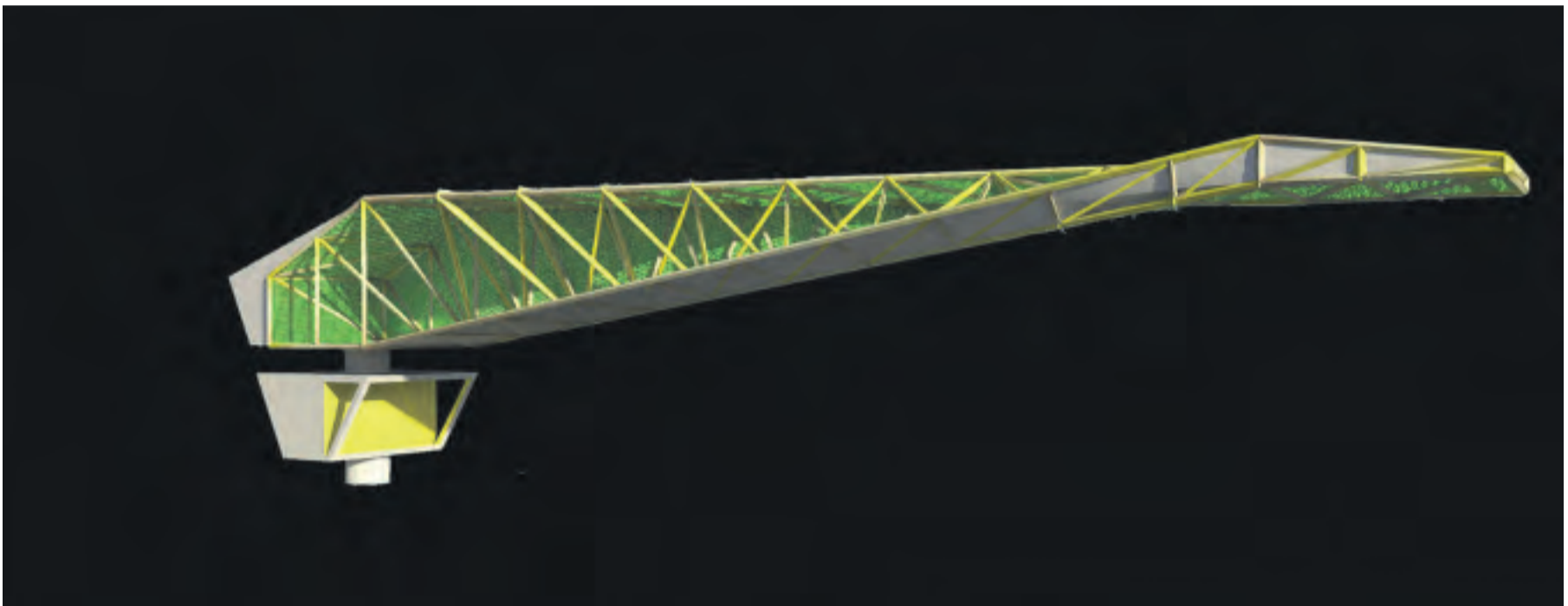
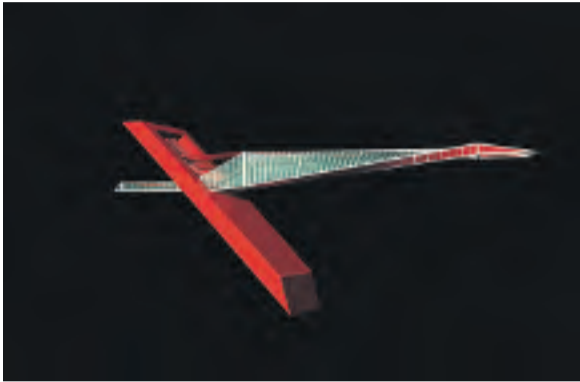


MARIA VAN EMBDEN ANDRES, DOCK SURPRISE !
Based on the images of the cranes, materials en structures of the harbor this pavillion provides a shelter and an outlook spot cantilevered above the water.

constructural solution and visualised in the architectural expression. Calculations were made to check out if the finding were realistic.

A great number of possibilities were explored; the forces involved in this "balance" were translated into the

Tutors: Jan Engels, Frank Schnater



JASPER HENDRIKS "WHOOSH" IS A DESIGN FOR A PAVILION INSPIRED BY THE TECHNOLOGY OF KITES.

It consists of a volume on the top of an existing building on RDM-CAMPUS shaped to accelerate the speed of the wind. Internal spaces (working boxes) can be lifted from

this volume by this wind speed and by a number of kites, designed to produce enough lift and drag to take off.

Tutors: Jan Engels, Arjan van Timmeren

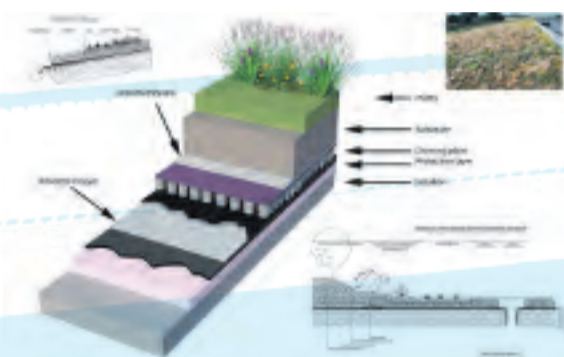
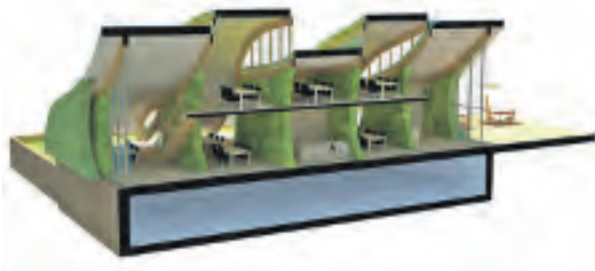


MSC3 DESIGN RESEARCH STUDIO

AMAR SJAUW EN WA GREEN SKINS

A thorough research into the possibilities of the green skin and the types en specimen of vegetation suitable for horizontal and vertical surfaces. Special interest was given to a natural watering of the vegetation and the translation of the finding into the architecture of the building.

Tutors: Jan Engels, Arjan van Timmeren, Ann Karina Lassen

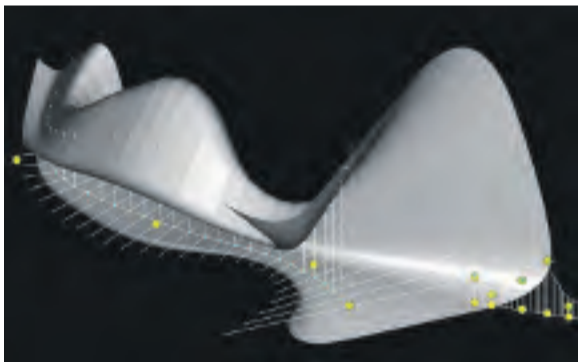


ARNOUD HERDER PARAMETRIC DESIGN

A research into reducing the complexity and costs of free form constructions.

Investigation of geometrical and constructional aspects of double curved surfaces approximated with single curved strips resulting in the design of a pavilion for a stop for the river taxi of Rotterdam harbor.

Tutors: Jan Engels, Frank Schnater



ARJAN KLEM PIEZO ELECTRICITY

Piezo Electricity is a physical phenomenon that occurs in different materials and that generates electric energy. The properties of different materials and their piezo electric potential, as well as the ways to harvest the energy were the leading issues for the architectural design, which resulted in floating pavilions connected to the bottom of the river Maas and generating energy by the movement of the water.

Tutors: Jan Engels, Patrick Teuffel



CHRISTIAN VAN GRUIJTHUIJSEN LIGHTWEIGHT MODULAR DWELLINGS

The project concerned the design for lightweight modular dwellings based on the principle of the "plastic folding crate", materialized in a light fiber/composite/epoxy mixture/material and dimensioned to fit on a standard truck. Detailing of all building components with special attention for the "hinge".

To be transported to and used in disaster areas.

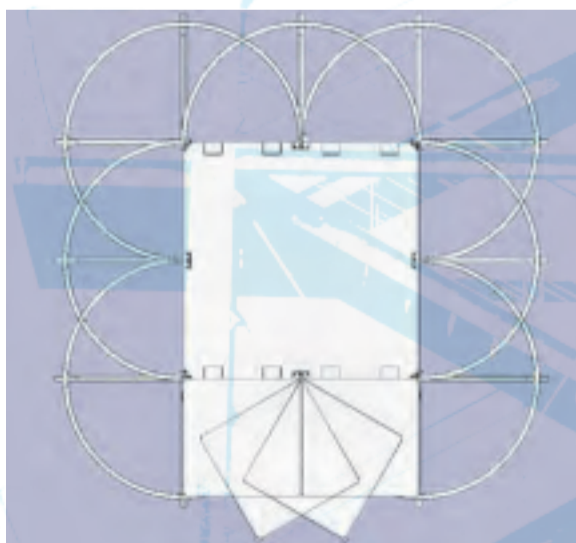
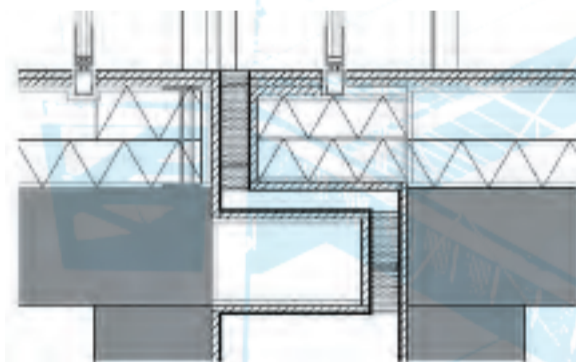
Tutors: Jan Engels, Jaap van Kemenade



DAVE KOOMEN FLOATING, ADDAPTIVE BUILDING

A design proposal for a floating pavilion, starting with the analysis and research of existing floating systems. Calculations of weight, balance and their interactions. Technical detailing of a fixed pavilion combined with moving building parts to alter the program and the image of the architecture.

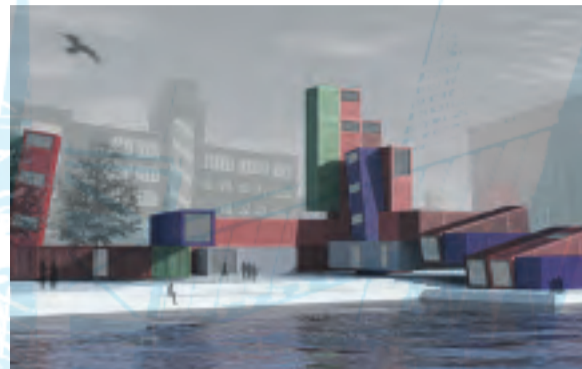
Tutors: Jan Engels, Wim Kamerling



MARK MIN CONTAINER VILLAGE

Design for a modular system based on the sizes of a "sea container". Proposals for the modification of the bare container to make it suitable for conditioned interior use. Much effort was put in the composition of a series of containers and their connections.

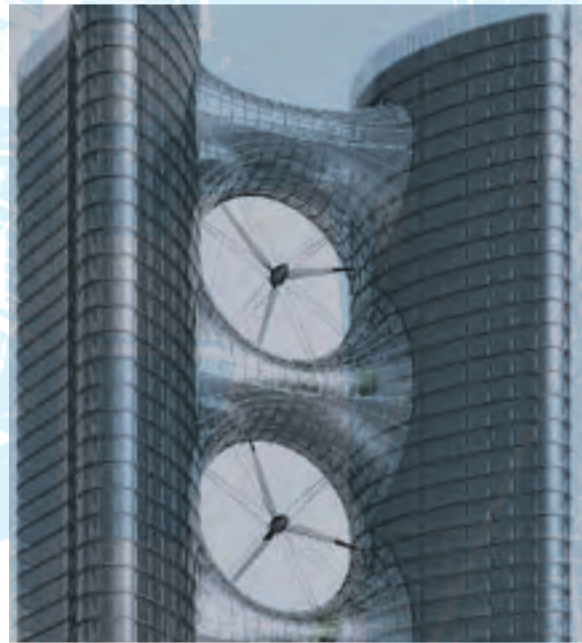
Tutors: Jan Engels, Jaap van Kemenade



STEVEN GOEMAN WIND TURBINE TECHNOLOGY

A thorough research into climate and wind conditions on the RDM site, existing types of turbines, the possible building geometry and energy related issues resulted in a pavilion following the typology of the harbor crane. In using the energy generated by the turbine the pavilion is fully self-supporting.

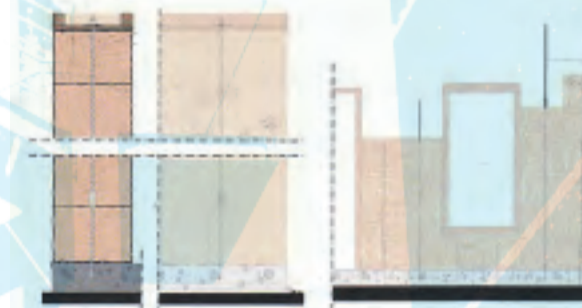
Tutors: Jan Engels, Patrick Teuffel



WOUTER BAK BUILDING WITH STRAW

Being intrigued by the philosophy of Cradle to Cradle and from his interest in biological materials Wouter designed a pavilion with straw bales. Advantages and disadvantages were investigated; the physical properties of the material (density, thermal and acoustical properties, fire resistance and mechanical behavior) determent the architectural image of the result of this research.

Tutors: Jan Engels, Arjan van Timmeren, Ann Karina Lassen



Eastward



Like Amsterdam, Haarlem has a history that goes back to mediaeval times. The area between these cities contains all elements of infrastructure one can imagine: highways, waterways, railways, airways, nondescript industrial areas and peaceful rural places with abundant green and recreational water. If Haarlem wants to expand it has to do so eastwardly. Twelve aE master students have collaborated in developing four master plans East of Haarlem, inspired by a specific theme. A transit oriented development, vased on the presumption that a satellite of Schiphol airport will be built in the North Sea, a plan that emphasizes the use of sustainable energy, an Urban Green scenario making connections between the green areas around Haarlem and a Water City plan, un-reclaiming land thus giving Haarlem a new waterfront. These master plans in turn provided the context for individual designs ranging from a large airport terminal like building to small scale industrialized housing. Dong-Eung Lee has finished his thesis design; another nine projects still are works in progress.

DONG-EUNG LEE, ENERGY CITY, R & D CENTER FOR THE RENEWABLE ENERGY IN ARCHITECTURE

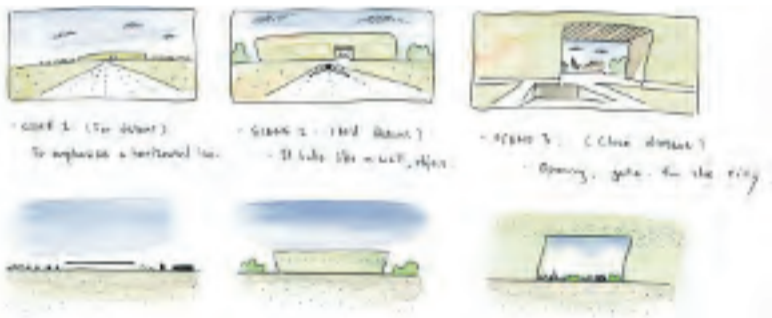
This project is a gate building east of Haarlem. Its boldness gives structure to the complexity of the site. The building contains an R & D center, with public exhibitions, a library and a laboratory with workshops to develop new energy saving and generating building components. The envelope of the building rood and facades are mounting racks on which newly developed devices can be attached and tested. This gives the façade a quilt like appearance

that changes over time. The façade shape and mounting facilities were derived from extensive studies on energy harvesting methods. Sun, wind, water and sound were identified as energy sources and their effectiveness was mapped.

The structural design of the building has resulted in a hybrid structure of concrete for the regular parts of the building and steel structures for the exemptions, such as the

bridge, the roof and the façade. The research and design process was supported by a continuous stream of small cartoon like watercolours and high precision models.

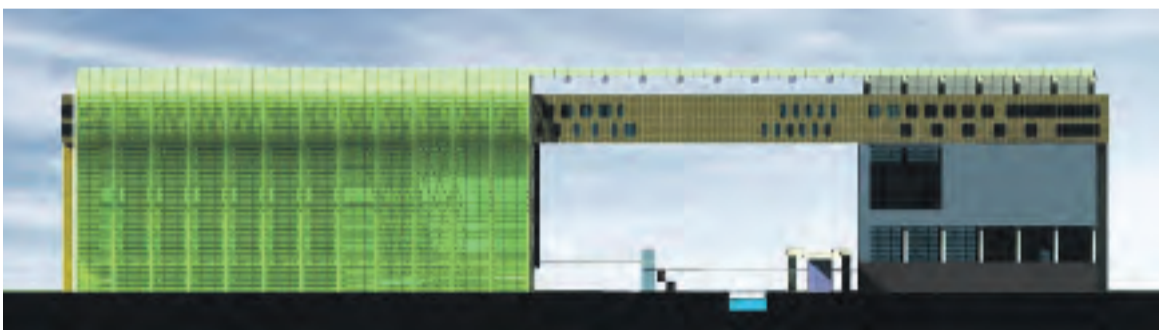
Tutors: Ype Cuperus and Martin Tenpierik.



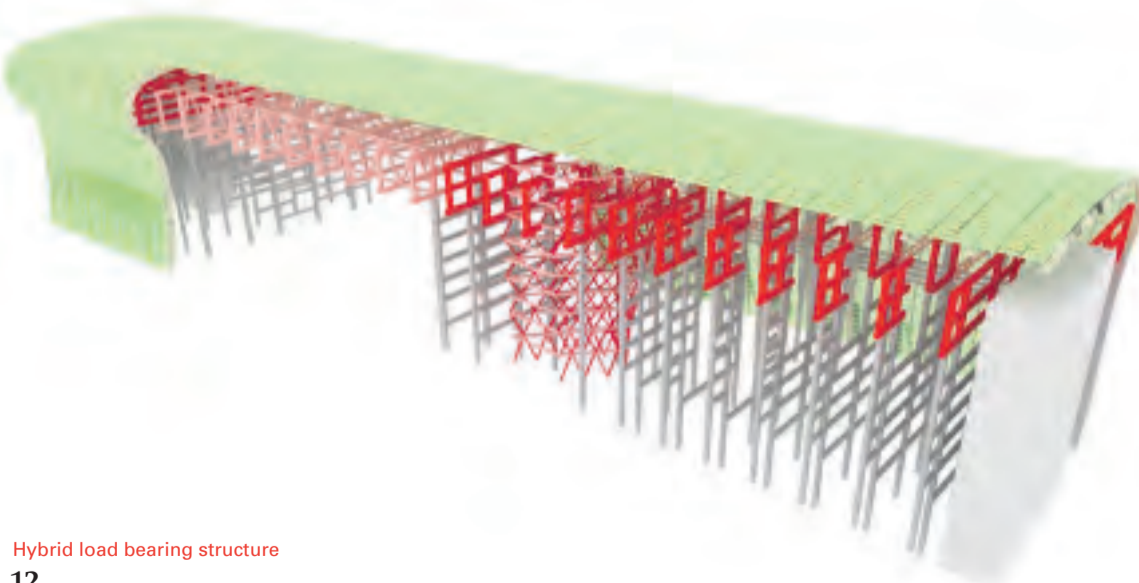
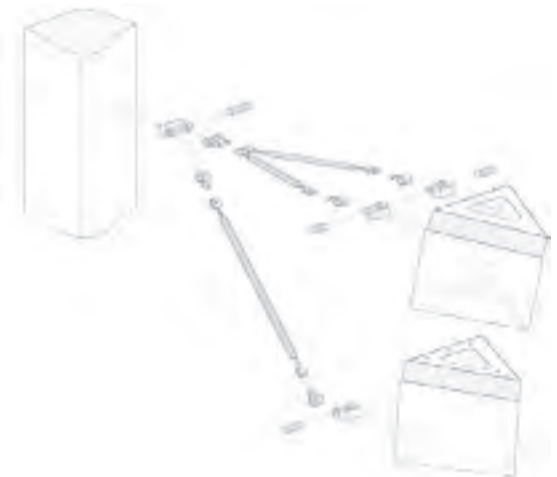
Gateway to Haarlem



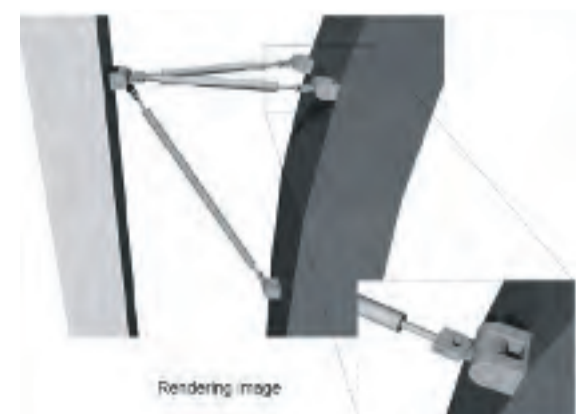
Every building represents a level of technology in each era. Each pattern in a quilt work represents a technology or material in the building at that time, era. New face of the building can express its own aesthetic beauty.



East elevation



Hybrid load bearing structure



Facade details

DAYANARA FRANKEN EN DANIEL VAN KERSBERGEN
T.O.D. TRANSIT ORIENTED DEVELOPMENT



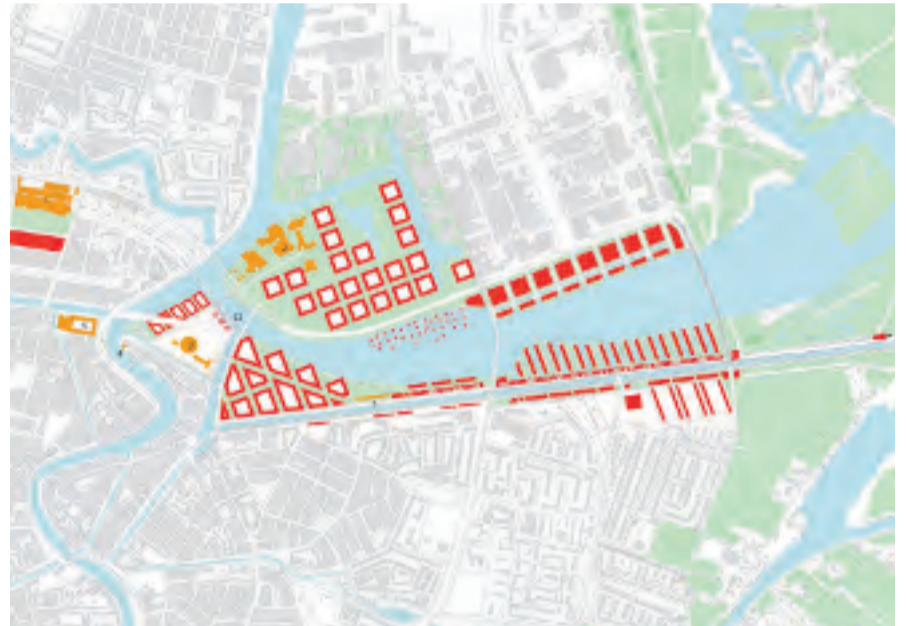
DONG EUNG LEE, REIN ROOSMA, AUKE VERBRAAKEN: SUSTAINABLE ENERGY



ANNE-MARIJE SCHEFFE, MARCEL VAN HEST, ANDJELKO HARKEM, TIM VELDHIJS: URBAN GREEN:



JERRY VOLKMAN, IEKE SELEN: WATERCITY:



IEKE SELEN: THE WATERCITY

The Watercity master plan has added waterfront to Haarlem. This thesis design has explored the capacity of the location and has used its potential to its full extent. Three building volumes for movie theatres have created an introvert semi-public urban space, covered by a high tech

transparent roof. The exterior facades consist of tall vertical blinds with a moiré type effect that refer to the continuous movement of the surrounding water.

Tutors: Ype Cuperus and Karel Vollers.



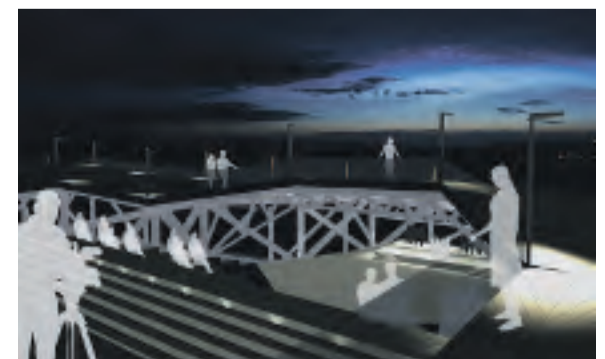
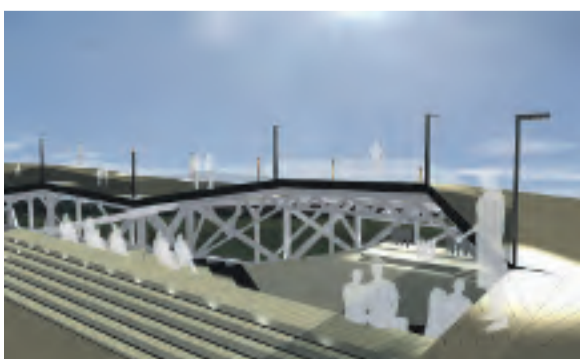
MARCEL VAN HEST: SPAARNWOUDE TRANSFERIUM

This thesis design represents a new breed of buildings connecting building and landscaping, thus skipping the design level of the urban space. The Urban Green master plan resulted in a complex intersection of water-ways and land routes. This building, or should we say struc

ture? consists of a set of bridge like spans to support a curved and twisted artificial deck as a ripple of the green landscape. It cover functions housed in kiosk like follies and offers accommodation for not yet known functionalities, change and an unknown future. The roofscape

offers a podium to enjoy the variety of the skies over Holland in its revolving seasons.

Tutors: Ype Cuperus and Florian Heinzlmann.

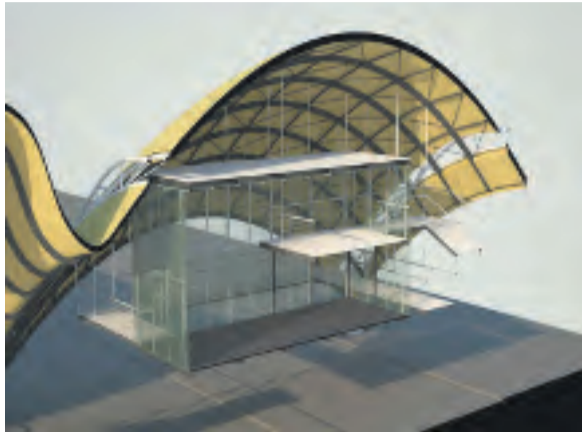


MARCO VISSER:

LIGHTWEIGHT SHELL STRUCTURES

A pavilion was too small for this study. Its subject was the exploration of light weight shell structures that by its own nature better fit a larger type of building. A shell with a square footprint, supported at its corners was morphed to gain extra cover, by reducing the thickness. The roof includes suspension points for free hanging pavilions.

Tutors: Ype Cuperus, Wim Kamerling.

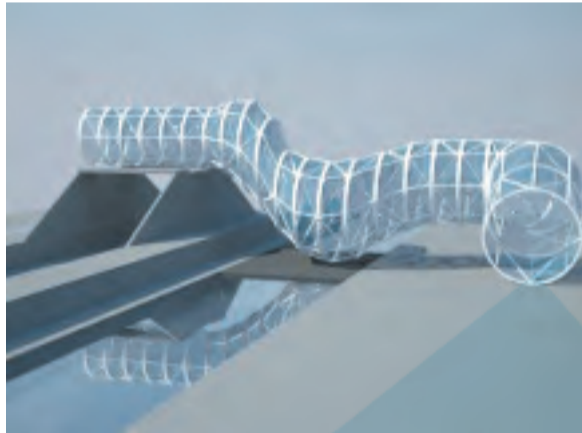


ANDJELKO HARKEMA:

HARVESTING KINETIC ENERGY

Electrical principles to harvest energy were investigated: piezo electric floors and fabrics as well as mechanical ones: shock absorbers that generate compression, thus heat or rotation to drive a generator. Wind turbines driven by the moving air of passing trains and tidal wave power generators to tap energy from the adjacent water surface. All principles found were combined in a bridge building like pavilion.

Tutors: Ype Cuperus, Arjan van Timmeren.

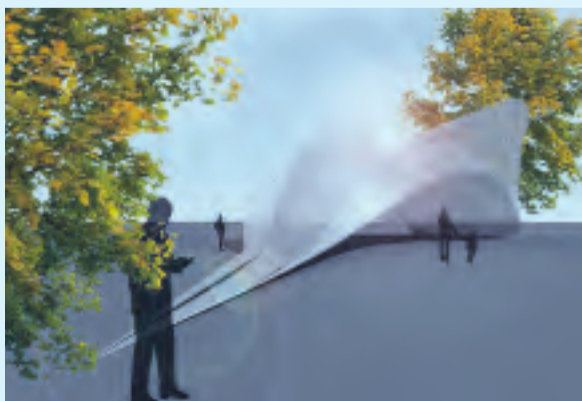


DAYANARA FRANKEN:

LIGHTWEIGHT STRUCTURES IN COMBINATION WITH SMART FABRICS

'The report contains the research from the starting point windsurfing to the final choice of smart fabrics. The fascination was that an architectural expression can be found that doesn't consist out of wood, concrete or steel. It will give the possibility to design a light but strong structure. The last part of the report contains conclusion and the integration of the research into the design.'

Tutors: Ype Cuperus, Florian Heinzlmann, Patrick Teuffel.



DANIEL VAN KERSBERGEN:

KINEMATIC STRUCTURE SYSTEMS

This project has investigated kinematic structures, from tensegrity via foldable plate structures to scissor and pantograph systems as a way to build a pavilion. The principles of the Hoverman dome were studied, adjusted and tested in physical models.

Tutors: Ype Cuperus, Florian Heinzlmann.



AUKE VERBRAAKEN:

A SOUND WAY OF GENERATING ENERGY

Noise is a nuisance, however by the same token it also represents energy. How can noise be tapped as a source for energy? This study contains data on sound production on Netherlands highways it has identified the principles to transfer sound into electrical current, for example the microphone. The piezo electric sensor was chosen as a means to use sound as an energy source for the illumination of buildings.

Tutors: Ype Cuperus, Tillmann Klein

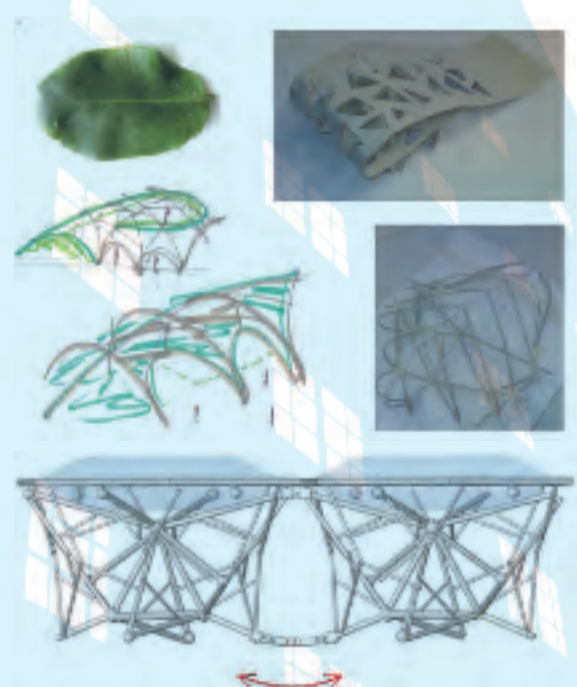


TIM VELDHIJS:

BIOMIMICRY

This project is inspired by nature. How can we learn from leaf structures? The biology, of the leaves was studied in detail. The outcomes were translated in models using Knexx and then transferred into a roof design for a pavilion.

Tutors: Ype Cuperus, Arjan van Timmeren



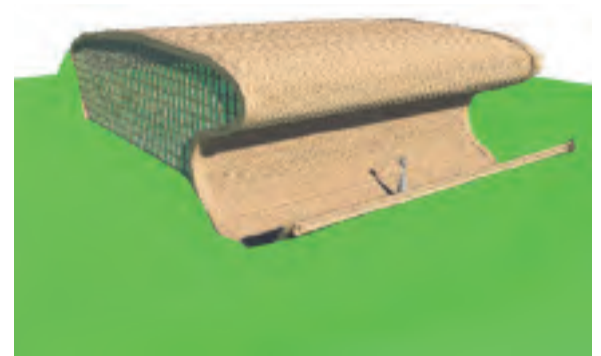
lab^{03/05}

ANNE-MARIJE SCHEFFE:

BUILDING WITH REGENERATIVE MATERIALS

This study advocates the use of regenerative building materials, harvested close to the building site, thus saving on non-renewable resources and traffic. Potential types of wood were compared in a table presented database and different types of timber joints were compared on the aspect of non-destructible inter-changeability. The outcomes were applied in a pavilion design.

Tutors: Ype Cuperus, Arjan van Timmeren



IEKE SELEN:

BASIC ARCHITECTURAL GEOMETRY

After collecting data on different types of geometry it was decided to choose elements made of regular shaped hexagons as top and bottom surface. These surfaces were rotated 10 degrees relative to each other. Complex corner joints were avoided by chamfering the corners, thus resulting in open centres that needed to be closed with an additional element.

Tutors: Ype Cuperus, Tillmann Klein

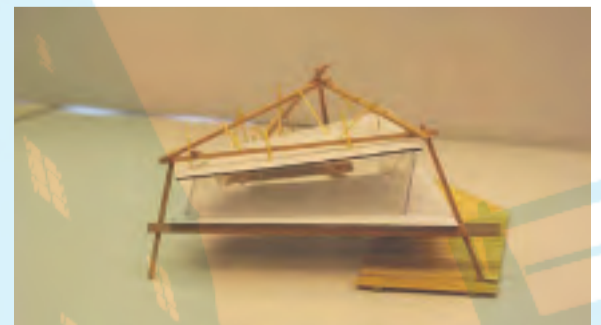


MARCEL VAN HEST:

STRUCTURAL DESIGN AND ARCHITECTURE

The aim of this project was to design a weather and user resistant structure as a resting point for joggers that merges well with its environment. To this extent basic log cabin type timber structures were studied and connections reduced to its basic principles on joining. From three interconnected tripods all the redundant elements were removed and a structure remained to suspend a roof and to carry a floor.

Tutors: Ype Cuperus, Kees van Weeren



European Solar Decathlon in 2012

03/05

Buildings account for one third of the total energy consumption worldwide and are equally responsible for their share of CO2 emissions. Further do the building industries produce 25-40% of all solid wastes worldwide and use approximately one half of all primary resources.

This fact and the incredible success of the TO with the Nuon Solar Team and their Nuna race car inspires the department of Building Technology to set up a similar team for developing an energy efficient Solar house in order to participate for the European solar Decathlon 2012.

Solar Decathlon 2011

TU Delft Building Technology with the chair of Architectural Engineering currently contributes as an advisor for the successful application and participation of the University of Tennessee for the next US Solar Decathlon in 2011.

Preparation for the European solar Decathlon 2012
For the next European solar Decathlon 2012 held in Madrid, the TU Delft Building Technology is currently preparing for an own application, which was due in September 2010. Student teams were set up with an interdisciplinary background and expertise working in an office like situation in order to design our project in various disciplines in their own right.

- Architectural Engineering: development of adaptive, flexible and modular quickly erectable housing units;
- Structural Engineering: development of resilient and seismic resisting structures ncl. Primary structure and building components;

-Sustainable Design: Life-cycle analysis by taking new building materials an energy consumption into account;

-Climate Design: Energy concepts and building envelopes;

-Design of construction: concepts and materialization of building envelopes and facades;

-Materials: smart use of various materials (and its combinations);

-Design Informatics: Modelling, simulation and assessment of buildings and evaluation of their performances;

-Product Development: research in building products, building components and building systems.

Students Wanted!

Does participation in the Delft submission of Solar Decathlon appeal to you? Please get in touch with Prof. Patrick Teuffel.

This is an abbreviated and adapted version of the European solar Decathlon in 2012 summer brochure.



NEXT aE lab06 STARTS SPRING 2011

LOCATION AMSTERDAM BUIKSLOTERHAM

Buiksloterham is part of Amsterdam North. This will be the location of aE lab 06. It is a wonderful industrial area connected with the west side of the harbour of Amsterdam. Buiksloterham will change in the coming years in a unique and sustainable mixed residential working place, with space for existing and new businesses and dwelling for adventurous people. It is yet another perfect location to apply Architectural Engineering.



more information about the aE graduationplans see <http://discover.tudelft.nl/en/page/search>

MASTERTRACK

BUILDING TECHNOLOGY

Building Technology

In today's society, there is a growing demand for smart buildings: sustainable, comfortable and environmentally intelligent buildings that can have free forms and that use innovative hybrid materials. Furthermore, the predominant and ever growing share of existing buildings is increasing the demand for techniques for preserving and transforming architectural heritage.

The strength of our Department of Building Technology rests in its combination of creativity, scientific inquiry, product development and integrated design with technical and scientific depth. Research, development and design are the three main anchors of our research and education programme.

The Bt mastertrack

The Building Technology mastertrack focuses on the innovative and sustainable design of elements, components and (sub) systems of building structures and looks at how these relate to each other and to the architecture of the building. The track stresses the importance of research into technologies required to build effectively functioning building systems, focused at the following themes:

- Computation & Performance
- Green Building Innovation
- Facade Design

The Msc 1 and Msc 2 program of Building Technology is shared with the specialisation Architectural Engineering within the Architecture Track.

MSc 1 Bucky Lab:

In the Bucky Lab and Bucky Lab Seminars the combination between architecture and building technology is brought to a higher level. The semester starts with the design of the architectural facade concept, which will be materialized and developed to the level of final design. The 'Design by tech-nological research' method integrates Computer Aided Design and Modelling (CAD & CAM) and technological research in the design process. The research is done by virtual and physical testing the design's materials and structural performance. The results are used as feedback to optimize the design.

The final test is the realization of a full scale prototype of a part of the facade. This means the design will be translated into working drawings, material quantities and a production strategy as a preparation for the actual building. The students will construct and assemble their prototype themselves.

MSc 2 BD+E:

The design assignment of Building Design + Engineering (BD+E) deals with the problems of multi-story buildings in which a variety of functions are included. They are wide-ranging in nature and pose different demands on the interior climate. The arrangement of functions also represents a challenge to the spatial and constructional composition of the buildings. The structure of the building and aspects relating to installations will be studied in relation to the design of the exterior facade. The coordination of the technological systems together with their impact on the overall appearance of the building is part of the assignment and should involve a methodological approach relating to an industrial way of building.

The integration of the supporting scientific fields, applied mechanics, construction design, structural design, building physics and climate design will be the main goal in combination with the design.

MSc 3 + 4

The MSc 3 starts with an introductory project in the first quarter of the MSc 3. The individual graduation project starts in the second quarter of the MSc 3 and continues into the MSc 4.

To be able to enroll in the MSc 3/4 Design & Technology, the student is obliged to successfully have finished the MSc 1 & 2 AE/ BT: Bucky Lab & BD+E.

Main focuses in the graduation project's subject are the themes of Computation and Performance, Green Building Innovation and Facade Design.

**MSc 1
Bucky
Lab:**

**MSc2
BD+E:**

**MSc 3 + 4
BT**

**MSc 4
BT**

ARCHITECTURE

Architectural Engineering:

The aE masterprogram

Architectural Engineering delivers engineering architects. The technology based architect combines the vision of the architect with the ingenuity of the engineering professionals.

Architectural Engineering is an Architecture program offered by the Department of Building Technology. Graduates have the possibility to enter the professional architects training of two years, which leads to registration in the Dutch Architecture Register (SBA).

For the first year of the aE program, Building Technology and Architectural Engineering have joined forces, interests and expertise, creating a set of inspiring semesters: in MSc 1 Bucky Lab & MSc 2 BD+E the connection between architecture and technology is explored.

In the Msc 3 & 4, the aE lab integrates spatial, structural and climate design. The student designs a building in relation to research on these aspects.

MSc 1:

BT Msc 1 Bucky lab or another Architecture MSc 1 of your own choice

MSc 2:

BT MSc 2 BD+E completed with the history thesis or the 'free choice' Architecture MSc 2

MSc 3 + 4



MSc 4



MSc 3 + 4:

The graduation year of the aE Lab starts with the Design Research Studio. The focus of this design studio lies in the integrated approach of all Building Technology disciplines, the results of the findings (both in research and design) and the way they influence the elaboration and realisation of the Architectural Design.

The Graduation Project Preparation in the second quarter of the third semester is mainly used for elaborating the graduation assignment into a curriculum description and for the preliminary building design and research that is needed. In the MSc 4, the emphasis lies on the integration of architectonic aspects and building technology within the design, guided by technical research (material, structural, climate & parametrical design).

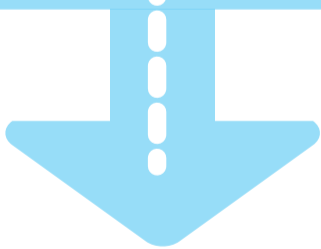
In the MSc 4 the full development of the graduation project will take place under the supervision of the teachers from Architectural Engineering and Building Technology in combination with the possibility to be advised by teachers from all specific disciplines inside the Building Technology group, hereby guarantying the full depth of the study of the 'making of architecture'.

**MATERIALISATION
RMIT
EXPLORELAB**

**HYBRID
INTERIORS**

**PUBLIC BUILDING
DSD**

**DWELLING
HYPERBODY**



Colophon

aE Journal

Volume 1, no 1/2010

Editor:

Text contributions:

Publisher:

Art work:

Thijs Asselbergs
Ype Cuperus,
Jan Engels, Elise van Dooren

Chair of Architectural
Engineering at the Faculty
of Architecture,
Delft University of Technology

Bureau Arjan Karssen BNO
Haarlem

Printing:

Lenoorschuring drukkers
Amstelveen

