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 the 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 Ka-him 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, Eliza Guse
**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 MSc 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 graduate 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 explanation 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. 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 Borgeart 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 form 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.

They have all been or still are second mentor and have been instrumental in making aE work.
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 major 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 in 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 see where 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.
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 is 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 corten steel facade elements follow the curved shape of the building and give it its armadillo shrub like skin.

Tutors: Ype Cuperus, Joop Paul.

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 office wings were designed on flexible use and a noise and pollution free working environment. This has resulted in a layered facade 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 ’s-Gravenzande 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.

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's suitable for other buildings in similarly challenging locations.

Tutors: Ype Cuperus and Eric van der Ham.

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: Ype Cuperus and Rudi Stouffs.

SALMAN KAHULI: GENERATING HIGH DENSITY RESIDENTIAL HOUSING APARTMENTS
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Tutors: Ype Cuperus and Rudi Stouffs.

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, Rees van Weeren.

NATHAN VAN ESBROECK: SILOCENTRE
Reuse, adoption 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.
Rotterdam is the largest or at least one of the largest ports of the world. Docks 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) role 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 op 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.

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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 cfd-analysis (computational fluid dynamics), Ecotect and Fluent the engineering and the shaping of the architect 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
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 fulfill 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 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.

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 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

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 smaller 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.
ARNOUĐ 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 an 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 triangulated 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
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.

Leon van oojen: 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, Truus de Bruijn

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. (Rhinoceros)
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

Arjan Klem: Modular Housing
By using the IFD-checklist (Industrieel, Flexibel, Demon- tabel) 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 and structures of the harbor this pavilion provides a shelter and an outlook spot cantilevered above the water.

A great number of possibilities were explored; the forces involved in this “balance” were translated into the structural solution and visualised in the architectural expression. Calculations were made to check out if the finding were realistic.

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
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/resin 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

TUTORS: Jan Engels, Patrick Teuffel

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 Schовать

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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.
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Tutors: Jan Engels, Arjan van Timmeren, Ann Karina Lassen
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 master students have collaborated in developing four master plans East of Haarlem, inspired by a specific theme. A transit oriented development, based 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 roof 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.

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.

Gateways to Haarlem

Dong-Eung Lee has finished his thesis design; another nine projects still are works in progress.
The Watercity master plan has added waterfront to Haarlem. This thesis design has explored the capacity of the location and has used it potential to its full extend. 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 waterways and land routes. This building, or should we say structure? 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 Heinzelmann.
MARCO VISSE: LIGHTWEIGHT SHELL STRUCTURES
A pavilion was too small for this study. Its subject was the exploration of lightweight 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.

ANJELKO 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 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 Heinzelmann, Patrick Taufel.

DANIEL VAN KERSBERGEN: KINEMATIC STRUCTURE SYSTEMS
This project has investigated kinematic structures, from tensileity 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 Heinzelmann.

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 or buildings.

Tutors: Ype Cuperus, Tillmann Klein.

IEKE SELEN: BASIC ARCHITECTURAL GEOMETRY
After collecting data on different types of geometry it was decided to chose elements made of regular shaped hexagons as top and bottom surface. These hexagons 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.

ANNE-MARIE 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 interchangeability. The outcomes were applied in a pavilion design.

Tutors: Ype Cuperus, Arjan van Timmeren.

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 extend 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 Wieren
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 incl. 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 lab 06 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 graduation plans see http://discover.tudelft.nl/en/page/search
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 emphasis 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 MSc 1 Bucky Lab Seminar on Building Technology
and the Bucky Lab Seminar on Green Building Technology take place in the first quarter of the third semester. This seminar is mainly used for elaborating the graphical description and for the preliminary building of the Architectural Research Project. The Graduation Project Preparation in Design is held in the second quarter of the third semester. The Graduation Project is the culmination of the Master’s degree and can be either an individual research project or a team project.

The MSc 2 BD+E Seminar on Building Technology
The design assignment of Building Design + Engineering (BD+E) deals with the problems of multi-storey buildings in which a variety of functions are included. They are widely used 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 structures 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.

The MSc 3 is mainly an individual 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 eligible to enrol 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 focus is the graduation project’s subject and the themes of Computation and Performance, Green Building Innovation and Facade Design.

The MSc 4 is mainly an individual project in the second quarter of the third semester. The student designs a building in relation to research on these aspects.

The MSc 2 + 4 BT Seminar on Building Technology
The BSc 1 Building Technology and the BSc 2 Building Technology seminars are held in the first quarter of the third semester. The seminar is mainly used for the preliminary building of the Architectural Research Project. The Graduation Project Preparation in Design is held in the second quarter of the third semester. The Graduation Project is the culmination of the Master’s degree and can be either an individual research project or a team project.

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.

The MSc 3 is mainly an individual 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 eligible to enrol 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 focus is the graduation project’s subject and the themes of Computation and Performance, Green Building Innovation and Facade Design.