MEGA

2020

Cover image: ‘De Gouden Doos’, design-proposal for the future logistic landscape.

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1. INTRODUCTION

The course MEGA is concerned with the design, computation, engineering, and construction management of a high/large building. MEGA2020 focuses on a highrise building. This design process is done as a collaborative digital design in a multidisciplinary group of students in which each student has his/her own different responsibility. The course targets master students in Architecture, Management in the Built Environment, Building Technology and Civil Engineering; and it is open to non-TUDelft students, conforming with TUDelft regulations. The course is supported by external (inter)national design/engineering offices. Students work in teams. The design team of 6 - 8 students is responsible for delivering an integrated design as a multidisciplinary team; while each student is responsible for one discipline. Disciplines involved are: architectural design; structural design; climate design and building services; façade design; project and construction management; computational design. The disciplines are divided amongst the team members; each member is responsible for the contribution and integration of these aspects in the collective design. Students are encouraged to match their role in the team with the specialization they follow in the Master track.

Note: Considering the large design assignment, it is recommended to consider having 2 students as structural engineers (at least one of which from CiTG). Considering having 2 students as computational designers per each team is also possible. It is mandatory that each team is composed by students of different tracks – whenever possible 1 student from A, at least 2 students from CiTG and at least 2 students from BK- BT. See Section 1.2.1 for details.

Special is the involvement of external practitioners and external experts linking this course to practice. The education methods are: lectures by professors and specialists; collaborative working sessions with other students; exposure to external architectural practice and external experts; weekly consults with tutors; making presentation and receiving/integrating feedback. Especially, feedback is received during the mid-term and final presentation also from the external experts and practitioners.

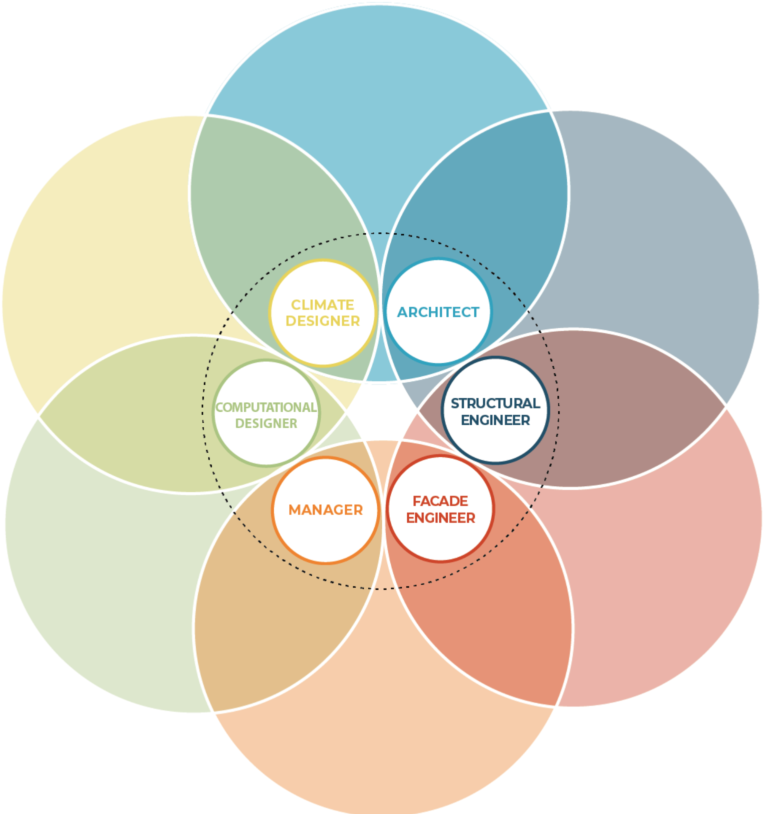


Image: Integral Designloop, Respective expertise is communicated and shared among the disciplines in real time, ranging over the entire process. Image based on a diagram by UNStudio (Juergen Heinzel)

1.1 COURSE OBJECTIVES

The course focuses on Interdisciplinary Design. The interdisciplinary integration of the various fields of expertise involved in the design process drives the activities of the course and will be evaluated and graded as a key aspect. The integrated design process is applied for the design of a Highrise building, as described in the following section. The assessment criteria are detailed in this brochure as well as in TUDelft BrightSpace.

1.2 LEARNING OBJECTIVES

The learning objectives are subdivided in two categories. The first one includes the learning objectives for the entire class (indicated as learning objectives for the whole team). The second one includes the learning objectives for each specific discipline (indicated as learning objectives for the specialist). Each student is supposed to meet the learning objectives for the entire class and the learning objectives for his/her own one specific discipline. The learning objectives are stated in the TUDelft Studyguide. The TUDelft Studyguide remains the main reference for this. Herby they are recalled as following:

Collaborative design (whole team)

After the completion of the course, the student will be able to:

- design together with different disciplines (different goals and backgrounds)
- design in a realistic design environment

Sustainable design (whole team)

After the completion of the course, the students will be able to:

- identify key goals of sustainability for an interdisciplinary project
- contribute as a specialist to the holistic sustainability of an interdisciplinary project
- work on the design of low/zero/plus energy tall/large buildings

Architectural Design (specialist)

After the completion of the course, the Architectural Design specialist will be able to:

- direct interaction between architecture/masterplan/environmental context
- develop architectural design concepts based on interdisciplinary inputs
- integrate structural, façade, climate concepts into architectural design
- integrate sustainability and construction into architectural design
- develop the interdisciplinary project until preliminary design

Climate design (specialist)

After the completion of the course, the Climate Design specialist will be able to:

- develop climate and building services concepts based on interdisciplinary inputs
- evaluate different climate and building services systems in relation to architectural design
- integrate with architecture, structure, façade
- calculate climate performances to provide feedback in design decisions
- dimension the HVAC installations
- develop the interdisciplinary project until preliminary design

Computational Design (specialist)

After the completion of the course, the Computational Design specialist will be able to:

- set a collaborative digital workflow across disciplines / BIM
- set interdisciplinary parametric design strategies/methods
- set processes for performance analysis with simulation tools
- set feedback loops between numeric assessments and geometric modelling
- coordinate digital interaction between design, engineering, analysis, manufacturing and construction

Façade/envelope design (specialist)

After the completion of the course, the Façade Design specialist will be able to:

- develop façade/envelope concepts based on interdisciplinary inputs
- evaluate different façade/envelope systems in relation to architectural and climate design

- integrate with architecture, structure, façade, building services
- collaborate with the climate design specialist to provide feedback in design decisions based on numeric assessments
- dimension the elements of the façade/envelope
- develop the interdisciplinary project until preliminary design

Structural Design (specialist)

After the completion of the course, the Structural Design specialist will be able to:

- develop structural concepts based on interdisciplinary inputs
- evaluate different structural systems in relation to architectural design
- integrate with architecture, façade, climate design
- calculate structural performances to provide feedback in design decisions
- dimension the structural elements
- develop the interdisciplinary project until preliminary design

Project and construction management (specialist)

After the completion of the course, the Project and Construction manager will be able to:

- develop real-estate business models based on interdisciplinary inputs
- evaluate different real-estate business models in relation to architectural design
- predict income and building costs; optimisation
- collaborate interdisciplinary to provide feedback in design decisions based on numeric assessments
- develop construction methods/planning and site management and logistics
- define and coordinate objectives, tasks, deliverables in the group process

1.2.1 Designing together with different disciplines

Students work in teams. Each team includes 6 (sometimes 7) students. Each team works as a multidisciplinary team and is responsible for delivering an integrated design of a complex building (usually a multifunctional high-rise building). Within the team, each student is responsible for one discipline. The disciplines are: architectural design; structural design; climate design and installations; façade design; design and construction management; and computational design. During the design process, the student responsible for architecture takes care of aspects such as functional arrangements, layouts, urban relationships, integration in the context, aesthetic of the building, etc. The student responsible for structural design takes care of the design of the structural system, its dimensions, the numeric assessment of its performances, etc. The climate designer takes care of strategies for passive thermal comfort and daylight comfort, design of mechanical installations, the numeric assessment of their performances, etc. Similarly, other students take care of what concerns the domain of the other disciplines.

Each student can express a first, second and third preference to choose his/her discipline. The preference is supposed to be related to the master track the student is following. Students from the track of Architecture are encouraged to choose architectural design, etc. The background knowledge that is expected for each discipline corresponds to the standard bachelor education and the basic courses offered in each track during the first semester of the master studies. When forming the teams, the preferences should be respected as much as possible.

Teams are formed during the first week of the course. In 2020, preliminary teams are formed before the start of the course (to facilitate setting up the course on-line for COVID-19). There are rules to form the teams. Each team must include students from different MSc tracks (no teams with only students from A or from CiTG or from BT are anyhow allowed). Whenever possible, each team must necessarily include at least 1 student from BK A; at least 2 students from BK BT; at least 2 students from CiTG. Different compositions are allowed only and exclusively when the total number of students do not make anyhow possible what described above.

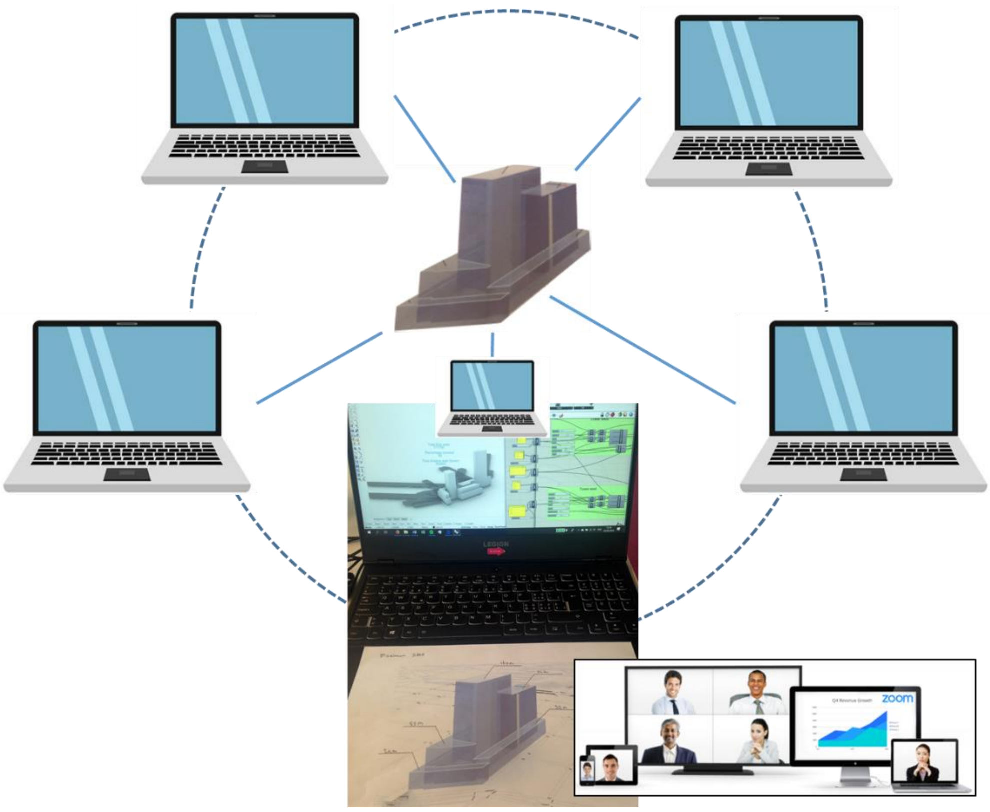
1.2.2 Designing in a realistic design environment

One of the main goals of the course is to let students learn and experience what design processes in realistic design environments are. In order to develop this aspect, each year the design assignment is formulated based on an actual project, in which usually a public institution is truly interested. In past years, this involved collaborations with different Dutch or foreign Municipalities or Provinces, such as the City of Rotterdam, the City of Den Haag, the Province of Friesland, The EU in Brussels, etc. This year the City of Rotterdam is the location of the project. The design assignment relates to a real on-going competition.

The course organizes also lectures and presentations from specialists actually working on the actual project or similar projects – for them to share with the students hints on their experiences and on the real process. Moreover, to simulate as much as possible an experience in real-world for the students, representatives from the public institution and/or architectural and/or engineering firms involved in the real project or similar projects are invited for design critics during the mid-term and final presentations of the students. They are encouraged to engage in debates with the students as if they were the clients or colleagues of the students.

Next to the clear benefits this implies for the students' experience, this process also implies challenges. One of the major challenges often reported by the students is to cope (within the timeline) with the conflicting requirements non only each discipline within the course has, but also each party from the real-world demand. Students are strongly encouraged to take this aspect as a positive learning experience. The real-word profession advocates for the capacity to listen to conflicting demands, take decisions and make design choices that are coherent with these decisions. In this respect, each design team (or even each student) is not expected to satisfy all demands. They are expected to understand all the demands and to make their own choices. They are expected to defend their choices and develop their design coherently. This is what real-word profession is like, and the challenging experience in MEGA should prepare also for this aspect of real projects.

In 2020, the course is held on-line according to the protective measures against COVID-19. Working on-line remotely also corresponds to what professional offices do. In these COVID-19 times, all offices are demanded to deliver based on remote collaboration. On this aspect too, the experience in MEGA is aligned with demands in real professional world. It is also relevant to note there are professional situations in which teams collaborate remotely without having ever met in person, regardless these COVID-19 times. Nowadays, international architectural and engineering firms may deliver projects as outcome of remote collaborations across parties located in different countries/continents. In this light, a remote version of MEGA may offer the opportunity to training on real challenges and experiencing real professional requirements. Students are strongly encouraged to look at the current condition as a challenging but valuable learning opportunity.



DESIGN ASSIGNMENT

2. DESIGN ASSIGNMENT: M4H in ROTTERDAM

2.1 CONTEXT

The discussion on the accelerated growth of 'big boxes' and the effects on the landscape has recently resurfaced in the public debate in the face of proliferating distribution centres and datacentres that constitute the infrastructure of 21st century consumption. The big box of the 21st century wants to be close to its consumer market – ordered before midnight, delivered next day – when distribution is concerned and near an internet-backbone when cloud data-storage and computing servicing the new economy is the goal. Coupled with extremely specific requirements and economic parameters, this real estate does not comply with the subtleties of urban/regional planning and will, as is feared by many, potentially turn everything in a giant peripheral hinterland. Can the city, still dotted with de-industrialized brown-sites and the remnants of previous land-use have a role in accommodating, and also recalibrating the big boxes of the 21st century? Possibly by combining these robotic landscapes with less post-human uses? Can the tax-base of a city be reinforced not only by the social re-engineering of real-estate concerned with housing and commerce, but by addressing again industry and distribution as well? Is a resilient city, allowing for symbiotic relationships with regard to energy use, economic welfare, and a healthy environment, a possible different horizon that reifies this new economy?
MEGA 2020 will address the role that a MEGA-building can play in contributing to a new urban context, including residential, commerce, production, data and distribution in an engineered synthesis that forces a paradigm-shift for land-use.

2.2 SITE AND URBAN PLANNING CONDITIONS

2.2.1 M4H

M4H (Merwe-Vierhavens), once one of the largest fruit-ports in the world, is an urban renewal district in Rotterdam, that is to metamorphosize in the next instalment of the grand tradition of port area redevelopment by the city. Intended as a redevelopment that combines working and living with production in close proximity to the centre, it is a significant departure from the hitherto binary replacement of industrial ports with scenic urban waterfronts limited to living, working and leisure. Together with RDM Rotterdam (the innovation hub on the site of the former Rotterdamse Droogdokmaatschappij) M4H is part of the Rotterdam Makers District: a site for entrepreneurship and knowledge institutions for the new economy – a habitat for start-ups in close-proximity to the city to entice education and participation in the circular economy. M4H is to be de-enclaved and connected to the rest of the city. Circulation is reorganised to suit the new mix: Makersstraat (Keileweg + Galileistraat) will primarily serve freight traffic and Havenallee (Marconistraat + Benjamin Franklinstraat) will be dedicated to slow traffic. The different project areas envisioned by the planners offer their own production-work-living-services mixes. MEGA proposes an element that contains this mix in a single building.

2.2.2 Urban planning conditions

For the purpose of MEGA, a site in the western part of M4H is identified, on the municipal border with Schiedam in the old Merwehaven, originally built between 1923 and 1930. The building proposed by MEGA radically incorporates the programmatic mix envisioned by the current planning for M4H and only departs from it to the extent that it entails an additional structure in the water: between the two piers perpendicular to the Marconistraat. The minimum height is 120m and the maximum height is 150m above NAP. The footprint of the building sits entirely in the water, within the perimeter shown, and offset from the quay. To guarantee visibility of the water from ground level from the surrounding area, it is not allowed to have a plinth of the building in the water that exceeds the circumference of the building above.

The total gross square meters of the urban planning volume are based upon the following presumption: 120 to 150m subdivided by an average gross floor height of 3,6 meter will give a maximum equivalent of 33 to 41 floors. 145.000 m2 gross floor area divided by 33 to 41 floors gives 4394 to 3537m2 gross per floor. The average envelope, except for exceptions will stay within an area of 6400m2 (e.g. 80 by 80m). The difference between 6400m2 and 4394 to 3537m2 is an initial reservation for voids, setbacks and possible cavities on overall volume.

The logistic complexity of the building will need to be connected to the mainland in some way. Yet, the existing piers cannot be used for anything other than the access roads to the new building. No staging areas, ramps or parking can be situated on those piers. Imagine that both the Radiostraat and the yet to be named street on the western pier will be directly connected to the Schiedamseweg in the future. No large-scale navigation (inland- or sea-shipping) needs to be possible from the basin between the piers in the future situation.

Image - This is not the footprint, nor the envelope, but the footprint and the envelope need to remain inside this area. (51°54'36.6"N, 4°24'57.8"E). (Source: Elaborated from GoogleMaps)

2.3 PROGRAM

The MEGA-building is a puzzle of 7 clusters. Each of these clusters can be considered a puzzle all in by itself. Simply stacking one above the other will not do. The relation of each of the programmatic elements to the surroundings – including but not limited to the logistic aspects, and the interaction between the programmatic elements – again including but not limited to the logistic aspects – need to inform the combination.

The design brief contains five main programmatic groups:

1.	Fab Lab:	25.000 m2 gross
2.	Distribution centre:	25.000 m2 gross
3.	Data centre:	25.000 m2 gross
4.	Hotel and restaurant:	20.000 m2 gross
5.	Residences:	20.000 m2 gross
6.	Offices:	20.000 m2 gross
7.	General services:	10.000 m2 gross
	Total:	145.000 m2 gross

1. Fabrication Lab

The ‘factory’ part of the building is understood as an upscale fab lab (fabrication laboratory), accommodating spaces for digital fabrication, turning ideas into products (large and small). A fab lab tends to have a mission beyond or even opposite to serial mass-production, and instead wants to create an open-source laboratory environment engaging with the social fabric it is situated in. The fab lab in question is a company in itself offering its services making prototypes and custom products on demand, employing a team for the purpose. It is however also open to a spectrum of users ranging from other companies, independent professionals, DIY-minded individuals, artists, students, designers, etc. that can use the facilities or participate in workshops and classes, assisted by the support staff – this factory is a public building.

- three multi-robotic fabrication volumes of at least 50 by 20 by 8m each: total 3.000m2 net
- atelier space: 3.500 m2 net
- exhibition/storage space: 3.500 m2 net
- meeting/presentation/workshop rooms: total 3.500 m2 net
- support staff/guest office space: total 3.000 m2 net
- back-of-house (reception, toilets, janitor, etc.): 750 m2 net

Total: 17.250 m2 net

Internal clear heights:

- three multi-robotic fabrication volumes of at least 50 by 20 by 8m each: 12m
- atelier space: 4,5m
- exhibition/storage space: 4,5m
- meeting/presentation/workshop rooms: minimum 3,6m
- support staff/guest office space: 2,7m
- back-of-house (reception, toilets, janitor, etc.): 3,6m

Attention needs to be paid to be able to accommodate machinery for production itself and the equipment needed to load and unload materials, finished products and the replacing of machinery.

Relevant reference: https://ita.arch.ethz.ch/archteclab/rfl.html

The Robotic Fabrication Laboratory (RFL), a research laboratory for large-scale robotic fabrication, is set up as a worldwide unique digital construction environment that allows for internationally leading research in the field of robotic fabrication in architecture and construction. The RFL - initiated by the Chair of Architecture and Digital Fabrication - is as an integral part of the new Arch_Tec_Lab-building for the Institute of Technology in Architecture (ITA), located on the Hoenggerberg Campus of ETH Zurich. The RFL became operational in October 2016. The RFL is based on an overhead running gantry system covering the complete workshop space of the ITA building at ETH Zurich). Thus, a total of four six-axis robots can cooperatively work on a maximum volume of 43 by 16 by 8 meters. The RFL's flexible and extendable configuration allows for a broad scope of different architectural design and construction experiments at full scale. The RFL will also enable to simulate robotic fabrication and human-machine cooperation on-site, as well as advanced automated factory-based digital fabrication processes. Apart from the core research in the field of architecture, the RFL is set up as a platform open to other disciplines, providing the means to conduct numerous research projects that are dependent on digital controlled spatial applications. (Source: https://ita.arch.ethz.ch/archteclab/rfl.html)

Image: Robotic Fabrication Laboratory, 2010-16, part of the new Arch_Tec_Lab-building for the Institute of Technology in Architecture (ITA), located on the Hoenggerberg Campus of ETH Zurich. ©Andrea Diglas / ITA / Arch-Tec-Lab AG

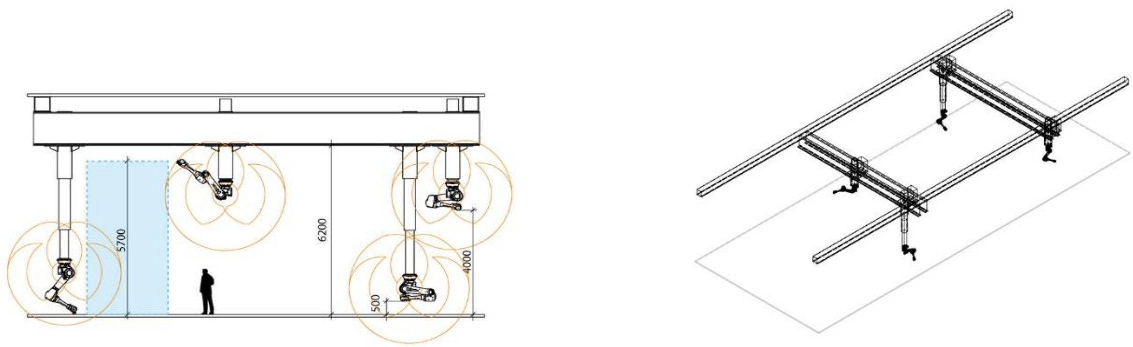


Image: Section Robotic Fabrication Lab and Axonometric view. © Gramazio Kohler Research, ETH Zurich

2. Distribution centre

This large-scale distribution centre (DC) for storage and distribution would fall under the “XL” designation in the October 2019 XXL-Agenda of the College Rijksadviseurs. The logistics sector itself considers everything between 20.000m2 and 50.000m2 as XL. Larger would be XXL. The standard size in the Netherlands is still “L”, between 2.500m2 and 20.000m2. No financial return minded speculative investor would consider a DC as a part of a hybrid MEGA-building a sound investment, as contracts for a first lease in the logistic sector are preferably for 10, but often for 5 years. To monetize investment in land and a structure with an economic life-span between 40 and 50 years, being able to adapt the DC to the requirements of a second, third and fourth user, is a primary concern. Also, the logistic sector is hesitant to automatize, for the same reasons. Imagine instead a distribution centre that caters to the ‘makers’ of M4H that functions as a cooperative not unlike an agricultural silo, storing and distributing locally produced goods for local and global distribution. Nevertheless, the standards of contemporary DC’s, informed by economy and internal efficiency, remain relevant when considering the dependency on the highly-standardized world of logistics.

Current DC’s consist out of c10.000m2 compartments, circa two times deeper than wide – ideal dimensions combining the most cost-efficient sprinkler-installation with the distance a forklift has to navigate between dock-shelter staging area and storage. The typical column grid is 24m wide by 12m deep, because of construction standards and costs. An XXL version would today be longer than deep combining multiple 10000m2 compartments in a row. An ideal compartment is 72m (=3x24m) wide and 120m deep (=10x12m), but ranging in practice between 96m and 144m deep. Internal clear heights are a minimum of 10,5m but often c12m, in relation to shelving/rack storage height (forklift) and sprinkler system (fire insurance based on K28 international sprinkler certification). A single sprinkler system installed at a height up to 13,70m under the roof suffices (according to the FM Global standard). Going higher means installing additional sprinklers in the shelving/rack storage structure, as is already the case when storing for example clothing or chemicals. Floor loads are 50KN/m2 with point loads of 85KN (in practice meaning thick reinforced concrete). Consider that when going vertical, it makes sense for the shelving-structure to be an integral part of the structure. High-rise shelving, in today’s practice between 20m and 36m tends not to rely on forklifts, but rather on a fully-automated crane-system (operating in narrow ‘corridors’ in the dark, since humans have no business here). Once the investment for this crane-system is made, it makes more sense to go higher than making the ‘corridors’ longer, limiting the necessity for the crane to waste time moving horizontally. The higher density of storage offsets the higher investment. DC’s tend to have only one “active” side: this is where the dock-shelters would be located in a normal situation, opening up to an area large enough for truck to manoeuvre. There needs to be 1 dock-shelter for every 1000m2 of storage. Since here one transits to the height-dimension of trucks, in most DC’s there is room in section to situate offices occupying the first 12m deep bay along (part of) the façade above the dock-shelters on a 1st floor ‘mezzanine’. A 3% to 5% of the total gross m2 tends to be needed for office space.

Our 25000m2 gross surface would generously fit the equivalent of 2 ‘ideal’ 72x120m compartments in a single-(ground)floor solution. When we subtract from the actual storage volume the first 12m deep staging bay, this equals: 17.280m2 minus 1.728m2 is 15.552m2 actual storage. With a height between 10,5m and 12m, between 163.296 and 186.624m3 of gross storage volume would thus be achieved. This should be the range to aim for, in any configuration, including when going vertical.

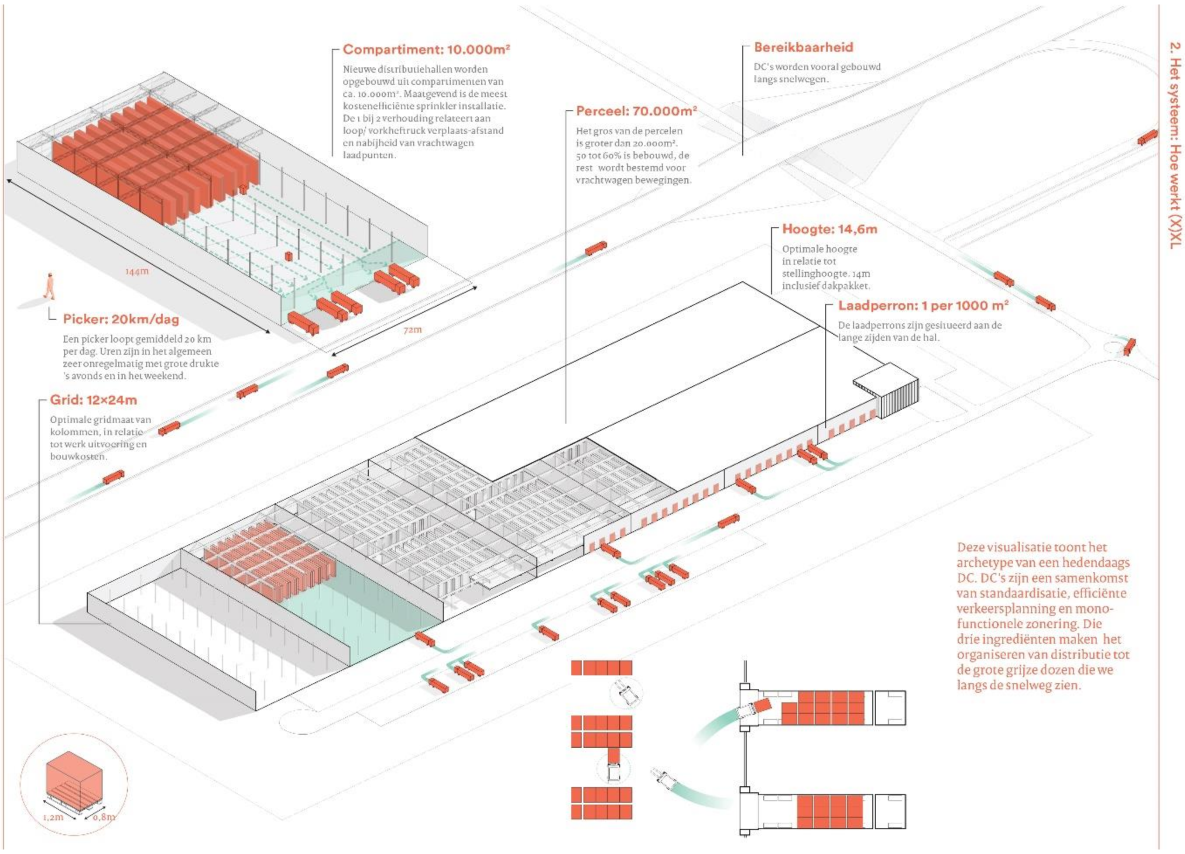
- the equivalent of at least 163.296m3 actual storage (excluding staging area)
- for the purpose of the brief the above is the volume-equivalent of 15.552m2. Another 1.728m2 max. is available for staging, depending on the configuration, but always allowing for the necessary operations.
- related office space and applicable back-of-house programme (reception, toilets, janitor, etc.): between 520 and 850m2 net (this is c3% to c5% of 17280m2)

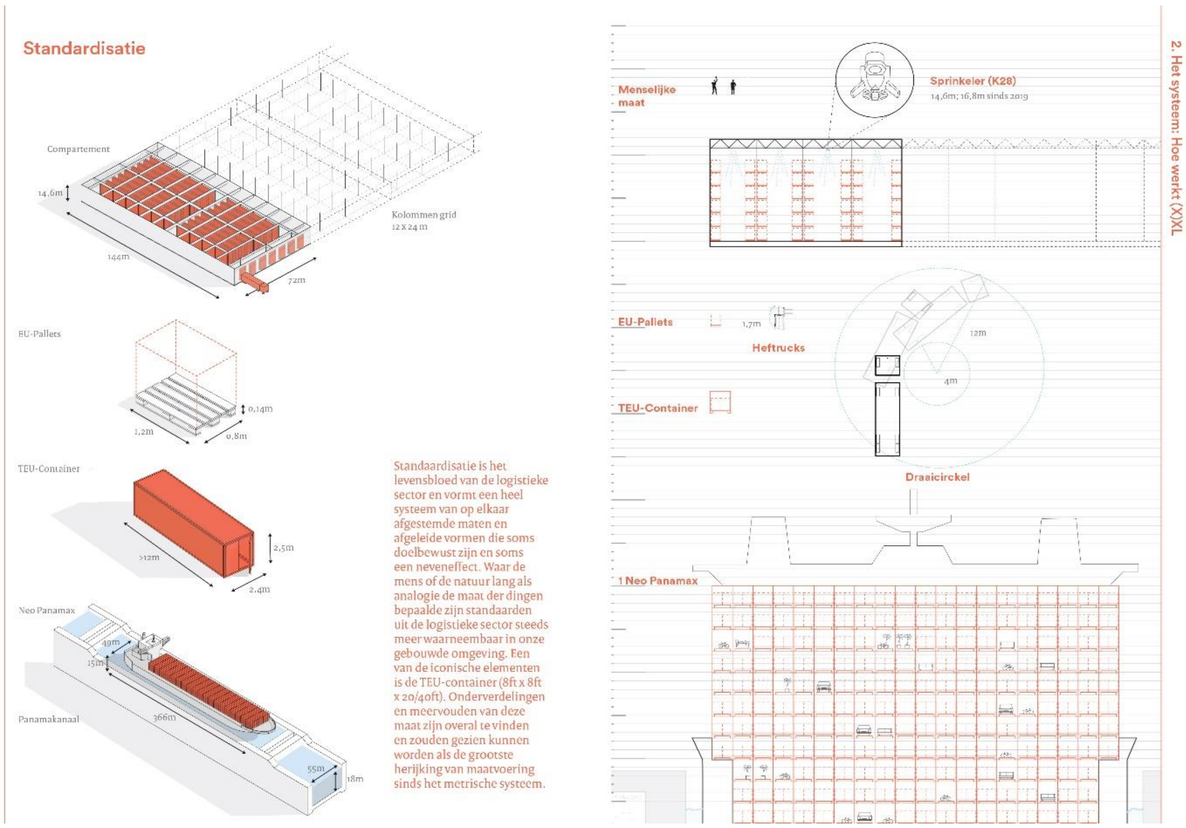
Total: 18.130m2 net

Internal clear heights:

- depending on configuration (see in text above)
- related office space: 2,7m
- back-of-house (reception, toilets, janitor, etc.): 3,6m

Independently of where the DC is situated in relation to the rest of the MEGA-building, our DC’s storage volume would necessitate 15 or 16 dock-shelters. For every-dock shelter an inside area of minimum 12m deep and 4m wide is required (the centrelines of dock-shelters should be a minimum of 4m apart). Depending on the position and configuration of the DC, this area can be included in the staging area mentioned above.





Source: '(X)XL verdozing - Minder, compacter, geconcentreerder, multifunctioneler' 2019. ©2019 Team (X)XL Verdozing, College van Rijksadviseurs https://www.collegevanrijksadviseurs.nl/adviezen-publicaties/publicatie/2019/10/29/xxl-verdozing

3. Data centre

Also this large-scale data centre would fall under the “XL” designation in the Oktober 2019 XXL-Agenda of the College Rijksadviseurs. It is nowhere close however to the hyperscale data-centres elsewhere in the world. The average commercial multi-tenant data-centre operation would not be integrated with other programmes, let alone in a MEGA-building, because of the elimination of risk presented to the collocated clients. Yet, the geographical distance between a data centre and its end-users has however a direct relationship with latency: the closer, the lower the latency. Imagine that one would care where your data is stored or where your computing power is generated, combining the advantages of scale (contributing to lowering the ecological footprint as large data centres are in general better equipped to take measures to reduce energy consumption, while the many nearby proprietary data centres of companies that still exist nearby, are on average older and have a much higher PUE-Power User Efficiency) with the same ‘cooperative’ spirit mentioned for the DC above, a data centre integrated in the fabric of everyday life could be an asset.

Current data centres organise server equipment in a clean and secured “white” space, positioned in racks, back to back along ‘cold’ and ‘warm’ alleys, more often than not on a raised access floor (accommodating cooling) in a grid of 60 by 60cm standard tiles. When stacked, examples show a gross floor height of 5,4m. Floor loads are 12KN/m2 with point loads of 5KN. Internal clear heights are a minimum of 3m and a false ceiling tends to accommodate wiring and also completes the climate cycle. Data centres consume vast amounts of energy. Some of that energy can be recuperated when connected a heat network (district heating).

As security is essential, no data floor should be below NAP, and access to this cluster, and especially the ‘white’ space should be controlled.

Our 25000m2 gross surface should generously fit at least 6500m2 of server floor (cf. the 12 floor AM4 Datacenter-tower of Equinix in Amsterdam Science Park)

- 6500m2 of “white” server floor
- the balance is mainly related technical installations, including cooling systems etc.
- only some office space and applicable back-of-house programme (reception, toilets, janitor, etc.) as only a very limited amount of people work here per m2

Total: m2 net tbd.

Internal clear heights:

- (see in text above)
- office space: 2,7m
- back-of-house (reception, toilets, janitor, etc.): 3,6m

Attention needs to be paid to be able to accommodate loading/unloading to facilitate replacing of machinery.

AM4, Equinix datacentre, 2014-17, by Benthem Crouwel Architectss ©Jannes Linders

4. Hotel and restaurant

The facilities of the hotel are not only available to the hotel guest, but are open as well to the residents (5.), office workers (6.) and between certain hours, the general public as well.

- 250 rooms of 20m2 net
- 150 rooms of 32m2 net
- for every 50 rooms there has to be one cleaning room and intermediate storage of 15 m2 net each
- restaurant/food court: 2.000m2 net
- swimming pool and fitness area: 1.000m2 net
    - the minimum swimming pool dimensions are 12 x 25m
- the balance is for reception/lobby and back-of-house (staff rooms, waste management, luggage storage, toilets, janitor, etc.)

Total: 13.800m2 net

Internal clear heights:

- Hotel-rooms incl. cleaning room and intermediate storage: 2,70m
- restaurant/food court, reception/lobby areas: minimum 4,5m
- swimming pool and fitness area: 4,5m

5. Housing

The housing units within the building should benefit from the services and program available in the hotel like the swimming pool and the fitness/gym area. The housing needs to reflect an idea on how to relate it to the rest of the building. The housing should provide a mix of unit types, including those that reflect the needs of short-term (single) labour migrants, active in the area:

- Short-stay studio-apartments of 50m2 net: 50% of all units
    - these can be serviced by the hotel
- Three/Four rooms housing units of 100m2 net: 50% of all units

Total: 13.800m2 net

Internal clear heights: 2,70m

6. Offices

The layout of the office spaces should be flexible and able to accommodate diverse contemporary office concepts. The office layout should be based on 90 cm grid and should have a flexibility based on 3,60 unit sizes.

The office area should be designed in such a way that it can serve multiple tenants leasing a minimum of 1.000m2.

Total: 13.800m2 net

Internal clear heights:

- Office space: 2,70m
- Main entrances, lobbies etc.: 3,6m

7. General services

These need not to be clustered and include:

- Childcare facility for c.15 children
- central garbage facilities and delivery
- car parking
- bicycle parking

Total: 6900m2 net

Internal clear heights:

- Loading docks, garbage disposal etc: 4,5m
- Main entrances, lobbies, childcare, etc.: 3,6m

Net-gross ratio

For all functions except the Distribution Centre and the Data Centre a net-gross ratio of 1,45 is demanded. Hence the difference between net and gross surface is based on the following:

• Net surface	100%
• Reservation MEP services/technical spaces/vertical risers	7%
• Inner circulation, emergency stairs etc.	23%
• Reservation structure and façade thickness	15%
• Total Gross surface	145%

Internal clear heights

All heights given in this brief are minimum net, clear internal heights: all height necessary for structural elements, beams, trusses, floor-thicknesses and height for M.E.P. (mechanical- electrical-, pluming-) services are not included.

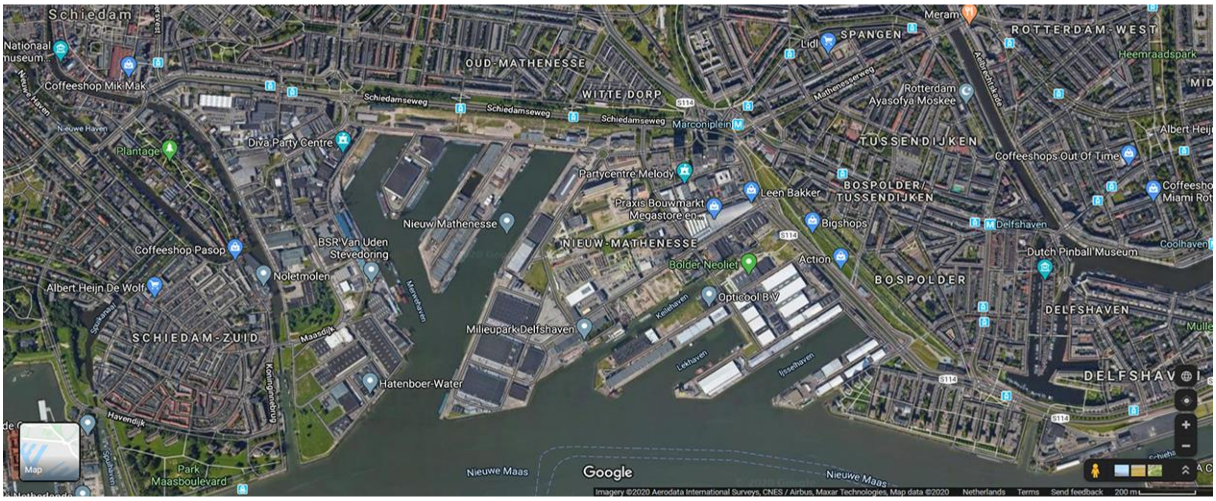
2.4 PRINCIPLES IN BROADER VISION

The design brief for MEGA is an educational exercise freely defined for didactic goals. However the exercise assumes as general context the Vision on Rotterdam Makers District. As they state, "the municipality of Rotterdam and the Rotterdam Port Authority want to develop M4H into an innovative living-work environment, optimally equipped for innovative manufacturing industry and with a mix of working, residential, culture, catering, sports and education. An energetic district with an impact on both the city and the port." "For the municipality and the Port Authority itself it forms the basis for a new zoning plan and a foundation for future investments." "It is the ideal location for new businesses to develop into established enterprises. It also gives large companies the opportunity to experiment with new products and processes. Here, they can invent, test and implement new technologies. New technologies based on digitisation, robotisation, additive manufacturing and the application of new, sustainable energy and materials. Consequently, the Makers District is a testing ground and showcase for the new economy. Visible to everyone. The added value that the Makers District has to offer is not just the result of the physical space, but especially that of a business climate that encourages and boosts collaboration and entrepreneurship. Cooperation with knowledge and educational institutions in the region is crucial, as this is where young people are introduced to the techniques of the future. The objective is to create a community of successful and innovative entrepreneurs, integrated with the broader, regional innovation ecosystem of businesses, knowledge institutions and sources of funding. The Makers District is rapidly turning into a vibrant area with housing, a wide range of facilities, culture and events." (Source: Spatial Framework Merwe-Vierhavens Rotterdam Future in the Making) The vision and future plans for the area can be seen at: https://www.rotterdammakersdistrict.com/ Additional brochures can be downloaded at: https://m4hrotterdam.nl/wp-content/uploads/2019/11/LOWRES_DM_makersdictrict_brochure_Visie_ENG.pdf and https://m4hrotterdam.nl/wp-content/uploads/2019/11/M4H_brochure_spreadsdigitaal_Engels.pdf

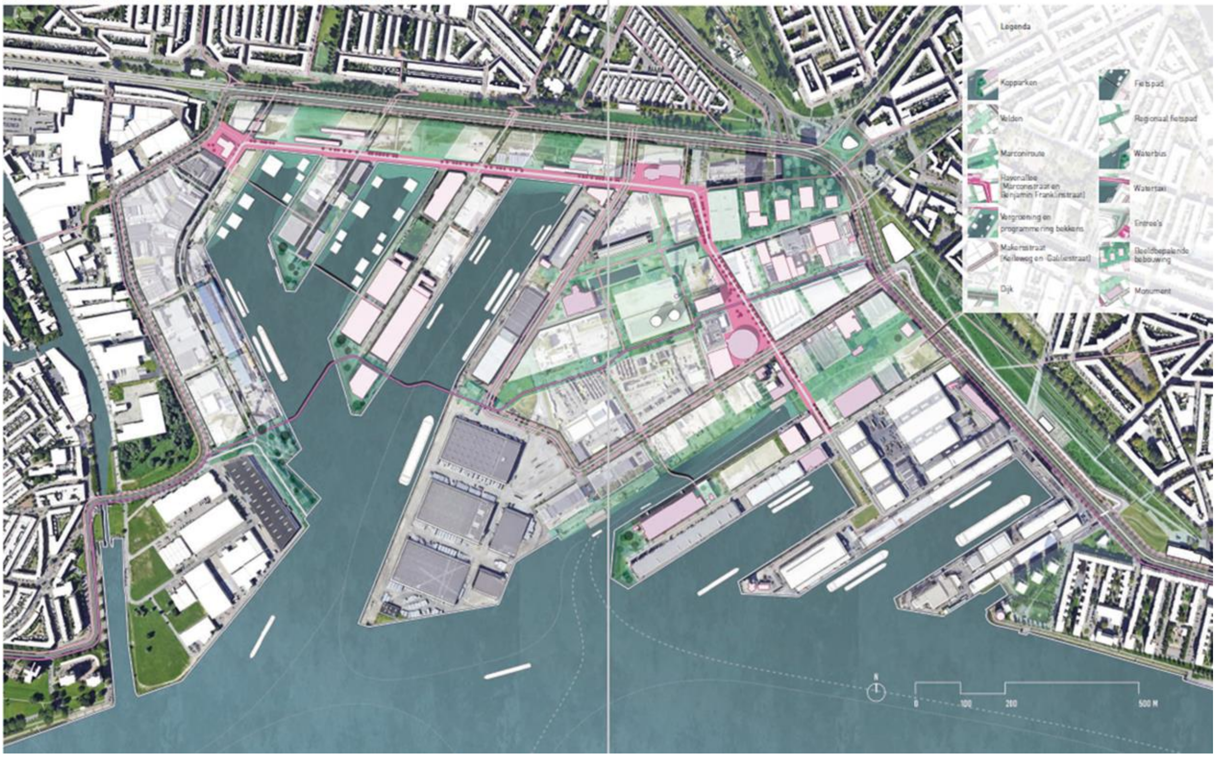
The Spatial Framework for M4H contains 8 guiding principles for sustainable development of the area. These focus on Circularity based on collectivity – and are:

1. M4H keeps space for the makers
2. M4H chooses sharing above ownership
3. M4H provides free zones for testing & prototyping
4. M4H generates and uses sustainable energy
5. M4H has a high regard for waste
6. M4H makes it possible to choose for sustainable mobility
7. M4H functions as one climate resilient system
8. M4H uses the existing industrial capacity of the area

The MEGA's building poses it-self as part of this vision and aims at pro-actively implement the main 8 principles of the area.



RUIMTELIJK RAAMWERKKAART 2035 OP LUCHTFOTO



Images: Top: view in GoogleMaps. Bottom: top view of intended situation in 2035. Source: https://m4hrotterdam.nl

2.5 MATERIAL AND FILES ON CONTEXT AND SITE

All students are welcome to pro-actively collect and share material on the context and site. Please, while doing so, all students are requested to pay attention and respect to sources (to be acknowledged) and conditions (if any) under which the material can be used.

As a starting point, the following material is provided to all students attending MEGA 2020:

- Set of historical maps of Rotterdam, provided by TUDelft Kaartenkamer;
- The 2D to 3D model of the urban district where the assignment is located;
- Sketch 3D models for Virtual Reality (made by TU Delft Design Informatics);

The files can be downloaded from TUDelft BrigthSpace, by all enrolled students.

ASSESSMENT-DELIVERABLES

3. ASSESSMENT

3.1 GRADING SYSTEM

In order to successfully complete the course a student needs to score 6 out of 10 points in the final grade. All assignments are mandatory. The assignments are the mid-term presentation, the final presentation and the final deliverables. The mid-term presentation will be taken into account as a mandatory milestone in the design process (no explicit grade is given at mid-term). The final presentation and the deliverables will be explicitly assessed as part of the final grade (they have direct numeric impact on the final grade). The mid-term and final presentations are a team-work. The final deliverables are individual.

Each student receives a grade based on: 50% for the team product (intended as overall integrated design and engineering, developed as interdisciplinary collaboration within the team; this grade is common for all team members); and 50% for the individual discipline (intended as own tasks within the design process; these tasks are the focus of the individual deliverables; this grade is possibly different for each student).

3.2 TEAM WORK ASSESSMENT

Assessment criteria for the final design and engineering as team-work are the following (these determine the 50% grade common to the whole team):

Final design (Team grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Urban and Architectural Design Quality: How well is the design embedded within its urban context? How is well dealt with the extraordinary size of the building? How well is the architectural quality of the final design, including the integration with technical aspects?	20%
Meeting Technical Requirements: How well satisfied are the technical requirements of the project? How much the design and engineering solutions meet criteria for sustainability?	20%
Stakeholder Value: How is the quality of the design in terms of its potential value for users, owners/investors and society/municipality?	20%
Originality and Innovation: How is the innovative quality/originality of the design?	10%
Interdisciplinary Integration: How integrated is the final design and engineering? Is the engineering coherent with the main design idea/concept? Does the main design idea/concept take into account engineering inputs?	10%
Group work in solving problems	10%
Group work presentation	10%

3.3 INDIVIDUAL WORK ASSESSMENT

Specifications for each individual workflow (process, weekly milestones, deadlines and deliverables) are presented in the following sections. The section dedicated to each discipline also presents the Assessment Criteria for the individual grade of that discipline.

4. DELIVERABLES

The deliverables include main official deliverables and deliverables as milestones during work-in progress. Especially when working remotely coordination is crucial to produce good deliverables. In this light, the Manager of each team is responsible to coordinate the schedule for the team to meet the deadlines. The Architect is responsible to coordinate the architectural coherency of the project as well as the graphic and visual consistency to express it in the deliverables. The Computational Designer is responsible to coordinate the 3D digital workflow for remote collaboration leading to deliverables.

4.1 Formal presentations (on design as integrated product)

There are three moments for formal presentations, PinUp, Mid-term and Finals. Until Mid-term the process mostly corresponds to concept design; after Mid-term to definitive design.

- **1 May 2020: Pin-up Presentations.** This is a mild milestone. It is a team deliverable. No grade is given at the pin-up presentations. The pin-up presentations are an opportunity to discuss with the tutors. During the presentation, each team explains multiple design directions / different design strategies the team is considering. Each team should have at least 2-3 different options. Pros and cons are discussed for each option. Challenges and promising aspects are identified for further development. In such discussion, students receive feedback they can use to identify a design direction for each student team. The presentation is informal and each team can freely include hand-sketches, pictures, diagrams, and any graphic and verbal material useful to illustrate and communicate the different design directions. The presentation should include inputs from all disciplines. This means it includes architectural massing and relation with the urban surroundings; preliminary options for climate strategies, structural typologies, façade systems, investment strategies, and ways to handle the process digitally. Though inputs are preliminary, it is important all disciplines are already pro-actively contributing to the designing thinking.
  COVID-19: Usually the presentation would occur by pinning up at the Studio sketches and drawings. COVID-19 changes this way of presenting into remote communication. With COVID-19 measures, each team is supposed to make a submission in Brightspace not later than by 10.00 am on 1 May 2020. During the day, teams receive on-line feedback from the tutors. The submission includes:
  1) One PDF booklet where sketches and drawings are collected. The booklet should be organized per different design options (option 1; option 2; etc.). It is informal (e.g. pictures of sketches, diagrams, etc.)
  2) One recorded presentation of the booklet, as slideshow or video with voice over and talking heads. Max 8-10 minutes.
- **20 May 2020: Mid-term presentation.** This is an official deliverable. It is a team deliverable. No grade is given at mid-term, but the mid-term will be taken into account as a mandatory important milestone in the design process. Each team presents the design developed until mid-term, including contributions from all disciplines. The overall design must be coherent to one clear design direction. However, at a more detailed level still multiple options can be presented, with pros and cons. For example, different options for architectural details and for building technology and engineering details. The options should be presented with clear (numeric) assessments on technical pros and cons; as well as with reflections on their potentials to come together into a coherent unified architectural vision. The mid-term presentations are still a moment of discussion during a work-in-progress, therefore uncertainties are to be shared for open discussion.
  COVID-19: Usually the presentation occurs in a classroom in front of a jury. COVID-19 changes this way of presenting into remote communication. With COVID-19 measures, each team is supposed to make a submission in Brightspace not later than by 8.30 am on 20 May 2020. During the day, the teams receive on-line feedback from the jury and can interact with the jury. The submission includes:
  3) The PowerPoint (or similar format) file of the presentation.
  4) One file of the recorded presentation, as slideshow or video with voice over and talking heads. Sharp 12 minutes.
- **19 June 2020: Final presentation.** This is an official deliverable. It is a team deliverable. This deliverable is explicitly graded for the team grade. Note that this deliverable may also be made public in case of exhibitions and / or publications or similar options for dissemination. (Of course, eventual dissemination will acknowledge the students who performed the work). By submitting this deliverable, students agree on this possible dissemination, unless they explicitly express differently.
  Content-wise, the final design should be presented as in a design competition set-up. It should be explained as a convincing and well-thought integrated product. It should be valorised for its architectural coherency and unity in the architectural character as well as for its technical performances. In this light, the final integrated product is the main focus of the presentation. However, the design process is relevant to explain

and substantiate the appropriateness of the final design. This means each team should be able to stand for the design and engineering choices made and explain why they are considered to be appropriate. Each team should show awareness of how the final design performs as compared to possible alternatives considered along the process. For each discipline, the underlying reasoning and decision making that brought to the final design should be argued credibly and based on factual assessments. This applies to what concerns the main line of the design as well as how it technically performs, in an interdisciplinary integrated manner.

COVID-19: Usually the presentation occurs in a classroom in front of a jury. COVID-19 changes this way of presenting into remote communication. With COVID-19 measures, each team is supposed to make a submission in Brightspace not later than by 8.30 am on 19 June 2020. During the day, teams receive on-line feedback from the jury and can interact with the jury. The submission includes:

1) The PowerPoint (or similar format) file of the presentation.
2) One file of the recorded presentation, as slideshow or video with voice over and talking heads. Sharp 12 minutes. (Please make this with a quality high enough for public dissemination)
3) One PDF fine of an A1 poster that represents at best the integrated design

Images: Examples of teams' pin-up presentations in MEGA 2019 (pictures of students' work)

4.1 Weekly deliverables (on interdisciplinary integration process)

The 3 presentations listed above are major moments for interacting with juries. In addition to these main moments and related deliverables, a weekly deliverable is implemented with the goal of tracing the design process as well as creating an explicit and mandatory weekly moment for each team to reflect on its own interdisciplinary collaboration (and how the contributions of each discipline in the team come together into a unified design). The submission is in Brightspace on Fridays (with the exception of deliverable Week 1 which is developed on Friday and Tuesday during workshops; and submitted on Tuesday). These weekly deliverables are structured as in the following table.

	Monday	Tuesday	Wednesday	Thursday	Friday	
Week 4.1					1	1 - Deliverable: 1 A3 with template style + 1 A3 (according to template)
Week 4.2		1			2 Pin up	(2 - Deliverable: PinUp presentation)
Week 4.3					3	3 - Deliverable: 1 A3 (according to template) per each discipline
Week 4.4					4	4 - Deliverable: 1 A3 (according to template) per each discipline
Week 4.5			5 Mid-term			(5 - Deliverable: Mind-term presentations.)
Week 4.6					6	6 - Deliverable: 1 A3 (according to template) per each discipline
Week 4.7					7	7 - Deliverable: 1 A3 (according to template) per each discipline
Week 4.8					8	8 - Deliverable: 1 A3 (according to template) per each discipline
Week 4.9					9 Finals	(9 - Deliverable: Final presentations + poster.)
Week 4.10						
Week 4.11				Report		(10 - Deliverable: Report.)

Tuesday 28 April 2020: Week 4.1 - Deliverable: 1 A3 with template style (each team defines its own) + 1 A3 (according to template) with studies on volume and square meters. The template will be used for all A3s in the following weeks.

Friday 8 May 2020: Week 4.3 - Deliverable: 1 A3 (according to template) per each discipline with schemes of 3D volumes, plans, sections, front views. Emphasis on schematic plans. It aims at integration between discipline's contribution (architecture, structural system, climate strategies, façade system, real estate perspective) and building's plans. How all aspects relate in plans?

Friday 15 May 2020: Week 4.4 - Deliverable: 1 A3 (according to template) per each discipline with schemes of 3D volumes, plans, sections, front views. Emphasis on schematic sections. It aims at integration between discipline's contribution (architecture, structural system, climate strategies, façade system, real estate perspective) and building's sections. How all aspects relate in sections?

Friday 29 May 2020: Week 4.6 - Deliverable: 1 A3 (according to template) per each discipline with schemes of 3D volumes, plans, sections, front views. Emphasis on detailed plans. It aims at integration between discipline's contribution (architecture, structural system, climate strategies, façade system, real estate perspective) and building's plans. How all aspects relate in detailed plans?

Friday 5 June 2020: Week 4.7 - Deliverable: 1 A3 (according to template) per each discipline with schemes of 3D volumes, plans, sections, front views. Emphasis on detailed sections. It aims at integration between discipline's contribution (architecture, structural system, climate strategies, façade system, real estate perspective) and building's sections. How all aspects relate in det. sections?

Friday 12 June 2020: Week 4.8 - Deliverable: 1 A3 (according to template) per each discipline with schemes of 3D volumes, plans, sections, front views. Emphasis on front views. It aims at integration between discipline's contribution (architecture, structural system, climate strategies, façade system, real estate perspective) and building's front views. How all aspects relate in det. front views?

The architect of each team is responsible to coordinate the architectural coherency of the project as well as the graphic and visual consistency of these A3 submissions.

4.3 Informal submission for consults (on individual discipline-related work)

These submissions are merely to facilitate the remote communication between each student and his/her tutor in the related discipline and across tutors of different disciplines (to be able to trace the progress / inputs). Before each individual consult, each student should upload in Brightspace 1 A3 PDF with a brief summary of the progress since last consult and the questions / points for discussion for the upcoming consult. This submission is functional to help the discussion between tutor and student, therefore it should be very transparent on eventual doubts, uncertainties, concerns, etc. – on which the student desires to receive feedback and advice. The submission should occur by 8.30 am the day of the consult if the consult is on the morning; by 12.00 at noon if the consult is in the afternoon. Tutors may look at the submission before starting the on-line consult. At the end of each consult, each student should integrate the submission with few lines of text to summarize the inputs of the consult. This integration should be made within 1-2 hours after the consult.

4.4 Individual Report

2 July 2020: Individual reports must be submitted in Brightspace. Each report is individual; however the submission occurs per team. Each team should collect the individual reports of its team-members and assemble it into one booklet in one PDF file. The booklet should be organized in 7 chapters:

1) One short introduction (max 2-3 pages) for the overall team project;
2) The Architectural report by the Architect of the team;
3) The Climate Design report by the Climate Designer of the team;
4) The Computational Design report by the Computational Designer of the team;
5) The Façade Design report by the Façade Designer of the team;
6) The Structural Design report by the Structural Designer of the team;
7) The Management report by the Manager of the team.

If a team misses one discipline, that chapter will be missing. If a discipline is shared between two students, the chapter of that discipline must make crystal clear who did what (this is very important because the grade is individual).

Each chapter must be organized on the same layout for the full submission. In this way, each team will deliver one coordinated booklet coherently composed by individual chapters sharing the same layout. Each team can choose its own layout. The booklet is in A4 portrait, and can include pages in A3 landscape.

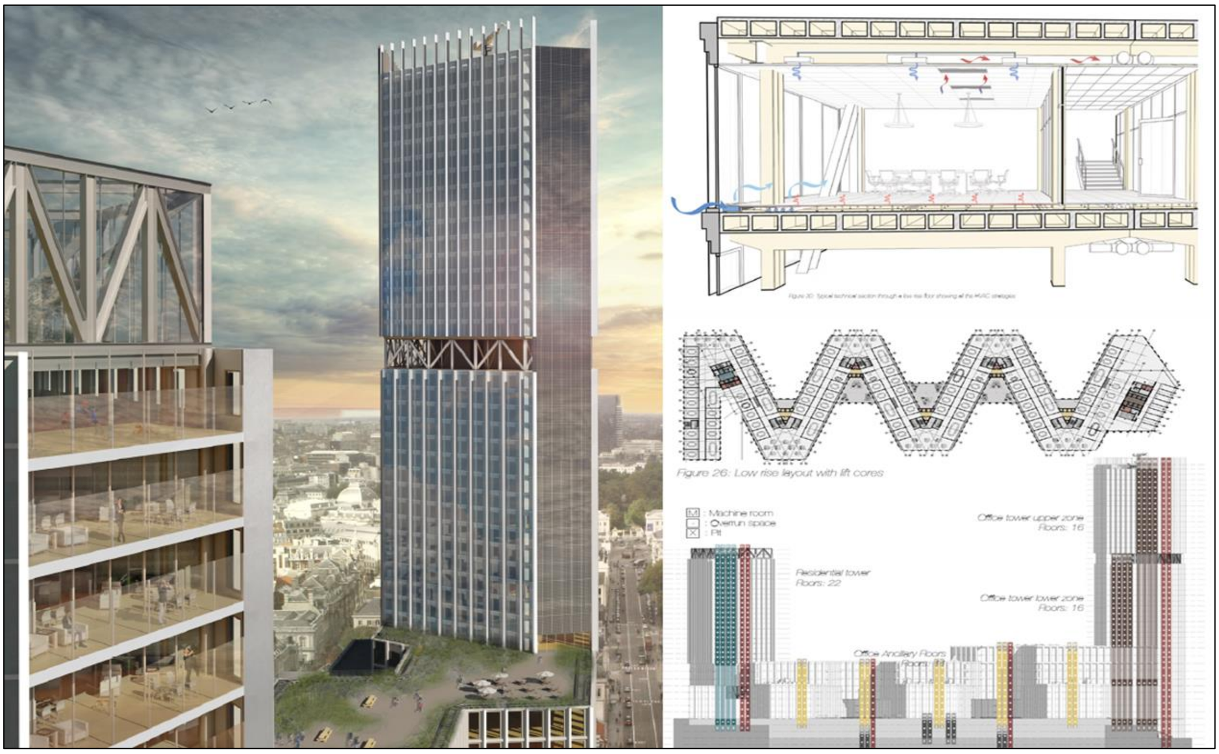


Image: Example from MEGA 2019 – Team 1

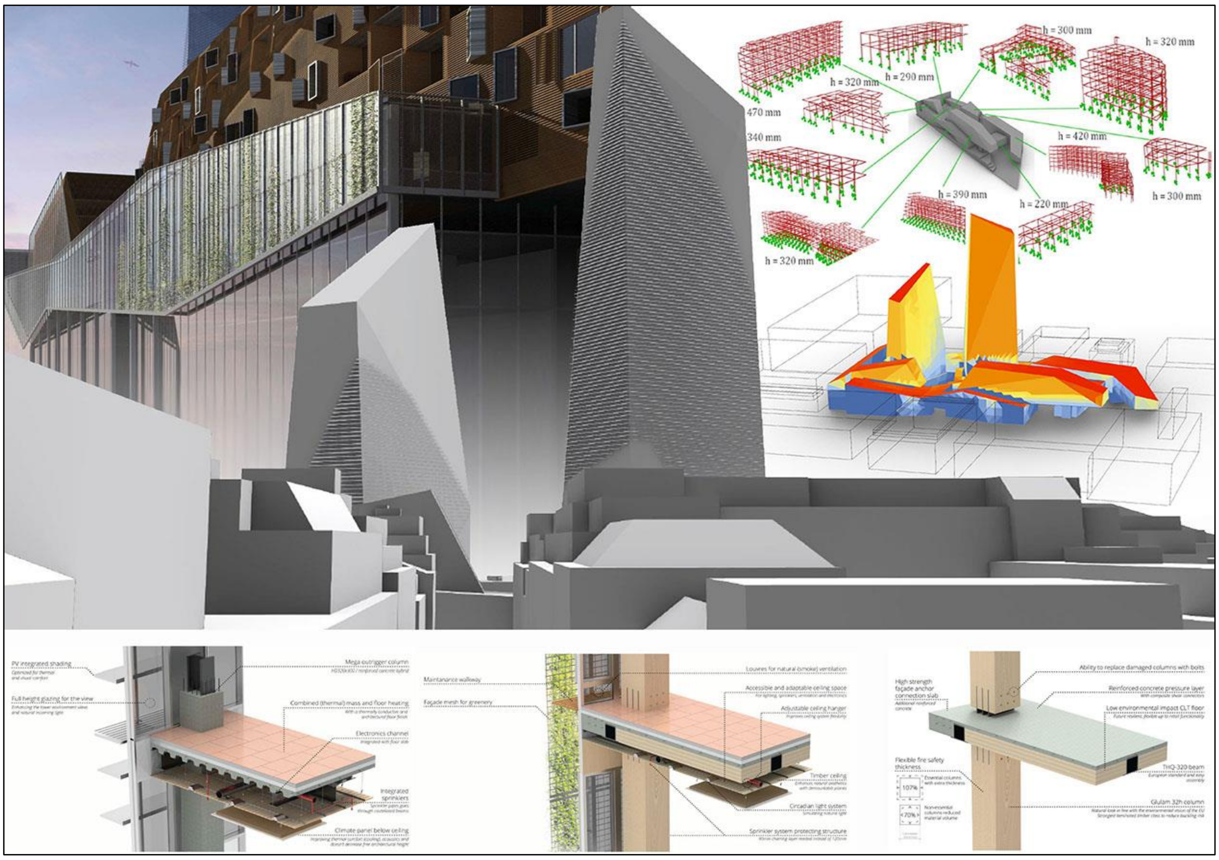


Image: Example from MEGA 2019 – Team 6

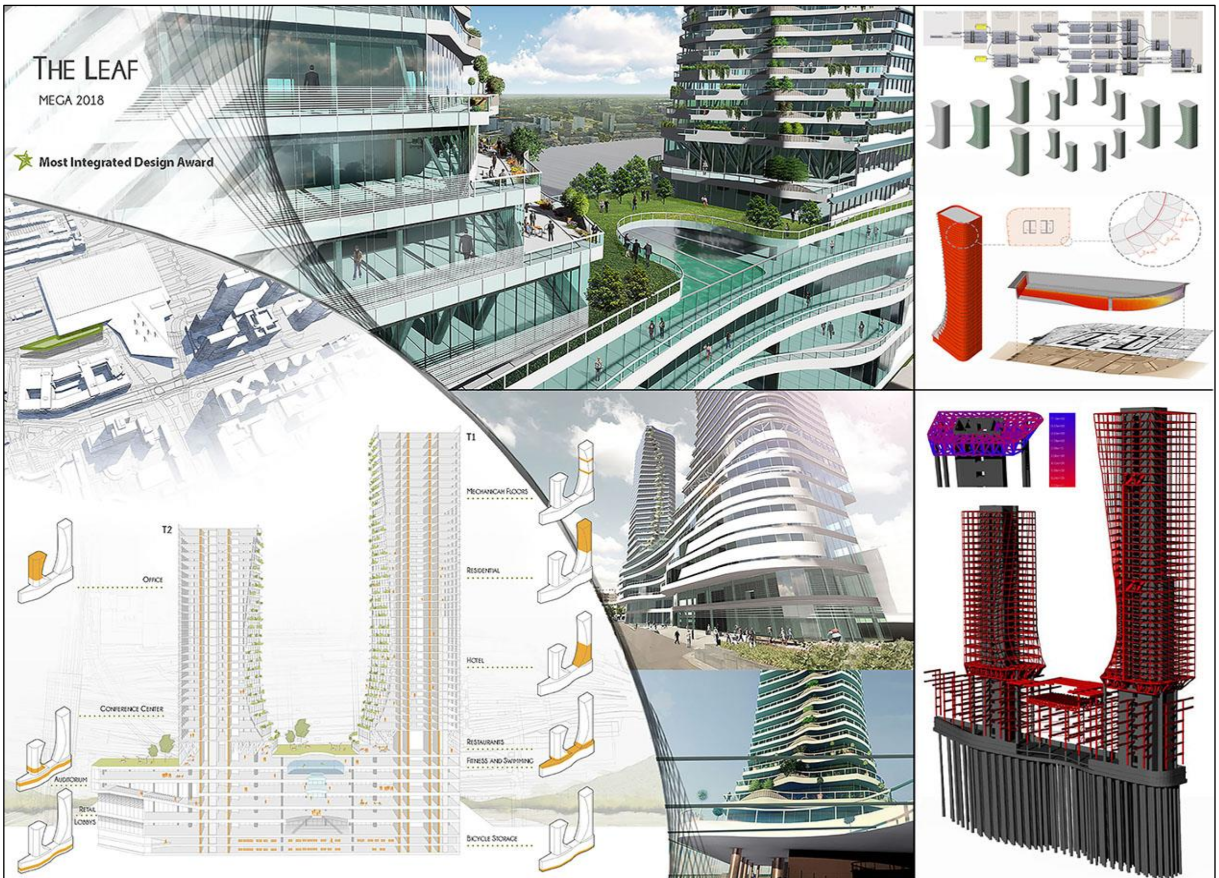


image creadits - MEGA 2018 - STUDENTS TEAM: Cristina Maria Marginean, Francisco Guzman, Despoina Pouniou, Ivneet Bhatia, Jacco Verhage, Jordy Bouts, Fatima El Hadji

Daniel Podrasa - Allessandro Passoni - Kees Leemeijer - Zixia Andrea Wu - Bart van Nimwegen - Bo Dorresteijn - Maximilian Mandat

ARCHITECTURAL DESIGN

5. SPECIFICATIONS FOR ARCHITECTURAL DESIGN

The course MEGA aims to provide profound knowledge of the roles of different disciplines within complex design assignments and to understand the dynamics and advantages of collaboration within a design-team. To understand the specificity of each role within a team, whether it is the architect, the quantity surveyor, the process manager, the building services engineer, or the structural engineer, one has to know the specific qualities of each participant first. What is the essence of the architectural design intervention within the design process of large buildings? What is done by the architect and has to be done by other participants with the design process? How do you communicate with the design teams and what should architect and design team aim at?

5.1 ROLE AND VISION

The role of the architect can be envision as following. To understand the role of the architect in the design process we distinguish three main competences: knowledge, skills and future thinking – knowledge of your own discipline and understanding the essence of what other professionals in the design team are providing; skills to draw, integrate and visualize all ideas; and lastly the possibility the imagination of a future yet unknown, since the design becomes reality in the future, it has to cater future needs and has to respond to future questions in society. Future thinking aims at understanding spatial situations in such a way that it can materialize in an architectural concept that can be translated into an architectural design. The usage of models of organization like exemplary types of buildings and urban organizations, as well as the translation of parameters into spatial models help to construct conceptual models. The architect should be able to internalize the three components (knowledge, skills, and future thinking), in all design steps; this is of paramount importance to act as an architectural designer within a team. To summarize: the role of the architect within a design team with different professionals is to develop a conceptual design solution that can become the framework to skillfully integrate information provided by others into architectural knowledge synthesized in a drawing that answers the question posed in the design brief.

5.1.2 Position, concept design development and materialization

Furthermore, designing starts with interpreting the assignment at hand: how do you read the assignment? What is important and to what extent do different design aspects like the site, the brief and the societal context are of influence in the assignment By posing questions you start to understand how you relate to the task you are facing, hence you position yourself vis-à-vis the design assignment. One of the main tasks of the architect in a large design team is to formulate a cultural position: what qualities does this building provide when it is realized? How does the building operate in the city? Does it provide a healthy and comfortable interior climate? Is its performance sustainable or not? Does it resemble historical or contextual examples or does it invent a new position and composition? How do the different elements of the brief interact with each other? The architect should formulate a position in relation to these questions and translate this into an architectural concept, represented in concept diagrams and a manifesto, possibly with the help of scripting. The architectural concept is the first step to translate the chosen cultural position into a spatial reality. The concept can be further developed in an architectural composition, visible in plans, sections and facades and in a three dimensional drawing in its context, based on and giving direction to all input generated by other parties in the design team. The architectural composition is not necessarily buildable yet, but drawings, or models, comprise a clear hierarchy between what is important and what not, what are the main elements of the design and what will be secondary.

5.1.3 Inspiration, teamwork and methodology

In architecture, knowledge and skills relating to designing were traditionally, conveyed within the studio from Master to Bachelor or Apprentice. Nowadays architecture is usually teamwork, in which architects can play different roles at different moments in the process or divide up roles between them. In this studio, each team will have only one architect member, so this person should be aware that he or she is responsible for all the tasks belonging to a traditional architect. This means the architect should suggest general conceptual ideas and visualize them for the other team members, and translate cultural, technical and societal issues related to the project into design objectives. Also, he or she should create a framework in which ideas brought up by the other team members can be synthesized, or if necessary, rejected. This project deals with very large programs in a complex site including infrastructural elements. Inspiration how to deal with the development of MEGA projects can be found for example in the publications: FARMAX (1998) by MVRDV, that deals amongst others with density and zoning regulations, S,M,L,XL (1995) by OMA Rem Koolhaas and Bruce Mau, explaining what scale differences mean for the conceptual approach of a building, and This is Hybrid: An Analysis of Mixed-Use Buildings (2011) by a+t research group, on the combination of a diverse set of programs including infrastructure into new typologies.

5.1.4 PARTI

Traditionally the main architectural design intervention is called 'Parti'. The Parti of the architectural composition conveys to all partners how the main spaces are arranged and distributed in plan and section. The composition results as well in an arrangement of materials: the materialization. The initial position informs the designer how to materialize the different building components: are the future facades for example made of marble or conceived in cardboard? The materialization will illustrate the chosen position of the architect, because conceiving a façade of cardboard contains other ideas in relation to for example sustainability then conceiving the same element in marble. Also a MEGA complex will impact its context and create new connections and conditions in the urban context. However, since the design of a very large building is also challenging traditional architectural design practice and theory, the architect has to create a new type of synthesis. In the design studio we expect from all students a clear elaboration of their position, design strategy and materialization, by using architectural means, like diagrams, drawings like plans, sections and elevations, as well as 3D models and if possible, real models.

5.1.5 Drawings and Models

We presume that the architect exercises his role within a large design team through drawings (both traditional as well as computational) and other architectural design means and instruments; hence the architect should not communicate his or her ideas with words but through actual drawings and models with as much as possible a three dimensional quality. Of course, the explanation will be either verbal or written; however, the main means of communication is always a drawing. The architectural drawing describes the size, position and material properties of architectural elements, like floors, walls and facades. So, drawings cater specific means and goals: the nature of the drawing varies throughout the design process. Whether it is highly abstract and showing only the main design elements or highly concrete by conveying all material properties, the type of drawing should always relate to its specific task and moment in the design process. Within this design studio we will use specific modes of expression related to specific steps in the design process, based on the presumption that either step in the design demands its own means. Note: The architect of each team is responsible to coordinate the graphic and visual consistency of the A3 submissions (See section 4).

5.1.6 Readers and Bibliography

- Durand
- Learning from Las Vegas
- Rem Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan*, 1978.
- Iñaki Ábalos and Juan Herreros, *Tower and Office: From Modernist Theory to Contemporary Practice*, 2003.
- MVRDV, *FARMAX*, 1998
- OMA Rem Koolhaas and Bruce Mau, *S,M,L,XL*, 1995
- a+t research group, *This is Hybrid: An Analysis of Mixed-Use Buildings*, 2011
- The publication of College Rijksadviseurs (it's downloadable)

5.1.7 Reference Projects

Image: Groothandelsgebouw, Rotterdam

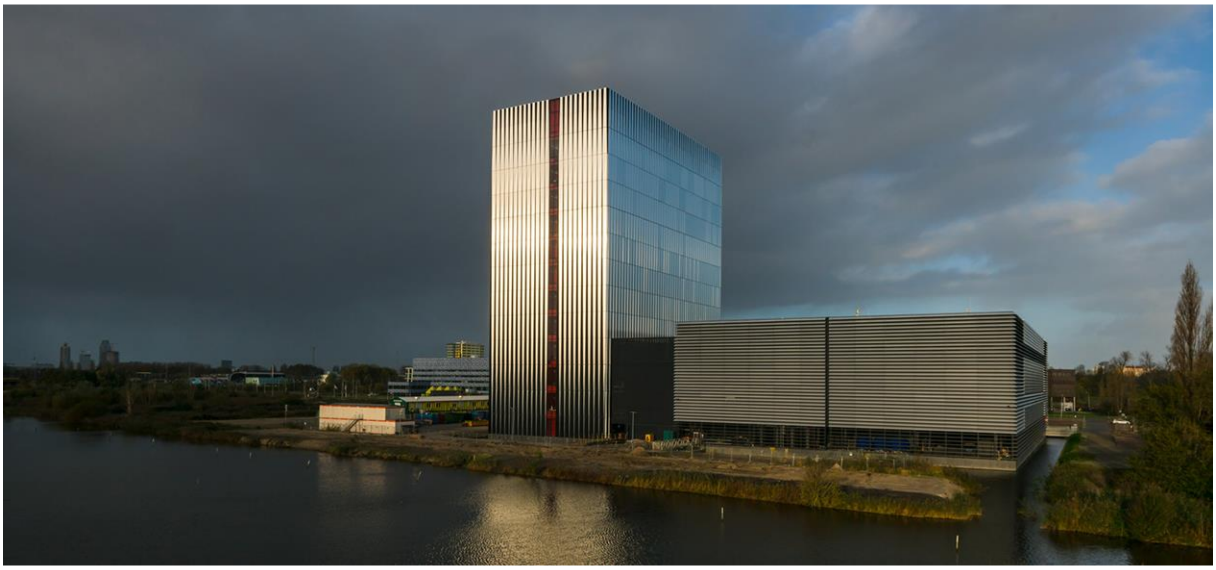


Image: The Datacentre in Amsterdam by Benthem and Crouwel. ©Jannes Linders

Image: 1111 Lincoln Road Herzog and DeMeuron

Image: De Pot Boijmans van Beuningen MVRDV © MVRDV

5.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments.

5.2.1 Weekly Milestones

Overview of the Architectural Design Process and Weekly Milestones. This overview comprises a breakdown of different design steps and of foreseen design itinerary. However be aware the breakdown is a simplification. In reality to some extend all steps should be consider simultaneously. The weeks are dedicated to themes and design means; evidently all other sketches and drawings that you would like to make are of course welcomed.

when	Key word	Content and actions	Questions and notes
Week 4.1	INTRO	Translate the assignment into gross cubic meters: scale 1:500. This gives you a series of different volumes, all dedicated to a specific programmatic demand. Compose from the cubic meters a series of small volumetric conceptual models. Make substantial differences in volumetric organization. Cut and paste the volumes, be aware that you do not 'loose' volume while cutting and pasting. Imagine what the main volume or element is in the model (Parti) and what not.	The week is fully scheduled with lectures and introductory activities. However, some activity already offers the opportunity to elaborate on the content.
Week 4.2	VOLUME	Work on volumetric models scale 1:500. Translate the volumetric sketches into drawings, by imposing a grid system, or measurement-system, on all architectural drawings. As architect, try to be consequent: imagine the grid system will be eventually also the indication where walls and ceilings will be positioned. Choose the right size with care, it will influence all future choses. Discuss with all team-members the perspective from their discipline and relate their perspectives to each design concept. Consider their perspectives as pro-active inputs to the design concepts, and as architect integrate these inputs in coherent overall concepts.	This week each team is working on several design proposals to be presented at the PinUp. This includes the analysis of the qualities of the different design proposals; as architect, what volumetric proposal conveys your design intention (position) in the most compelling way? Can structures, facades, climate strategies be integrated coherently in the volumetric proposal? To be discussed at the PinUp.
Week 4.3	SYSTEM	Collect as many maps and data of the direct surrounding of your site; study aerial pictures and interpret the non-tangible aspects of the context you are working in. Analyze the qualities within the site, use colors, arrows and symbols to articulate your argument. Make a collage of your first design ideas within a picture of the site, taken on grade; Elaborate the contrast or mitigate the difference with the current site according to your position vis a vis the assignment. Make a collage of the design within the aerial picture to investigate the grain-size of your intervention, scale 1:1000; compare other large buildings in the surrounding and analyze similarities and differences.	After the PinUp, the team has chosen one design concept to develop further. Each discipline now works on it. As architect, how does your design relate to the public domain, what are the main characteristics of the site? Are there other elements you would like to relate to or not? Are there specific features of the current situation that you would like to articulate or that you would like to suppress?
Week 4.4	CONTEXT		
Week 4.5	VERTICAL LOGIC/SECTION SPACE	In a high-rise project the vertical organization is characterized by the way the different programmatic elements are stacked. Make a sectional model (2,5 D) and develop within the sectional model the way the vertical stacking creates pockets, cavities, sky-lobbies, panoramic terraces etc. Use the routing as a means the investigate the vertical stacking of the building.	This requires a lot of collaboration among all disciplines, but as architect this week you may pay special attention to your collaboration with the Structural Designers. At the mid-term, the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details, but all discipline must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.

Week 4.6	SENSES	The quality of an architectural design is highly depending on the way all five sense are mobilized within, and through the design. Think about differences in temperature, humidity, echo's, colors and the quality of all surfaces. Consider whether all spaces of the design have to be 'inside'. Make diagrams elaborating main climate zones and the way this influences the architectural lay-out. Draw scenarios of different ways of using the building in order to reconsider all HVAC systems and think about use of sun, shadow, wind and other elements that directly stimulate all senses.	As architect, this week you may work very closely especially with the Climate Designer of your team. Is it useful to consider so-called half- climates by means of winter-gardens? What is the influence of the wind or the sun? Can you imagine different patterns of usage that allow you the reconsider the HVAC systems?
Week 4.7	PATTERN	Within the building large components are assembled, so the way elements come together is a main design issue. Together with the Façade Designer, as architect you should finalize the façade concepts 1:50 and study fragments of the façade models 1:50.	As architect, this week you may work very closely especially with the Facade Designer of your team. Do all building components overlap or touch? Do you introduce a rim or a seam to design all joints between elements?
Week 4.8	CAVITY	Identify the main space with your design and try to understand the way this space is articulated in your architectural concept. Provide black-white diagrams indicating the Parti and the way the main spaces are related to the parti: scale 1:500.	Is this main space of the design identified as a part of the Parti or not?
W 4.9		No consults are planned for this week. Finalize the work and prepare for the final presentation.	See section 4. DELIVERABLES
W 4.10 W 4.11		No consults are planned for this week. Finalize eventual improvements. Write the report and finalize the final deliverables.	See section 4. DELIVERABLES

5.2.2 Deadlines and Deliverables

when	what	content	format
Week 4.2	PinUP	• Diagrams elaboration the main design intentions: Volume, design system and overall organization; • Urban planning drawing 1:1000 or 1:2000; • Different scale models 1:500; • All relevant plans and sections 1:500;	See section 4. DELIVERABLES
Week 4.5	Mid-term	• Diagrams elaboration the main design intentions • Scale model 1:500; • All relevant plans and sections 1:200 • Preliminary façade concepts 1:50 • Preliminary façade model, fragment: 1:50	See section 4. DELIVERABLES
Week 4.9	Finals	• Diagrams elaborating the main design intentions; • Scale model 1:200; • All relevant plans and sections 1:200; • All relevant plan fragments: typical housing unit, typical hotel-room, typical offices: 1:50; • All relevant façade fragments 1:50; • Final façade model fragment: 1:50; • Relevant detailing 1:10	See section 4. DELIVERABLES
W 4.11	Report	• Individual chapter in booklet, conveying all relevant design intentions	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

5.2.3 Assessment Criteria

Architectural Design (Individual grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Architectural design: quality of the choices reflecting the particularities of the requirements - programmatically, culturally, ecologically and in the context of MEGA-buildings.	25%
Elaboration: quality of the articulation of design development choices in the detailing in inside and outside spaces.	25%
Urban design aspects: quality of the choices made regarding the surroundings, related requirements and the articulation the presence of bureaucracy in the city.	20%
Design process: productivity in the team, researching, elaborating, testing, self-criticism, based on interdisciplinary inputs, independently from the result.	15%
Presentation: overall quality of the report incl. drawings, picture of models, insightfullness of the text.	15%

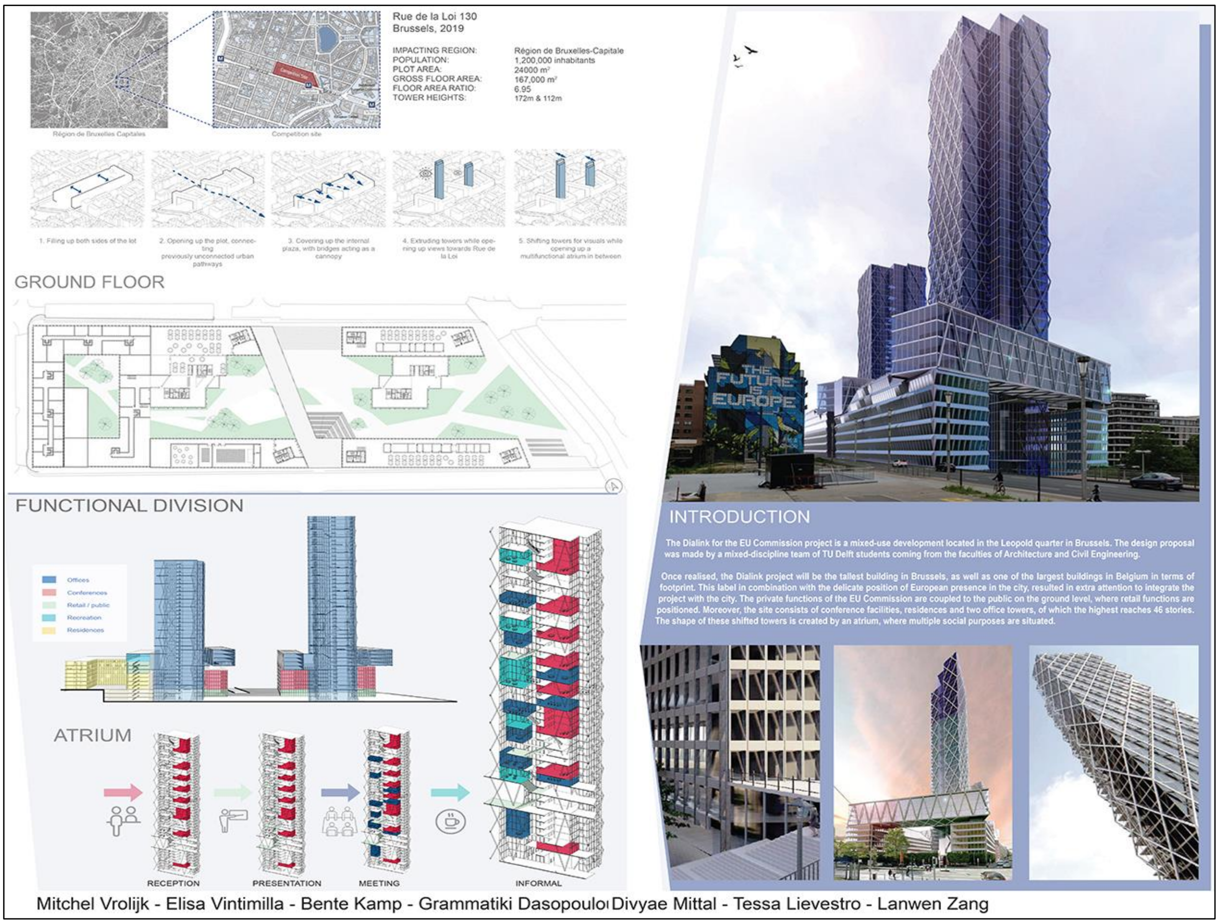


Image: Example from MEGA 2019

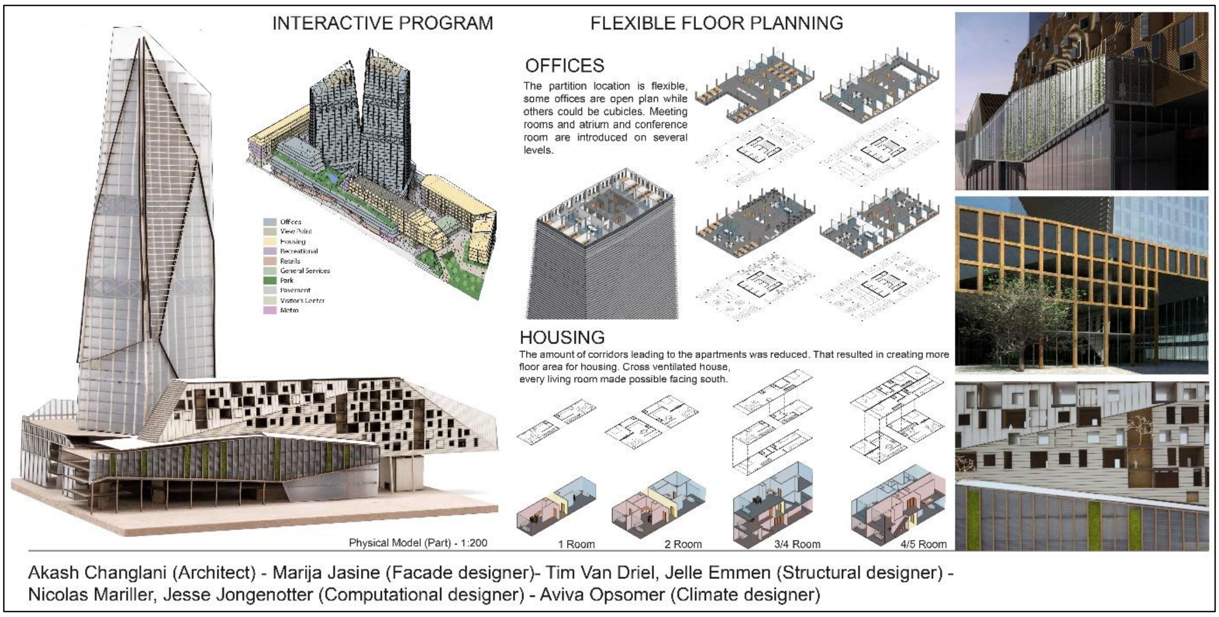


Image: Example from MEGA 2019

Image: Examples from pinup presentations in MEGA 2018. Work randomly pictured from different students' teams.

CLIMATE DESIGN

6. SPECIFICATIONS FOR CLIMATE DESIGN

As part of the studio MEGA, the module on Climate Design focuses on the integration of building physics, fire safety and building services in architectural design within the overall goal of a sustainable building. The student should focus on the main objective: “establishing a functional indoor climate in a sustainable way”. The indoor environment should guarantee a high level of comfort and health.

In order to design a building, which meets it’s functional requirements, one should focus on those aspects that most strongly influence the building. For instance, how can the installations be reduced, which installations take up much space in floor area or are determining the floor to floor height? What is the relation between the capacity of the ventilation or cooling system and the design of the façade? This is influenced by the level of transparency of the façade and the occupancy of the building. Furthermore the fire-safety concept will strongly influence the core design. For instance, how many stairs and elevators are necessary to ensure a safe egress for the building and what are their dimensions. What provisions are taken to make sure that the conditions for egress are sufficiently safe and make intervention by the fire department possible?

One core task of the climate designer is to generate quantitative information for design choices. Building services-related priorities should not conflict with priorities related to other disciplines. The best result to be achieved is synergy between disciplines. In cooperation with the other team members, the climate designer performs global calculations in order to estimate the required capacity and costs of the building services.

6.1 ROLE AND VISION

Sustainability is an integrated goal, i.e. the climate designer should meet the needs of the present without compromising the needs of future generations. Sustainability has a social component (social sustainability – ‘People’), an economic component (economic sustainability – ‘Profit’) and an ecological component (ecological sustainability – ‘Planet’). To simplify the assignment for the Climate Designer, we focus on social sustainability, ‘People’, but with ‘Planet’ as the basis. ‘People’ refers to the following aspects of sustainable design: visual comfort, indoor air quality, thermal comfort, acoustic comfort, drinking water quality, and wind comfort. ‘Planet’ refers to passive energy design, closing the cycles of resources as energy, water and materials, the service life of components, flexibility and demountability.

Lectures and supervision will provide methods, design solutions and technology to achieve the sustainability. Personal innovative ideas will, however, be appreciated. A special research theme can accelerate the design process and improve the quality.

6.1.1 Responsibilities

Health and wellbeing
The climate designer deals with the requirements for indoor climate and user comfort in the different spaces and makes sure that the building is sufficiently safe (in case of fire). The requirements for indoor climate and user comfort in the different spaces must be defined. The climate designer must adhere to prescribed daylighting, ventilation capacity and thermal comfort for some functions, as outlined in a separate document. For the other comfort aspects, as given by the Health and Wellbeing (HEA) aspects of BREEAM International new construction 2016, the climate designers may choose the set of criteria themselves. The design of the building must efficiently meet its requirements of achieving user comfort in the different indoor (and outdoor) spaces.

Energy demand for heating, cooling and lighting
The focus is on passive climate strategies of the building design to minimise the energy demands for heating, cooling and lighting. The energy demand for heating, cooling and lighting needs to confirm to the new Dutch BENG (Nearly Energy Neutral Buildings) regulations. The energy requirements per programmatic group and calculations methods are described in a separate document.

Building services
Besides the passive design, the climate designer is also responsible for the active climate-systems. A selection of systems for various spaces is necessary, based on the façade design, occupancy, equipment loads, system capacities, room shapes and building construction. The system capacities for heating and cooling must be calculated. Conflicts between building services and construction or façade elements are the shared responsibility of the climate, construction and facade designer. Solutions must be shown in floor plans and important cross-section drawings indicating the location of air handling units, other plants, ducts, pipes and terminal devices.

Energy production

There are many options at this location: District heating is available at the site ('Leiding over Noord'). Heat and cold storage in the ground in combination with a heat pump is an option as well. Also the surface water of the Nieuwe Maas can be used as a source for heat and cold. Waste heat from the data center can be re-used. An additional option is combined heat and power generation, for instance with bio(waste)fuel or hydrogen.

Vertical transportation plan
The climate designer must work together with the architect in order to develop a vertical transportation plan.

Fire safety concept
The Climate Designer must work together with the rest of the design team to develop an integrated fire safety concept that makes the desired architectural and climate concepts possible and ensures safe egress and safe intervention by the fire brigade.

Cleaning and maintenance
Façade or roof accessibility must be taken into account to ensure easy and safe cleaning and maintenance. The number and character of façade cleaning and/or maintenance equipment must be defined.

6.1.2 Literature

Books, manuals and readers

- BREGlobal Ltd. BREEAM International New Construction 2016. Technical Manual. https://tools.breeam.com/filelibrary/Technical%20Manuals/BREEAM_International_NC_2016_Technical_Manual_2.0.pdf
- BREAAM_Netherlands: https://www.breeam.nl/sites/breeam.nl/files/bijlagen/BRL%202014%20v1,01%2020140711%20-%20ENG.pdf
- Boonstra, D., Help, How do I use BREEAM, Design Manual, Smart and Bioclimatic Design, TUDelft, 2013
- Daniels K. Advanced building systems: a technical guide for architects and engineers. 2003 (in library and bookshop).
- Engel, PJW van den. Hybrid ventilation, a design guide. 2019 https://klimapedia.nl/publicaties/hybrid-ventilation-a-design-guide
- Gonçalves JCS, & Umakoshi EM. The environmental performance of tall buildings. Washington, DC: Earthscan. (Chapters 3 and 4). 2010. https://tudelft.on.worldcat.org/oclc/669497767?databaseList=1697,2572,638
- Guidelines DesignBuilder calculations MEGA 2020, see BrightSpace.
- Klimapedia https://klimapedia.nl/thema/gebouwinstallaties/ (information about building services, developed by the DUT, generally in Dutch, partly in English)
- Lechner N. Heating, cooling, lighting: sustainable design methods for archtitects. 2015. https://tudelft.on.worldcat.org/search?queryString=lechner+heating%2C+cooling%2C+lighting#/oclc/867852750
- Meyer H, Zandbelt D. High-rise and the sustainable city. Amsterdam: Techne Press. 2012 https://tudelft.on.worldcat.org/oclc/812115710?databaseList=1697,2572,638
- Overview of relevant theory on Energy Systems for Buildings and Neighbourhoods. See BrightSpace.
- Wood A, Salib R. Natural ventilation in high-rise office buildings (CTBUH technical guides). 2013. https://tudelft.on.worldcat.org/oclc/905864183?databaseList=1697,2572,638 and available via M. Turrin or the library.
- Wood A. The tall buildings reference book. London: Routledge. (Part 3 - pp.143-193). 2013. https://tudelft.on.worldcat.org/oclc/905866311?databaseList=1697,2572,638

Literature

- Ali M, Armstrong P. Overview of sustainable design factors in high-rise buildings. CTBUH 8 World Congress, Dubai. 3-5 March 2008. http://www.ctbuh.org/LinkClick.aspx?fileticket=SU9Ek8AzBy4%3D&tabid=1323&language=en-US
- Elotefy H, Abdelmagid KSS, Morghany E, Ahmed TMF. Energy-efficient Tall Buildings Design Strategies: A Holistic Approach. Energy Procedia, 74, 1358-1369. 2015. doi: http://dx.doi.org/10.1016/j.egypro.2015.07.782
- Oldfield P, Trabucco D, Wood A. Five Energy Generations of Tall Buildings: A Historical Analysis of Energy Consumption in High Rise Buildings (via internet).
- Raji B, Tenpierik MJ, Dobbelsteen, A van den. An assessment of energy-saving solutions for the envelope design of high-rise buildings in temperate climates: A case study in the Netherlands. Energy and Buildings. doi: http://dx.doi.org/10.1016/j.enbuild.2015.10.049
- Wood A. Green or grey? The aesthetics of tall building sustainability. CTBUH 8 World Congress, Dubai. March 3-5 2008. http://global.ctbuh.org/resources/papers/download/1313-green-or-grey-the-aesthetics-of-tall-building-sustainability.pdf
- Yeang K and Powell R Designing the ecoskyscraper: premises for tall building design. Struct. Design Tall Spec. Build., 16: 411–427. 2007 doi: 10.1002/tal.414

6.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments.

6.2.1 Weekly Milestones

Overview of the Climate Design Process and Weekly Milestones. This overview comprises a breakdown of different steps and of foreseen itineraries. However, be aware, the breakdown is a simplification. In reality all steps should be considered simultaneously. The weeks are dedicated to themes and design means; all other sketches and drawings you would like to make are welcomed.

when	keyword	Content and actions	Questions and notes
Week 4.1	INTRO	Get familiar with the context. Understand the climate conditions (use for example Climate Consultant). Analyse the energy potentials of the area. Get a feeling for the assignment and its requirements (comfort and health) and start considering different climate strategies.	The week is fully scheduled with lectures and introductory activities.
Week 4.2	VOLUME	The architect and the whole team will work on volumetric models scale 1:500 and will translate the volumetric sketches into drawings by imposing a grid system or measurement-system. As climate designer, realize that the grid system will eventually also indicate where walls and ceilings will be positioned. This highly affects the climate interaction between spaces and between indoor and outdoor, especially daylight. It will also strongly affect the size and location of installations, elevators, and fire safety measures. In other words, help the team choose the right sizes with care, as the sizes will influence all future choices for climate design too.	This week each team is working on several design proposals to be presented at the PinUp. This includes the analysis of the qualities of the different design proposals. The climate designer produces an inceptive climate concept and indoor comfort and health criteria for the different building functions at the PinUp. Does the massing has an influence on daylighting?
Week 4.3	SYSTEM	Consider the chosen design option and fine-tune its climate strategy. Make use of all aspects, not only within the building but also of the building as part of the urban system. Finalize the indoor comfort and health performance criteria and start exploring the energy demand for heating and cooling using simple calculations. Work on the vertical transportation plan and fire safety concept.	After the PinUp, the team has chosen one design concept to develop further. Each discipline now works on it. As climate designer, are there specific features of the current situation that you would like to articulate or that you would like to suppress?
Week 4.4	CONTEXT		
Week 4.5	VERTICAL LOGIC SECTION SPACE	This week the architectural design will focus mainly on the different programmatic elements arranged in the volumes, including pockets, cavities, sky-lobbies, panoramic terraces, etc. These programmatic elements may have a major impact on the climate design and a close collaboration is needed. Finalize the vertical transportation plan and fire safety concept, Further develop the climate concept for heating, cooling and ventilation. Explore the integration of ventilation ducts and of the energy production.	At the mid-term, the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details, but all disciplines must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.
Week 4.6	SENSES	This week the architectural design will focus mainly on senses, including perception of temperature, humidity, echo's, colors, shadows and the quality of all surfaces. Areas such as eventual winter gardens (or similar spaces) will be exploited. The effects of wind and sun will be addressed. In collaboration with the architect, as climate designer you may work on all these elements to achieve a good integration between the architectural intentions and the effects on energy and climate comfort. Moreover, based on the mid-term, revise the elevator plans, fire safety concept and show the integration of air distribution systems at a more detailed level.	This week you work closely together with the Architect of your team. How can architectural intentions regarding sun, wind, sound and other aspects related to the senses be detailed? How can a synergy between architectural intentions and climate requirements be realized?

Week 4.7	PATTERN	This week the facades are being finalized. As climate designer, the effect of the facades on energy and climate comfort is a major concern. All choices should be taken based on full awareness, i.e. based on numbers and calculations (Design Builder, Phoenics)) of the climate advantages / disadvantages. The climate designer needs to make the team aware of the advantages and disadvantages and advice accordingly. Attention should be paid to the selection of materials and the way the facade is connected to the structure to prevent external or internal fire spread via the façade. Show the integration of facade elements (operable windows, ventilation components, shading devices etc.) at a more detailed level.	How is the building's envelope working best from a climate perspective? How can a synergy between architectural intentions, climate requirements and technical construction details of the facades be realized?
Week 4.8	CAVITY	Finalize the detailed design choices. Finalize the calculations, the design of the systems, the elevator plans, the fire safety plans and maintenance plans. Check the overall design holistically, including and assessment and discussion of the full 3D model.	
W 4.9		No consults are planned for this week. Finalize the work and prepare for the final presentation.	See section 4. DELIVERABLES
W 4.10 W 4.11		No consults are planned for this week. Finalize any improvements. Write the report and finalize the final deliverables.	See section 4. DELIVERABLES

6.2.2 Deadlines and Deliverables

when	what	content	format
Week 4.2	PinUP	Concept ideas for climate strategies in relation to the overall requirements, regional/urban context and different design options of massing.	See section 4. DELIVERABLES
Week 4.5	Mid-term	During the Mid-term presentation the design criteria should be clear. A vision is necessary of the façade and the spatial design in relation to the installations for indoor climate as well as for elevator plans in respect to the logistic movement in the building (people and goods). The sources and usage of energy are part of this system selection. Ideas to achieve a sustainable high rise building based on the Triple P and BREEAM should be given.	See section 4. DELIVERABLES
Week 4.9	Finals	During the final presentation the Climate Designer should give an explanation on how you ensured the following achievements: • Way in which a healthy indoor environment is obtained. • Energy demand of the building and compliance to BENG. • In which way the building services are supporting the operational functionality and logistics. • How the fire safety concept works. • How the vertical transport is organized. • The extent of integration. • Other sustainability focus points.	See section 4. DELIVERABLES
W 4.11	Deliverables	• Individual report(*)	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

(*) FINAL INDIVIDUAL REPORT:
The following should at least be included in the presentation (very short) and report. (this is in line with the assessment criteria):

The building

- A description of the building and the indoor (and outdoor) comfort and health criteria of the different rooms and functions.
- Provide the architectural floor plans and sections

Climate design and comfort

- A description on the chosen climate concept.
- Take into consideration passive design options such as sunlight, daylight, acoustics, insulation, thermal mass, zoning, wind and natural ventilation.
- Take into consideration sustainable energy solutions such as windmills, thermal solar panels, PV panels, thermal energy storage, surface water, etc.

Building services

- Insight in the spatial consequences of installations, supported by exploratory calculations and drawings. The focus is on the size and location of air handling units, air shafts and ducts.
- Insight in the technical principles of an efficient installation for heating, cooling and ventilation at the level of distribution and supply, supported by exploratory calculations, drawings and schematic diagrams. Referencing to proven successful techniques used in other modern high rise buildings will be appreciated.
- Describe and illustrate how the required climate is achieved in some representative rooms, and provide a corresponding heating and cooling load calculation, e.g. using DesignBuilder.

Transportation and maintenance

- Design of an economic and effective transportation system: elevators, staircases, sky-lobbies and corridors.
- A vertical diagram of the lifts in their assigned functional grouping is required. It should show all lift stops with pits underneath and headrooms/machine rooms on top, and information about car loads and dimensions, nominal speeds and the control system per lift(group).
- Easy maintenance of the façade should be considered as well.

Fire-safety

- The philosophy and design of the fire-safety-concept of the building.

Energy, comfort and daylight simulations

- The way to calculate thermal comfort, daylighting and energy use is described in a separate document. Additional calculations of sustainable energy production, for instance of photovoltaic energy, can be done with e.g. Grasshopper
- A CFD-calculation for a subject of choice. For instance, to evaluate thermal comfort in an atrium, ventilation effectiveness of a space or wind comfort around the building.

Communication, presentation and report

The work of the climate and sustainability consultant will also be evaluated on the basis of the level of cooperation with other team members and quality of the discussions with the climate teacher, an easy to follow presentation and transparency of the report.

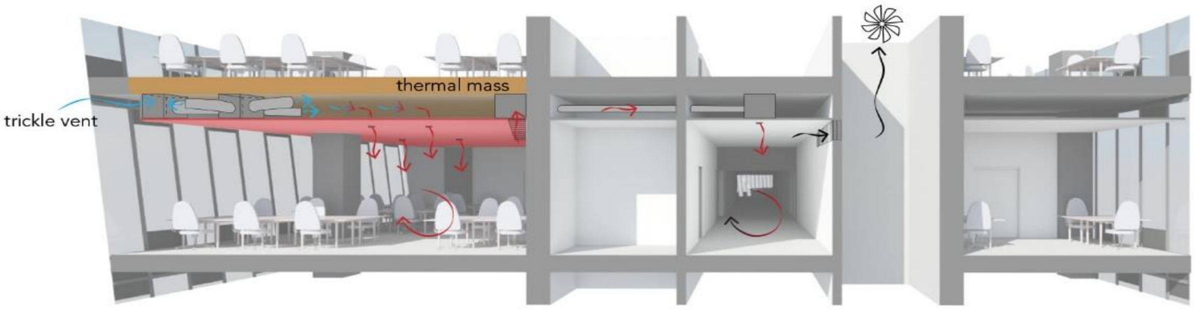
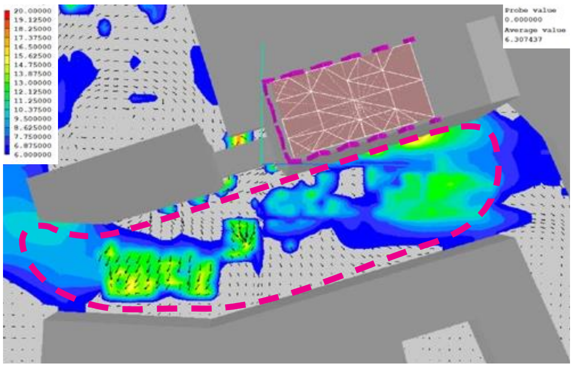


Image: Climate concept by S. Mori and S. Ramachandran, Team 10 (2018)

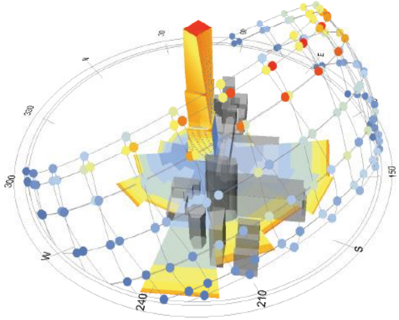
6.2.3 Assessment Criteria

Assessment criteria for the climate designer (determining the individual grade for the climate engineers of each team):

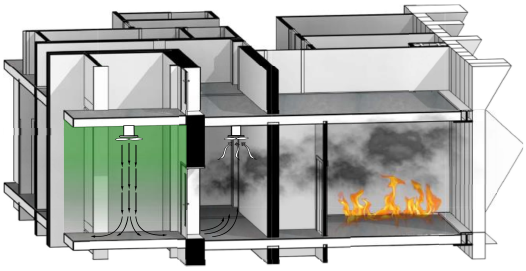
Climate design (Individual grade) - Assignments Criteria Table		
	Learning activity / deliverable	**Grading**
Climate Concept		**15 %**
Comfort and health	To what extend are the indoor (and outdoor) comfort and health criteria well formulated and substantiated?	
Heating, cooling and ventilation	To what extend are the heating, cooling and ventilation methods fitting with the chosen indoor comfort and health criteria?	
Energy	To what extend is energy produced on the building and the building plot?	
Depth of elaboration of the climate concept		**40 %**
Indoor comfort	To what extend do the indoor (and outdoor) comfort and health calculations prove that the criteria are met?	
Heating, cooling and ventilation	To what extend are the heating, cooling and ventilation systems integrated in the facade, the construction and, possibly, the computational model at different scale levels?	
Energy	To what extend are the calculations of the building energy demand and the building energy production correctly done and meet the criteria?	
Transport	**Design of an economic and effective transportation system: elevators, staircases, sky-lobbies and corridors. Easy maintenance of the façade should be considered as well.**	**15 %**
Fire-safety	**The quality of the fire-safety-concept of the building.**	**15 %**
Report		**15 %**
Structure	Is the report easy to read? Does it have a clear structure? Does the size of the report fit the content? Is the referencing correct and complete?	
Presentation of results	To what extent are the results presented in a well-organised manner (figures, equations, tables, schemes and diagrams)	
Language	To what extend is the quality of English spelling, grammar and style sufficient?	
		100 %



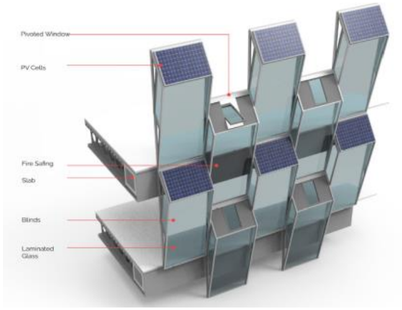
Windflow study by H. Yang, Team 02 (2018)



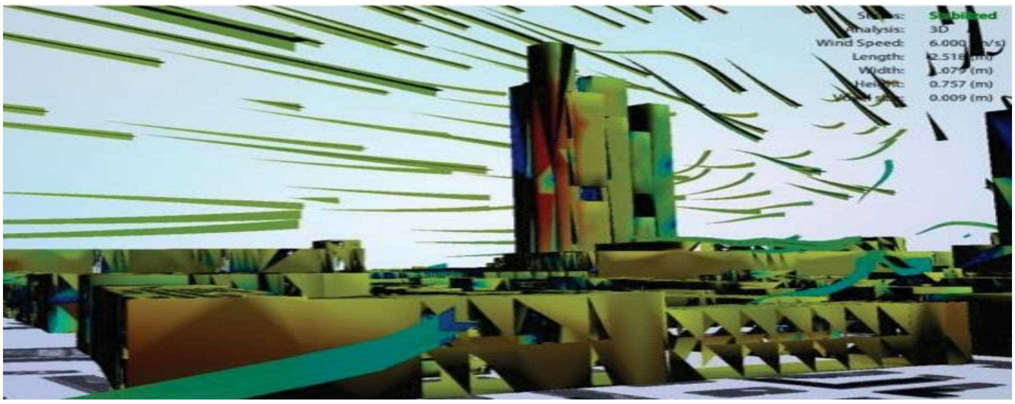
Solar Analysis by Team 10 (2017)



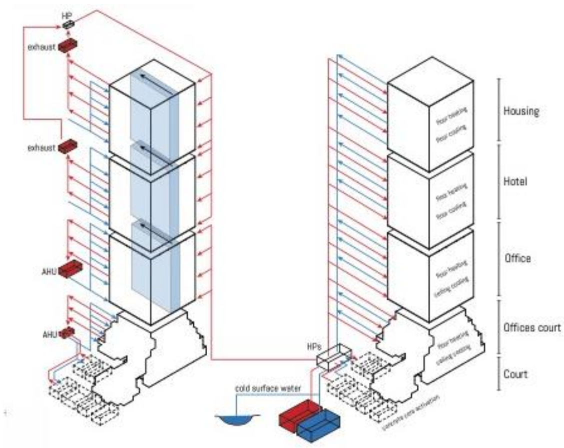
Fire safety concept by J. Dijkema, Team 07 (2018)



Climate concept by P. Nanda and D. Awe, Team 06 (2018)



Windflow study by E. Kapoor, Team 11 (2018)



HVAC systems by D. Vancso, Team 02 (2017)

COMPUTATIONAL DESIGN

7. SPECIFICATIONS FOR COMPUTATIONAL DESIGN

In general, Computational Design in building design addresses the application of information, communication and knowledge technologies for the entire breadth of the architectural design domain. This ranges from the conceptual design to the construction, operation during use and even demolishing or disassembling of buildings. The course AR0026 MEGA focuses on the early design phases (conceptual and design development phases). The design decisions taken during these early phases are crucial; because they have an enormous impact on the final building performance (how well the building will meet the requirements) as well as other aspects such as costs. Design changes occurring in later stages often come at a major time cost, producing delays in further stages or reducing the amount of time available for properly addressing certain features. Therefore, choosing the desirable design direction during the early design phases is essential. It is also challenging as it means to find a proper way to combine and integrate functional, technical, aesthetical, social, financial aspects and other aspects.

7.1 ROLE AND VISION

Highly performing buildings are increasingly necessary, also in view of urgent sustainability goals. Achieving highly performing buildings does not require just the appropriate engineering of architectural designs; it requires an integral design approach since the early stages. In the course MEGA, Computational Design is put forward as support to incorporate the different criteria in integrated computational models and facilitate the multidisciplinary design team to analyse and compare different scenarios in which different criteria are eventually analysed and prioritized. It allows the designers to explore very large numbers of design alternatives, under different simulated conditions, to identify optimal and preferred design solutions in a design exploration process. Computational design for integrating architectural and engineering design is meant for understanding the design options and related consequences. It differs from engineering optimization, which aims at providing an optimized mono-disciplinary design solution.

This occurs by using and developing computational design methods, techniques and tools to integrate interdisciplinary aspects in the design process. Often, this requires setting up a workflow for information exchange between different software packages since no current software package can cover entirely all what is needed. Students deal with customized digital workflows that support an integral design approach, in which architectural features are integrated with effective engineering. The digital workflows aim at facilitating the identification of well-performing design solutions in the early phases, in an interdisciplinary integrated manner.

Estimating in the early design phase how well different design solutions meet certain design requirements is challenging. One challenge is the complexity of building design. Each architectural project requires the convergence of soft and hard aspects, in an interdisciplinary manner. Social, financial, artistic, technical, engineering and other disciplines come together toward a design solution satisfying requirements from different fields. Dealing with this breadth of performance requirements, contributes to the complexity of the process. How can many different and often conflicting requirements be satisfied at best in one project? One other challenge is the scarcity of information during early design phases. In conceptual design, the information on the performance implications tends to be scarce. Traditionally, the design process integrates few performance estimations in the early phases and delegates most of the engineering assessments to later stages. Considering data on structural performance, on climatic performance and on other technical performances tend to be left for the later engineering process after the massing; the layout; and the envelope of the building are already shaped. Differently, AR0026 MEGA advocates the importance of generating and considering this information since the very beginning of the design, based on interdisciplinary integration. How can relevant (numeric) data be collected, generated and used for making informed design decisions?

In MEGA, the computational designer deals with both challenges. (S)he focuses on computational methods, techniques and tools to support the complex interdisciplinary collaboration and to support the generation of performance data and information in the early phase (e.g. to predict the building performances for some disciplines such as climate design; structural design; façade design; real estate values; etc.).

7.1.1 Collaborative Design

Collaborative design deals with the need of exchanging data and information across disciplines. This includes communication and exchange of data among experts from different disciplines as well as possible negotiations on design solutions according to the level of satisfaction against different design criteria. Technically, it aims at devising simultaneous interdisciplinary collaborative design during the entire design process, toward transparent processes based on BIM principles.

In terms of collaborative design, the computational designer is responsible for:

- Developing an interdisciplinary workflow for the design process, based on the 3D modelling and communication software used within the design team;
- Organizing a core model where each discipline can update the 3D design periodically;
- Coordinating the integration of (3D) digital models from the team's disciplines.

7.1.2 Performance-based design

Performance-based design deals with the integration of performance assessments in order to help the designer make informed choices. Abstract definitions of performance have to be formulated via measurable indicators for different engineering discipline at an early stage. The 3D models for modelling the form of the buildings can be coupled with these numeric evaluations and performance simulations, in order to assess different design alternatives. Technically, it includes the digital generation of (parametric) design alternatives; the assessment of their performances based on digital process and simulations; the eventual use of computational optimization and data analytics to facilitate the identification of well-performing solutions.

In terms of performance-based design, the computational designer is responsible for:

- Supporting disciplines to convert the relevant engineering goals at each design step into measurable criteria (performance indicators);
- Supporting disciplines to set up parametric models to generate design alternatives;
- Supporting disciplines to set up relevant simulations coupled with the parametric models, for numeric assessments of the performance indicators;
- Use optimization loops for identifying well-performing design options;
- Use digital visualization and data analytics to help the team making design decisions.

7.1.3 Readers

The readers listed here regard content on computational design approaches and methods. The tutorials and teaching materials on tools and software are available on-line in TOI-Pedia by the Chair of Design Informatics at http://wiki.bk.tudelft.nl/toi-pedia/Browse_by_Course > AR0026. Additionally, do look at the PDF provided in BrightSpace "AR0026 MEGA 2019. COMPUTATIONAL DESIGN. Collection of notes and study material"

General Introduction:

- Jeffries, Paul, What is computational Design? (2016) available at https://blog.ramboll.com/rcd/articles/what-is-computational-design.html
- Burry, J., Burry, M., (2010) The New Mathematics of Architecture, Thames & Hudson.
- Kolarevic, B., (2005), Performative Architecture: Beyond Instrumentality, Spon Press

Collaborative design (mandatory):

- Runberger, J. and Lienhard, J., 2018. Collaborative Models for Design Computation and Form Finding—New Workflows in Versioning Design Processes. In Humanizing Digital Reality (pp. 463-478). Springer, Singapore. https://link.springer.com/chapter/10.1007/978-981-10-6611-5_40
- Borhani, A., Dossick, C.S., Meek, C., Kleiner, D. and Haymaker, J., 2019. Adopting Parametric Construction Analysis in Integrated Design Teams. In Advances in Informatics and Computing in Civil and Construction Engineering (pp. 351-358). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-00220-6_42
- Cristie, V., Joyce, S.C., 2017. Capturing and Visualising Parametric Design Flow Through Interactive Web Versioning Snapshots. In Proc. of IASS Annual Symposia (2017, No. 5, pp. 1-8). Intern Association for Shell and Spatial Structures. https://www.researchgate.net/profile/Sam_Joyce2/publication/320299523_Capturing_And_Visualising_Parametric_Design_Flow_Through_Interactive_Web_Versioning_Snapshots/links/59dca2a3aca2728e201f8656/Capturing-And-Visualising-Parametric-Design-Flow-Through-Interactive-Web-Versioning-Snapshots.pdf

Performance based-design – parametric modelling (mandatory):

- Hudson, R. (2010). Strategies for Parametric Design in Architecture: An application of practice led research (Doctoral dissertation, University of Bath). http://opus.bath.ac.uk/20947/
- Wortmann, T. and Tunçer, B., 2017. Differentiating parametric design: Digital workflows in contemporary architecture and construction. Design Studies, 52, pp.173-197. https://doi.org/10.1016/j.destud.2017.05.004
- Gane, V., Haymaker, J., (2010). Design Scenarios: Enabling Requirements-Driven Parametric Design Spaces. In: Stanford Center for Integrated Facility Engineering Techincal Report # 194.

Performance based-design – optimization (mandatory):

- Ekici, B., Cubukcuoglu, C., Turrin, M. and Sariyildiz, I.S., 2018. Performative computational architecture using swarm and evolutionary optimisation: A review. Building and Environment. https://doi.org/10.1016/j.buildenv.2018.10.023
- Wortmann, T., 2018. Efficient, Visual, and Interactive Architectural Design Optimization with Model-based Methods https://www.researchgate.net/profile/Thomas_Wortmann/publication/327199280_Efficient_Visual_and_Interactive_Architectural_Design_Optimization_with_Model-based_Methods/links/5b7f697d299bf1d5a723c54d/Efficient-Visual-and-Interactive-Architectural-Design-Optimization-with-Model-based-Methods.pdf
- Evins, R., A review of computational optimisation methods applied to sustainable. http://www.sciencedirect.com/science/article/pii/S1364032113000920

- Turrin, M., Von Buelow, P., & Stouffs, R. (2011). Design explorations of performance driven geometry in architectural design using parametric modeling and genetic algorithms. Advanced Engineering Informatics, 25(4), 656-675. https://www.sciencedirect.com/science/article/pii/S1474034611000577
- Giouri, E.D., Tenpierik, M. and Turrin, M., (2020). Zero energy potential of a high-rise office building in a Mediterranean climate: Using multi-objective optimization to understand the impact of design decisions towards zero-energy high-rise buildings. Energy and Buildings, 209, p.109666. https://doi.org/10.1016/j.enbuild.2019.109666
- Du, T., Turrin, M. Jansen, S. and van den Dobbelsteen, A., (2020) Gaps and requirements for automatic generation of space layouts with optimised energy performance. Automation in Construction.
- Lin, S. H. E., & Gerber, D. J. (2014). Designing-in performance: A framework for evolutionary energy performance feedback in early stage design. Automation in Construction, 38, 59-73.
- Lin, S. H., & Gerber, D. J. (2014). Evolutionary energy performance feedback for design: Multidisciplinary design optimization and performance boundaries for design decision support. Energy and Buildings, 84, 426-441. https://doi.org/10.1016/j.enbuild.2014.08.034
- Brown, N., de Oliveira, J. I. F., Ochsendorf, J., & Mueller, C. Early-stage integration of architectural and structural performance in a parametric multi-objective design tool. https://www.researchgate.net/profile/Caitlin_Mueller/publication/316093348_Early-stage_integration_of_architectural_and_structural_performance_in_a_parametric_multi-objective_design_tool/links/58f00c5aaca27289c20fd9a2/Early-stage-integration-of-architectural-and-structural-performance-in-a-parametric-multi-objective-design-tool.pdf
- Wortmann, T., Waibel, C., Nannicini, G., Evins, R., Schroepfer, T. Carmeliet, J., (2017). Are genetic algorithms really the best choice for building energy optimization?. In Proceedings of the Symposium on Simulation for Architecture and Urban Design. Society for Computer Simulation International. https://doi.org/10.1016/j.destud.2017.05.004
- Cubukcuoglu, C., Ekici, B., Tasgetiren, M.F. and Sariyildiz, S., 2019. OPTIMUS: Self-Adaptive Differential Evolution with Ensemble of Mutation Strategies for Grasshopper Algorithmic Modeling. Algorithms, 12(7), p.141. https://www.mdpi.com/1999-4893/12/7/141
- Waibel, C., Wortmann, T., Evins, R. and Carmeliet, J., 2019. Building energy optimization: An extensive benchmark of global search algorithms. Energy and Buildings, 187, pp.218-240. https://doi.org/10.1016/j.enbuild.2019.01.048

Performance based-design – data analytics and optioneering (mandatory):

- Pan, W., Sun, Y., Turrin, M., Louter, C., Sariyildiz, S., (2020). Design exploration of quantitative performance and geometry typology for indoor arena based on self-organizing map and multi-layered perceptron neural network. Automation in Construction, 114, p.103163. https://doi.org/10.1016/j.autcon.2020.103163
- Wortmann, T. and Schroepfer, T., 2019. From Optimization to Performance-Informed Design. In Proc. SimAUD https://www.researchgate.net/profile/Thomas_Wortmann/publication/332407077_From_Optimization_to_Performance-Informed_Design_Simulation-based_Design_Tools_and_Methods_Architectural_Design_Optimization_Visualization_of_Optimization_Results/links/5cb2c1be92851c8d22e9b37e/From-Optimization-to-Performance-Informed-Design-Simulation-based-Design-Tools-and-Methods-Architectural-Design-Optimization-Visualization-of-Optimization-Results.pdf
- Chen W., Janssen P., Schlueter A 2015 Analysing populations of design variants using clustering and archetypal analysis https://www.researchgate.net/profile/Kian_Chen/publication/311534315_Analysing_Populations_of_Design_Variants_Using_Clustering_and_Archetypal_Analysis/links/584abdac08aecb6bd8bd04a8.pdf
- Janssen, P., & Stouffs, R. (2014). Multi-Perspective Urban Optioneering. eCAADe, Northumbria University. https://s3.amazonaws.com/academia.edu.documents/41762902/Multi-Perspective_Urban_Optioneering20160129-5674-1488nd7.pdf

Performance based-design – surrogate models (optional)

- Yang, D., Sun, Y., Sileryte, R., D'Aquilio, A. and Turrin, M., 2016. Application of surrogate models for building envelope design exploration and optimization. In Proceedings of the Symposium on Simulation for Architecture and Urban Design (pp. 11-14). https://www.researchgate.net/profile/Michela_Turrin/publication/303913707_Application_of_Surrogate_Models_for_Building_Envelope_Design_Exploration_and_Optimization/links/575d3cd708ae9a9c9559f7f7.pdf
- Yang, D., Sun, Y., Di Stefano, D., Turrin, M. and Sariyildiz, S., 2016, July. Impacts of problem scale and sampling strategy on surrogate model accuracy: An application of surrogate-based optimization in building design. In 2016 IEEE Congress on Evolutionary Computation (CEC) (pp. 4199-4207). IEEE. https://ieeexplore.ieee.org/abstract/document/7744323
- Ekici, B., Kazanasmaz, T., Turrin, M., Tasgetiren, M.F. and Sariyildiz, I.S., A Methodology for daylight optimisation of high-rise buildings in the dense urban district using overhang length and glazing type variables with surrogate modelling. https://www.researchgate.net/profile/Berk_Ekici/publication/335715852_A_Methodology_for_daylight_optimisation_of_high-rise_buildings_in_the_dense_urban_district_using_overhang_length_and_glazing_type_variables_with_surrogate_modelling/links/5d776f39a6fdcc9961bcb84c/A-Methodology-for-daylight-optimisation-of-high-rise-buildings-in-the-dense-urban-district-using-overhang-length-and-glazing-type-variables-with-surrogate-modelling.pdf

Additional readers (optional):

- SimAUD 2009-2018: http://simaud.com/proceedings/
- Advances in Architectural Geometry (2008), Conference Proceedings, available at http://www.architecturalgeometry.at/aag08/aag08proceedings-papers_and_poster_abstracts.pdf
- Almusharaf, Ayman M.; Mahjoub Elnimeiri (2010) A Performance-Based Design Approach for Early Tall Building Form Development, CAAD - Cities – Sustainability, Proceedings of ASCAAD 2010, pp. 39-50.
- Attar, R., Prabhu, V., Glueck, M., Khan, A. (2010). 210 King Street: A Dataset for Integrated Performance Assessment. SimAUD 2010 Conference Proceedings: Symposium on Simulation for Architecture and Urban Design, pp. 27-30.
- Cross, P., Vesey, D., Chan, C.M., (2007), High-Rise Buildings. In Melchers, R.E., Hough, R., (Ed), Modeling complex engineering structures, ASCE Publications, 2007.
- Negendahl, K. (2015). Building performance simulation in the early design stage: An introduction to integrated dynamic models. Automation in Construction, 54, 39-53. https://www.sciencedirect.com/science/article/pii/S0926580515000369
- Pottmann, H., Asperl, A., Hofer, M. Kilian, A., (2007), Architectural Geometry. Bentley Institute Press.
- Stylianos, D., Charitou, R., Hesselgren, L., (2006) Computational Methods on Tall Buildings - The Bishopsgate Tower, Communicating Space(s) In proceedings of eCAADe 2006, pp. 778-785.

Relevant MSc thesis:

- E. Giouri, Zero Energy Potential of a High Rise Office Building in a Mediterranean Climate. https://repository.tudelft.nl/islandora/object/uuid%3Ab9943d48-eaab-4276-877d-fce9934a766d?collection=education
- D. Poniou, Computational optimization for facade design of a nearly zero-energy high-rise office building in temperate climate. https://repository.tudelft.nl/islandora/object/uuid%3A990911ae-7a8a-4407-84da-e1feebf14265?collection=education
- F. El Hadji, Design parameter guidelines for purely passive cooling buildings in Tropical regions https://repository.tudelft.nl/islandora/object/uuid%3Ad82e943e-58f1-4745-abb8-c7027f0674cc?collection=education

- M. Porcelli, Optimization Design Workflow for Large Roof Shading Systems https://repository.tudelft.nl/islandora/object/uuid%3A56e5bda5-7ea5-4bfe-bcb0-5e670d37f4b2?collection=education
- S. Prins, Sun shading of the future https://repository.tudelft.nl/islandora/object/uuid%3Aeab25c38-e0fa-4419-bcce-088ed9c52515?collection=education
- F. Guzman, Optimized Green Walls: Study of Vertical Green Systems' Performance in an Urban Setting https://repository.tudelft.nl/islandora/object/uuid%3A85daafee-5ddb-4d2e-b7cd-08d0663aac28?collection=education
- J. v Kastel, Visual Analytics for Generative Design Exploration. https://repository.tudelft.nl/islandora/object/uuid%3Aad6f454b-0e67-4664-88d4-87d2132a1f71?collection=education
- A. Rodriguez, Computational Design Method Based on Multidisciplinary Design Optimization and Optioneering Techniques for Energy Efficiency and Cost Effectiveness https://repository.tudelft.nl/islandora/object/uuid%3Aefd1c23f-4ab7-41dd-88e4-e9a1683c4ccc?collection=education

7.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments. Note: Computational Design tutors are not software teachers; in the entire process they guide students on computational approaches and methods.

7.2.1 Weekly Milestones

Overview of the Computational Design Process and Weekly Milestones. This overview comprises a breakdown of different steps and of foreseen itinerary. However be aware the breakdown is a simplification. In reality to some extent all steps should be considered simultaneously. The weeks are dedicated to themes and design means; evidently all other sketches and drawings that you would like to produce are of course welcomed.

when	Key word	Content and actions	Questions and notes
Week 4.1	INTRO	Attend the lectures. Familiarize with design assignment; Familiarize with team members and their responsibilities. Analyse the digital background and software skills of the team members. Make an inventory of software and digital tools that are expected to be used within the team. If you are not familiar with Rhino and Grasshopper and other software, you may look at the tutorials in TOIPedia AR0026 Week 1.	The week is fully scheduled with lectures and introductory activities.
Week 4.2	VOLUME	Attend the workshops. Familiarize with different options for organizing and coordinating an **INTERDISCIPLINARY COLLABORATIVE WORKFLOW AND DIGITAL CORE MODELS**. Follow tutorials for improving your skills with some software if needed. Look at the tutorials in TOIPedia AR0026 Week 2-3. Initiate the collaborative digital workflow. Recommended but not mandatory: Make **PARAMETRIC MASSING MODELS**. The architect and the whole team will work on volumetric models scale 1:500 and will translate the volumetric sketches into drawings, by imposing a grid system, or measurement-system. As computational designer, you can work on the massing by quickly generating design alternatives integrating numerical estimations of floors' areas, volumes, etc. Try to integrate in your 3D models also other assessments, such as shadows analysis from and to the context. At the pin-up, the team will chose one design concept. This choice will depend both on A) non-numerically measurable values and B) numeric data and quantities. A) Make sure the 3D parametric massing models can be used by the team to better understand the relations with the context, the visual impacts, the sculptural value of the masses, etc. The 3D digital models are integral part of the preliminary studies, together with hand drawings, sketches, physical models for massing. B) Make sure the team can extract useful numeric data from the parametric massing.	At the pin-up, the team will chose one design concept. Until the PinUp, in week 4.2 each team is working on several design proposals to be presented at the PinUp. This includes the analysis of the qualities of the different design proposals. As computational designer: What is the data supporting each design proposal? How is this data communicated across disciplines and how are different disciplines integrated? How can the team use the data to be informed about the potentials / drawbacks of different design options? How can the 3D models help the team understand the values associated with them. To be discussed at PinUp. Use the parametric massing models already to test and tune the digital collaborative workflow. (They are part of the digital collaborative design, not a separate exercise).

Week 4.3	SYSTEM	Finalize the set-up of **COLLABORATIVE DIGITAL WORKFLOW.** The team will now use it to work on the chosen design concept. After the PinUp, the team has chosen one design concept to develop further. Focusing on that concept, each team member will now work on his/her own digital models, but will exchange information and geometry within the team; and will integrate 3D geometry in a shared core model. Each team may customize this process, depending on the skills of the team-members and on the specificities of their design. By this week, the computational designer should finalize the organisation of this customized workflow. Make sure everyone is comfortable with the suggested workflow. Information and models must be shared effectively, without any discipline lacking information but also without any discipline being bothered by an excess of unneeded information. To anticipate next task, consider the chosen design concept and assess what computational task can be applied to the parametric design alternatives to support the documentation for the mid-term presentation. Look at the tutorials in TOIPedia AR0026 Week 2-3.	After the PinUp, the team has chosen one design concept to develop further. Each discipline is now involved in developing and improving it. As computational designer: What is an appropriate workflow to allow individual work in a shared collaborative process? How can the team work on individual digital models and share information in a core digital model? What are the design features that require the highest interdisciplinary collaboration? What are the shared parameters across disciplines? What are the parameters that each discipline can tackle individually?
Week 4.4	CONTEXT	Set-up and start performing the **COMPUTATIONAL NUMERIC ASSESSMENT ON PARAMETRIC DESIGN ALTERNATIVES** needed for the midterm presentation. The meaningfulness of the parametric models in relation to the needed assessment is crucial. Attention must be paid to the identification of meaningful parameters and appropriate performance assessment methods.	
Week 4.5	VERTICAL LOGIC/SECTION SPACE	Perform and finalize the computational numeric assessment on parametric design alternatives needed for the midterm presentation. The mid-term presentation will focus on one design concept (chosen at the pinup) but will consider possible design alternatives within that concept. For example, different climate strategies, different façade systems, different structural elements, etc. The data generated from the computational numeric assessment on parametric design alternatives must be helpful in order to address (some of) these alternatives and to make an informed design choice. Numeric data from parametric models are not the only criteria based on which the team will chose. Therefore make sure numeric data is visualized in a way that allows the team to consider it also based on other (non-numeric) design aspects.	At the mid-term, the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details, but all disciplines must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.
Week 4.6	SENSES	**OWN TOPIC**: After mid-term, the team converges the efforts to finalize the design. As computational designer, identify one specific topic in the design, which can benefit from a deeper analysis. Depending on the design, the specific topic may regard the façade, the climate, the structure, or else as agreed during consults. It is preferred that the chosen topic is related to the integration of relevant interdisciplinary design aspects. This specific topic may regard for example the computational optimization of geometries for some specific performance, the parametric detailing of complex geometries for fabrication and construction, or else. Once this topic is identified, set-up a specific computational workflow for you to deal with this topic. Also: Keep checking interdisciplinary collaborative workflow.	What is the main soul/character of the design? As part of this main soul/character, what relevant aspect of the design is challenging for the team to develop manually? What aspect would benefit from a deeper computational process? What computational process would provide this support appropriately?
Week 4.7	PATTERN	Work on your own topic in collaboration with the relevant team-members. Also: Keep checking the interdisciplinary collaborative workflow.	
W 4.8	CAVITY	Finalize own topic. With the team, check the overall design holistically, with assessments and discussions on full 3D model. Also: Keep checking interdisciplinary collaborative workflow	

W 4.9		No consults are planned for this week. Finalize the work and prepare for the final presentation.	See section 4. DELIVERABLES
W 4.10 W 4.11		No consults are planned for this week. Finalize eventual improvements. Write the report and finalize the final deliverables.	See section 4. DELIVERABLES

7.2.2 Deadlines and Deliverables

when	what	content	format
W 4.2	PinUP	Preliminary understanding and reflections on the use of computational workflows in complex projects: concept ideas.	See section 4. DELIVERABLES
Week 4.5	Mid-term	• How the interdisciplinary core model is structured. A) How the digital collaborative workflow was structured across disciplines; including diagrams on data and 3D models exchanges/integration. B) How the digital collaborative workflow is planned across disciplines, after mid-term; including diagrams on data and 3D models exchanges/integration. • In relation to the parametric 3D models, the relevant numeric performance indicators and design variables. Use the parametric 3D models and numeric data from simulations to support the design choices; use them to argue pros and cons of possible choices	See section 4. DELIVERABLES
Week 4.9	Finals	• The integrated core model of the final design: How is the overall digital collaborative workflow setup across disciplines; including diagrams on collected data and 3D models exchanges/integration. • Your own computational topic: How it is part of the main character of the design; how did the computational workflow influence the overall process; The results of the performance assessments/simulations for several parametric design alternatives; The results of the optimization runs, explaining why certain solutions perform better than others. The reflections on the technical performances of the final design compared to data from other simulated solutions and optimized design alternatives. (Not necessarily all final design choices derive directly from the best performing simulated solutions. The final design may be based also on other reasons. However, data from simulations and optimization can be used to illustrate pros and cons of the choices made).	See section 4. DELIVERABLES
Week 4.11	Deliverables	• Individual report(*) • 3D files and related scripts/gh definitions	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

(*) FINAL REPORT: The final report should be organized in 4 chapters:
1) Collaborative computational workflow
2) Performance-based design preliminary design (before mid-term)
- Parametric models
- Simulations / optimisation / numeric data

3) Performance-based design definitive design (after mid-term – own topic)
- Parametric models
- Simulations / optimisation / numeric data

4) Final integrated core models

It should:
- Present and illustrate the flow of data and geometry from the single models to the core model and vice versa, with emphasis on integrative principles, the interdisciplinary file exchange process and the archive

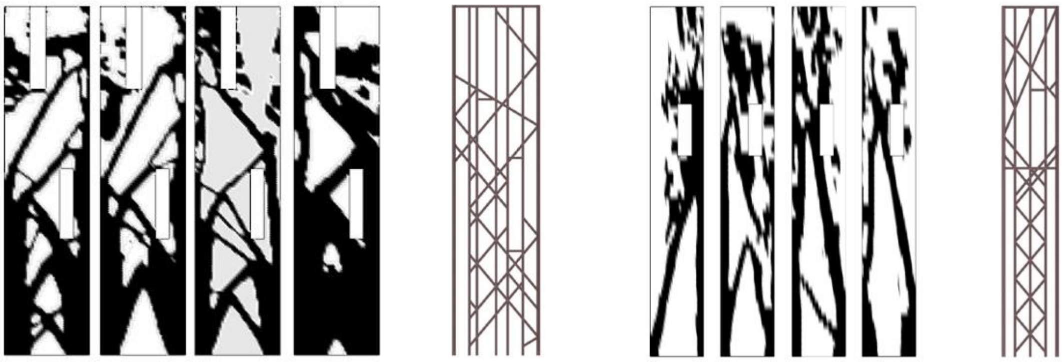
structure and the logic of the file naming – with emphasis on readability across disciplines. The report should include personal and critical reflection on the advantages or challenges of the process.

- Present and illustrate the flow of communication and the integrative principles of the interdisciplinary communication file exchange process and the archive structure and the logic of the file naming – with emphasis on readability across disciplines. The report should include personal and critical reflection on the advantages or challenges of the communication process.
- Present and illustrate the digital massing models and their (parametric) logic;
- Present and illustrate the parametric models, including an explanation on the choice of the design variables.
- Present and illustrate the simulations connected to the parametric models and their results, including an explanation on the choice of the performance indicators.
- Present and illustrate the optimization runs, including a critical reflection on performance differences between optimal solutions and sub-optimal solutions. Please explain how the optimization results were used to make design choices; or could be used to further improve the final design.
- Present and illustrate any eventual (parametric) logic developed to (pre)rationalize complex geometries toward production and construction.
- Present and illustrate the organisation of the final core models
- If Virtual Reality models are used during the design process, please include a section describing this work.
- Note: in the final report, appendixes are welcome, illustrating in details the digital models as well as the eventual scripts/codes.

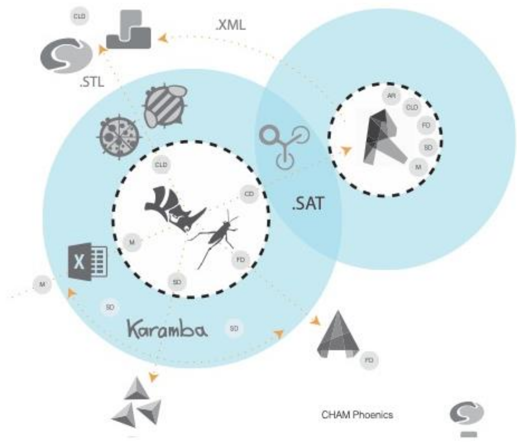
7.2.3 Assessment Criteria

Assessment criteria for the computational designer (determining the individual grade for the computational designer of each team):

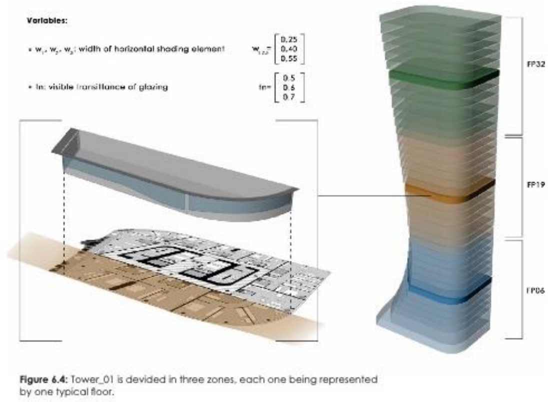
Computational design (Individual grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Collaborative computational workflow: Was the collaborative computational workflow set meaningfully and effectively for the design process across the different disciplines? Was the overall computational coordination appropriate?	20%
Interdisciplinary parametric design: By means of integrated parametric 3D models, did the computational designer support the interdisciplinary decision making process meaningfully and effectively? Where the 3D parametric models well organized, meaningful and coherent with the design concept and design goals? How much were the models informative to generate and compare parametric design alternatives?	20%
Interdisciplinary numeric performance assessment and optimization: By means of computational simulations and optimization, did the computational designer support the interdisciplinary decision making meaningfully and effectively? How much the data (produced based on optimization) were informative in order to explore (in a numerically-informed manner) different design options?	20%
Collaborative interaction within the team: how much was the student able to understand the design intentions of the architect and help him/her to enhance the qualities and design identity of the concept (by means of appropriate computational methods)? How much was the student able to understand the engineering ideas and support the engineers to achieve well-performing design solutions (by means of numeric performance assessments)? How much was the student able to facilitate the overall design integration by means of 3D models and numeric data?	20%
Final 3D models and representations: How much were the final core models appropriate and integrated across disciplines?	5%
Final deliverable: What quality has the final report? Is the report complete? Is the text well written? Are the images meaningful and appropriate?	15%



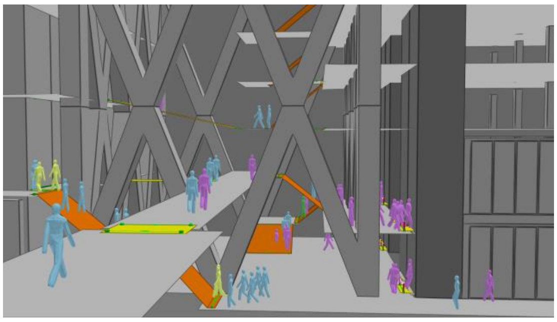
BESO Structural Optimisation of Mega Frame, Computational report, Team 03 (2017)



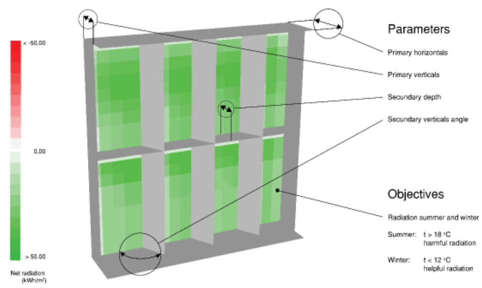
Computational worflow by N. Christidi, Team 02 (2018)



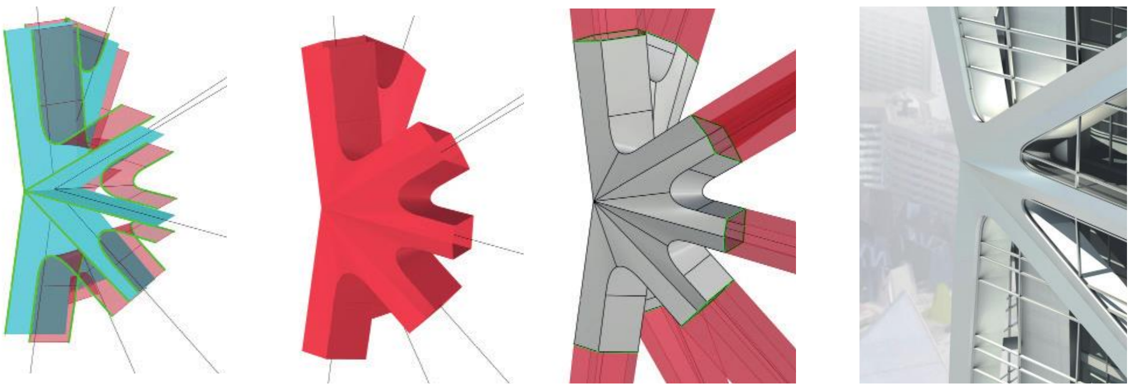
Solar shading optimisation by D. Pouniou, Team 03 (2018)



MassMotion simulation by J. de Bruijn, Team 09 (2018)



Façade optimisation setup by F. Bruinsma, Team 08 (2018)



Structural node modelling by E. Estrado, Team 10 (2018)

FAÇADE DESIGN

8. SPECIFICATIONS FOR FACADE DESIGN

Façade engineering concerns all the functional, technical and architectural aspects related to the design of the outer envelope of the building.

8.1 ROLE AND VISION

In the façade zone many aspects come together and have to be integrated into a well-fitting design:

- The architectural appearance of the building is strongly determined by the chosen material, texture, colour, reflection and rhythm of the façades;
- The quality of the lettable floor space is influenced by the available view over the city and the aesthetic performance of the façades;
- The load bearing structure of high rise buildings is often functionally related to or integrated with the façade; the façade in itself will also have to be structurally safe and robust, even when not part of the main structure;
- The climate design of the building is directly linked to the glass percentages, sun shading, thermal insulation and other building physical parameters, some of which are legally imposed upon the project;
- The façade will have to fulfil obvious traditional functions such as being a proper and robust barrier between the building and the outside by offering wind and water tightness and protection against the elements, offering fire protection, including enough cleaning and maintenance facilities;
- The performance characteristics of the building in terms of maximum energy use, embodied energy and required sustainability are mainly determined by the quality of the façade design. For instance, in order to create a sustainable building several energy collecting devices (for instance solar collectors, PV cells, integrated shading systems, etc.) probably will have to be integrated in the façade carefully from the beginning of the initial design phase. In terms of circularity and sustainable materials one should carefully think about disassembly, recyclability and reusability of chosen materials.
- Finally, the total building costs are determined for an important part by the design of the façade: approximately 20 to 30% of the investment for a high-rise building is spent on the façade; these costs are partially determined by for instance the logistics of the façade assembly, material usage, possibility of serial production, etc. Consequently, these aspects already have to play an important role during the design phase. Also, the façade plays an important part during the usage phase in terms of maintenance cost, Maintenance cost should therefor already carefully be considered in the design stage.

8.1.1 Responsibilities

The engineer working in the team as façade designer is responsible for the integration of the above aspects in the façade designs for subsequent building parts. (S)He initiates and concludes the communication of all façade related design choices with the other designers and manager of the project. On a number of aspects, calculations are made to underpin the design. The façade engineer is not responsible for detailed analysis of every single aspect, but will have to show that it is plausible that the façade will function as required and will be feasible in a realistic situation. Usually, more than one façade design is made as a result of the mixed use program with ranging functional requirements, the splitting of the program over multiple buildings on the site, the different orientation towards the sun, etc. This results in several façade designs with subsequent elevations, sections and details. Several drawings will have to be made to communicate the design choices and method of assembly.

8.1.2 Readers and Bibliography

- Technoledge Facade Design: course material available on Brightspace
- Boswell (2013): Exterior building enclosures
- Knaack et al. (2014): Principles of Construction
- Watts (2013): Modern construction handbook
- Patterson (2011): Structural Glass Facades and Enclosures: a Vocabulary of Transparency

8.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments.

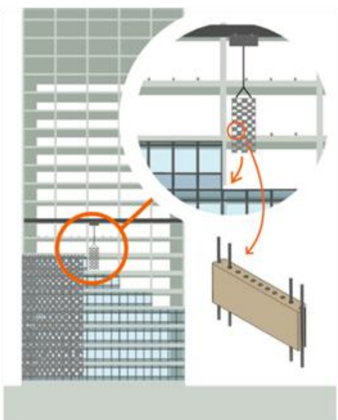
8.2.1 Weekly Milestones

Overview of the f Design Process and Weekly Milestones. This overview comprises a breakdown of different steps and of foreseen itinerary. However be aware the breakdown is a simplification. In reality to some extend all steps should be consider simultaneously. The weeks are dedicated to themes and design means; evidently all other sketches and drawings that you would like to make are of course welcomed.

Note from tutors: When consults are planned at the Studio, all students for façade design should you have ready for discussion some material. To have a fruitful meeting, please print you drawings (A3/A4 size) before the consults: looking at a laptop screen usually does not work.

when	Key word	Content and actions	Questions and notes
Week 4.1	INTRO	Lectures are given; please attend all of these lectures. Review important literature on façade design, such as the readers listed above. All of these available online through TU Library.	The week is fully scheduled with lectures and introductory activities. No individual consults with façade design tutors.
Week 4.2	VOLUME	Think about the following topics before the first consult: Sequence of topics in façade design: prepare a plan what to do first, when should final decisions by other team members be made to be able to finish two façade concepts in time for first presentation? Prepare for PinUp.	At the pin-up, the team will chose one design concept. Until the PiUp, this week each team is working on several design proposals to be presented at the PinUp. This includes the analysis of the qualities of the different design proposals, including facades.
Week 4.3	SYSTEM	Analyze the essential key elements and bottlenecks of your façade designs/ideas and try to come up with a clear vision, design strategy and some principle solutions. Also define which technical aspects/items and/or technical preconditions of your design needs more study / fine tuning and needs special attention in the design phase. Part of this analysis could be: • materialization in relation to suitability, functionality, architecture; • integration with other building functions such as load bearing structures and installations; • feasibility, manufacturability and assembly on site; • technical performance (building physics, acoustics, daylight and climate control, structure, etc.); • relation with architectural design: design grid following the floor plan, aesthetical appearance (texture, color, gloss, vertical/hor. lines …), etc.; • sustainability (embodied energy, circularity, disassembly, recyclability and reusability of chosen materials); • Maintenance aspects; • Level of integration with other disciplines; etc.	Before the consult, the following documents should be prepared: • Sketch drawings or sketches showing different ideas and concepts (technically, functionally, architecturally, etc.) of the different facades for both designs. • Show any other technical documents and/or information (articles, product information, reference projects, etc.) that support or illustrate possible façade concepts.
Week 4.4	CONTEXT		
Week 4.5	VERTICAL LOGIC/SECTION SPACE	The design work of the first weeks is concluded with a first presentation of the overall design so far. The inner and outer façades have to be developed on sketch-level according to the total design, proposed by the group. As being part of the final report, it is advised to already document the principle façade and building concepts and the design choices at this stage. Also, the principle measures and strategies to come to a sustainable building should be carefully explained and motivated. Later on in the project usually no time is left to do this thoroughly. This report is, however, not a part of the first presentation and does not have to be finished at this point.	At the mid-term, the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details (e.g. different facades), but all discipline must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.
Week 4.6	SENSES	Give reflection on the input and critics given during the first presentation and how this feedback will be translated and transposed into the design. Explain in more detail the façade design proposal in terms of sustainability, building integration and more practical aspects such as of façade assembly and disassembly, element sizes, cleaning, etc. See here for the list as part of Consult 2. Make a planning for the coming weeks.	

Week 4.7	PATTERN	On façade and all related aspects, most of the principle design decisions should be considered and be made by this week, such as: • Options for floors and location of columns; • Several (circa 3) ideas for the structure of the façade; • Size of the elements in relation to manufacturability and construction; • (Concrete) load bearing panels versus lightweight panels; • Façade composition (spandrel, full height, ….); • Building method; • Ideas on fixing procedure from the inside or outside; • Use of the crane or separate equipment; • Position of anchors; • Materials for the outside/inside (including dimensions), also in relation to sustainability; • Maintenance/cleaning; • Integration with other building functions (climate, daylight control); etc. For the quality of your façade design also rough performance calculations should be made. Think about the following aspects: • Acoustical performance; • Thermal Insulation and Energy Performance; • LCA; • Fire separation; • Wind load and wind noise; • Air tightness; • Maintenance and cleaning • Installations.	Be sure all façade aspects are properly coordinated with the entire team / all other disciplines. To show this coordination, the following drawings for facades should be ready: • (Concept) drawings of elevations, sections, etc. • (Concept) details of joints and connections.
Week 4.8	CAVITY	Start drawing and finishing your details in time! Usually you will need several iterations to develop good details. By now you should have the things for the final presentation ready on paper in a draft version. Don't change too much basic choices from now, or you have will have to work during the nights! With the team, check the overall design holistically, including based on assessment and discussions on the full 3D model.	• Details of joints and connections according to good architectural drawing standards (proper use of line styles, hatches, dimensions, textual explanations, etc.) • Discussion drawing work (see requirements final presentation)
W 4.9		No consults are planned for this week. Finalize the work and prepare for the final presentation.	See section 4. DELIVERABLES
W 4.10 W 4.11		No consults are planned for this week. Finalize eventual improvements. Write the report and finalize the final deliverables.	See section 4. DELIVERABLES



Façade assembly by L. Solarino, Team 06 (2017)

Façade fragment by V. Piccioni, Team 10 (2018)

Façade fragment model by M. Mourtzouchou, Team 02 (2017)

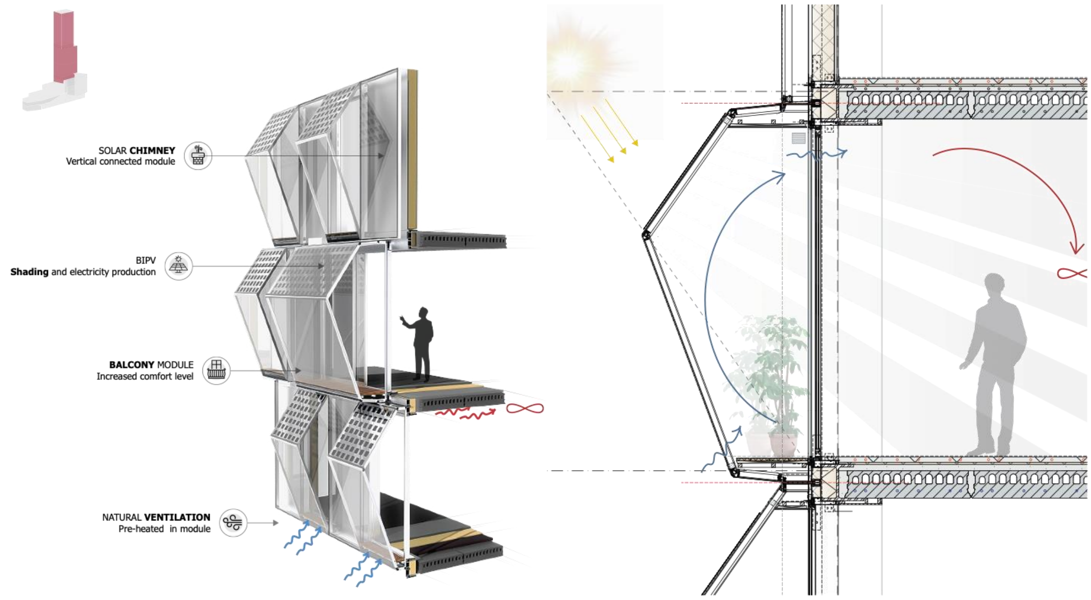
8.2.2 Deadlines and Deliverables

when	what	content	format
Week 4.2	PinUP	First ideas and possibilities for a sustainable concept of your building and the role the façade plays in achieving this challenge.	See section 4. DELIVERABLES
Week 4.5	Mid-term	The topics discussed during the first consults are presented, but than in a final draft version: • Text and sketches that explain the technical, architectural and sustainability concept and design choices; • What is the role of the building envelope (façade + roof) in achieving the sustainable building ambitions; • Level of integration with other disciplines; • Façade impressions 1:1000 or 1:500 for whole building; • Images of reference projects; • 1:20 draft sections of representative floor sections. - etc.	See section 4. DELIVERABLES
Week 4.9	Finals	The following material – that you already have been working on during the last couple of weeks - should be ready before the final presentation: • 3D renderings of façade showing architectural and technical concept of façade; • Isometric drawing of the main components of the different façades including floor system, column, ceiling (1:10); • Cross section of typical floors (1:20); • Vertical cross section of typical details (1:5); • Horizontal cross section at window level, including columns (or other structure), interior separation (1:5); • Horizontal section ca. 50 cm above floor level (1:5); • Fixing procedure and assembly and production method; • For some characteristic points of the exterior, like sharp corners etc., a general idea for possible solutions;	See section 4. DELIVERABLES
Week 4.11	Deliverables	• Individual report with the drawings as listed above, documentation of design choices and underpinning calculations and text.	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

8.2.3 Assessment Criteria

Assessment criteria for the façade designer (determining individual grade for façade designer of each team):

Façade design (Individual grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Attitude (own initiative, independence, cooperation in group)	10%
Obtained technical depth, amount of work done.	20%
Achieved integration of the aspects: architecture, construction, solar gain/climate, energy, HVAC, sustainability, assembly, maintenance, economics	30%
Technical drafting quality and clarity of façade elevations, exploded views or isometric views, renderings and 2D-details. Written presentation with motivation and underpinning of the design choices.	30%
Presentation and answering of questions	10%



Façade concept by Kees Jan Hendriks, Team 07 (2018)

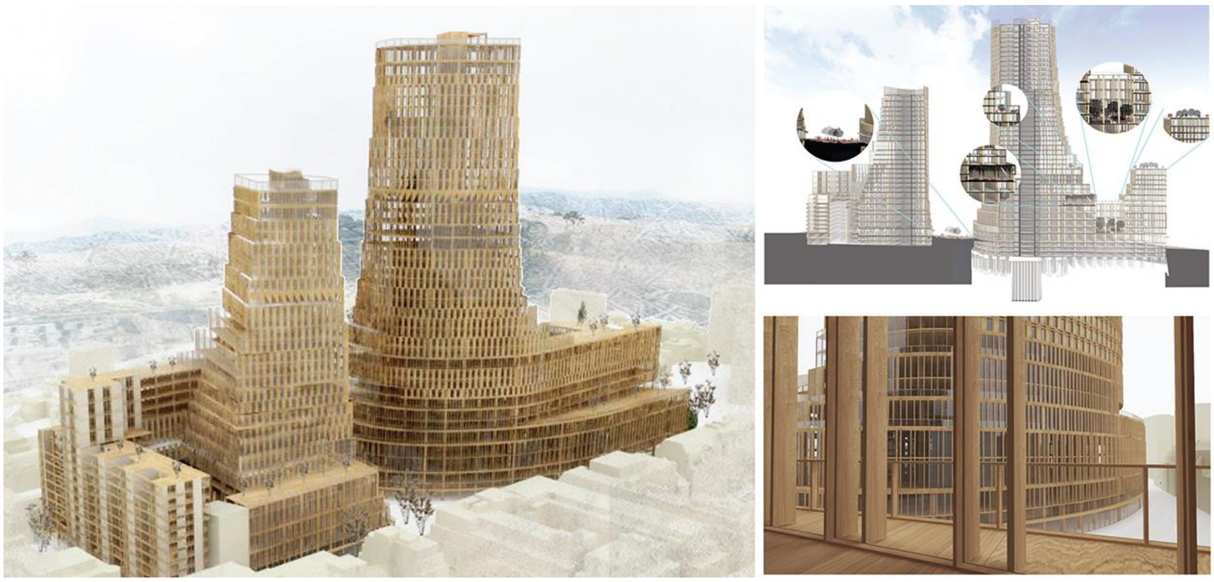


Image: Example from MEGA 2019, Team 3 (Architecture Nayanthara Herath - Facade design Hans Gamerschlag - Structural design Lisa van Iperen & Jose Abad Gonzalez - Computational design Tarang Gupta - Climate design Xianyue & Jesse Emmelot)

STRUCTURAL DESIGN

9. SPECIFICATIONS FOR STRUCTURAL DESIGN

Structural engineering concerns all the aspects related to the design of the structure of the building.

9.1 ROLE AND VISION

The structural designer, together with the architect and with input from the other consultants, has to develop a design for the structure. The different solutions for the structural design of the high-rise building have to be checked for strength, stiffness and stability, including possible dynamic effects. Together with all other team members the structural designer has to decide which solution will be chosen.

The main load bearing system has to be designed and optimal sizes of bracings, columns, walls, cores and flooring systems have to be determined. It is important that one starts with developing the concept with logic and making use of rules by thumb to set initial dimensions. When elaborating the concept you are expected to use appropriate calculation software. In many situations it will be possible to optimize through parametric modelling.

In addition, the structure has to be checked for the possibility of the installation of the HVAC (Heating, Ventilating, Air Conditioning) equipment, the elevators, the staircases and the façades in the most optimal gross net ratio for the building. A choice for a suitable piling system has to be made and an indication of the necessary foundation elements has to be elaborated. The structural engineer should give a rough design for the building pit. When designing the structure the construction logic has to be taken into account.

9.1.1 Readers

Mandatory Literature:

- Reader Structural systems for Highrise structures, P. Ham and K.C. Terwel, 2017
- Recommended:
- High-Rise manual, J. Eisele, 2002
- Designing Tall Buildings: Structure as Architecture, M. Sarkisian, 2016
- Cement 2001/2, Funderen van hoogbouw in Nederland, H.J. Everts
- Cement 2006/1, De constructeur in het hoogbouwproces: een factor van betekenis, J.P. van der Windt
- Cement 2009/8, 165 meter stabiliteit, J.P. van der Windt
- Cement 2007/5, Burj Dubai: hoogste gebouw ter wereld, R. Braam
- High-Rise structures. Preliminary Design for Lateral Load, J.C. Hoenderkamp, TU Eindhoven, 2007

Websites:

- www.hoogbouw.nl
- www.ctbuh.org
- www.skyscrapercity.com

9.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments.

9.2.1 Weekly Milestones

Overview of the f Design Process and Weekly Milestones. This overview comprises a breakdown of different steps and of foreseen itinerary. However be aware the breakdown is a simplification. In reality to some extend all steps should be consider simultaneously. The weeks are dedicated to themes and design means; evidently all other sketches and drawings that you would like to make are of course welcomed.

when	Key word	Content and actions	Questions and notes
Week 4.1	INTRO	Lectures are given; please attend all of these lectures. Review important literature on structural design, such as the readers listed above.	The week is fully scheduled with lectures and introductory activities. No individual consults with structural design tutors.

Week 4.2	VOLUME	Prepare for PinUp. Integration is always needed with all disciplines, but in week 4.2 and 4.5 do pay extra attention to coordinate with the Architect. Elaborate on impact of volume studies, determine volume for structure in relation to other disciplines, such as positioning of load bearing elements in relation to grids, exploration of floor and stability systems related to the architectural concepts, etc. Exploration of building materials.	At the pin-up, the team will chose one design concept. Until the PinUp, this week each team is working on several design proposals to be presented at the PinUp. This includes the analysis of the qualities of the different design proposals, including facades.
Week 4.3	SYSTEM	Define the position of stability elements such as core and bracings. Further exploration of building materials (especially for some material - such as timber – it heavily impacts the design and should be considered in conjunction with programmatic building aspects).	In this phase the structural designer should work in close collaboration with the architect on plans.
Week 4.4	CONTEXT	Place stability elements from bottom to foundation.	
Week 4.5	VERTICAL LOGIC/SECTION SPACE	Structural designers should pay attention to vertical stacking of the building again, since that's also a focus for the architectural design in this week. They should present an explanation of the considered structural alternatives and the final choice for the structural system of the two chosen architectural concepts. Attention should be given to the stability, main load bearing system and choice for the floor system. A rough idea of the foundation and construction in the water should be presented. The structural design can be presented with sketches, text and rough calculations. Though not mandatory, it is recommended to draft a small report (ca. 15 pages) that can be discussed with tutors at the next consult. Integration is always needed with all disciplines, but in week 4.2 and 4.5 do pay extra attention to coordinate with the Architect.	At the mid-term, the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details (e.g. different structures), but all discipline must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.
Week 4.6	SENSES	(Further) development of load takedown and stability calculation, required for detailed design of structural elements. The main structural material (steel, concrete, wood) should be definitely chosen.	Pay attention to the integration of fire safety concepts and escape routes. In this phase start working on structural plans and sections.
Week 4.7	PATTERN	Define the main structural elements and the relation to architectural and functional design.	
Week 4.8	CAVITY	Define the main structural elements and the relation to architectural and functional design.	Work on structural plans and sections.
Week 4.9		No consults are planned for this week. Finalize the work and prepare for the final presentation.	See section 4. DELIVERABLES. See also Brightspace.
Week 4.10 Week 4.11		No consults are planned for this week. Finalize eventual improvements. Write the report and finalize the final deliverables.	See section 4. DELIVERABLES

9.2.2 Deadlines and Deliverables

when	what	content	format
Week 4.2	PinUP	First ideas and possibilities for a concept of your building and the role the structure plays in achieving this challenge.	See section 4. DELIVERABLES
Week 4.5	Mid-term	Load-supporting structure: • Layout of main load bearing structures 1:1000 • Load-bearing structure of the floors 1:200 • Foundation principles 1:200 • Model of load bearing structures 1:500	See section 4. DELIVERABLES
Week 4.9	Finals	Load-bearing structure: • Principles of the chosen load-bearing system 1:1000 • Elaboration of the chosen load-bearing system 1:200 • Load-bearing structure of the floors 1:200 • Foundation principles 1:200 • Principle of relevant details: 1:20-1:50	See section 4. DELIVERABLES
W 4.11	Deliverables	• Individual report (*), conveying all relevant information;	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

(*)FINAL INDIVIDUAL REPORT:

Structural consultants should hand in a report (max. 40 pages) with an elaboration of the chosen structural concept. The rules for judgement are given below and in BrighSpace too (please check both). The report should contain an adequate description of the considered alternatives for floor systems, stability systems, foundation and other structural elements. The design should be explained by adequate drawings of floor plans and sections, accompanied by a 3D image. The feasibility of the design should be proven with calculations, including second order and dynamic effects. The report must include the following subjects: 1.Basis of Design (loads, options & design choices, etc.) 2. Load transfer & stability analysis; 3.Primary design calculations for the structure/structural elements; Drawings etc. in appendices.

9.2.3 Assessment Criteria

Assessment criteria for structural designer (determining individual grade for structural designer of each team):

Structural design (Individual Grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Attitude & Integration (own initiative, independence, cooperation in group, integration with other disciplines, attention to construction)	20%
Quality of the structural concept (main load bearing system, including all structural elements, foundation and building pit fulfills the requirements)	40%
Calculation and optimisation	20%
Detailing	10%
Written presentation	10%
Please do consult also the Excel file provided in BrightSpace – which contains clear references for the grading criteria	

MANAGEMENT

10. SPECIFICATIONS FOR MANAGER

Important note: **the tutorship for management is offered only to the teams that have a manager as team-member and if a sufficient number of teams have a manager as team-member.**

10.1 ROLE AND VISION

It is already a challenge to make a good tall building. Additional conditions increase this challenge to a paramount level. At one hand quality should be at the highest possible level, while at the same time, every penny too much will end in public discussion. Given the societal role of such a development, sustainability, as one of these qualities, should not be to present good standards, but top the requirements of the city by making a building lasting for centuries, a shining example for future generations, requiring not only the perfect result, but also the perfect process.

The objective of the management role is to support the high-rise development process. This task includes steering and control of the development process as regards quality (programme of requirements), time and budget through team co-operation (organisation and communication). The manager is responsible for project feasibility (sale-ability of the building to an investor, first as feasible development for investors, clients and other stakeholders and second as a well function commercial complex, lease-ability to users, makeability - in a technical sense and sustain-ability in the broadest perspective) and the quality of the end result in spatial/visual, functional and technical terms. All aspects have to be related to the stakeholders perspective (client/user, developer and investor, municipality). The manager controls the alignment of design proposals and programme of requirements and accounts for this at the assessment sessions.

10.1.1 Readers

- Ive, G.; Re-examining the costs and value ratios of owning and occupying buildings
- Fuerst and McAllister; Green Noise or Green Value
- Gray, C., Hughes, W. Building Design Management, ISBN 0 -7506-5070-2, Butterworth Heinemann
- Kok and Eichholtz; Doing well by doing good/Green office buildings
- Lawson, B. (2005) In “How designers think. The design process demystified.” Chapter 14: Designing with others, Oxford: Architectural Press. (BrightSpace)
- Morris and Matthiessen; Cost of Green Revisited: Re-examining the feasibility and cost impact of sustainable design in the light of increased market adoption
- NEN-ISO 15686-5; Buildings and constructed assets - Service-life planning, Part 5: Life-cycle costing (NEN-connect through TU Library)
- Van der Erve, F.; Sustainability in the existing Dutch Metropolitan office market (Repository)

10.2 PROCESS

The process is organized based on milestones and deadlines. Milestones are per week and are mild guidelines to help presenting the progress to the tutors during the weekly consults. Deadlines (and related deliverables) are mandatory moments of presentation for discussion and/or assessments.

10.2.1 Weekly Milestones

Overview of the f Design Process and Weekly Milestones. This overview comprises a breakdown of different steps and of foreseen itinerary. However be aware the breakdown is a simplification. In reality to some extend all steps should be consider simultaneously. The weeks are dedicated to themes and design means; evidently all other sketches and drawings that you would like to make are of course welcomed.

when	keyword	Content and actions	Questions and notes
Week 4.1	INTRO	Lectures are given; please attend all of these lectures. Review important literature on façade design, such as the readers listed above.	The week is fully scheduled with lectures and introductory activities. No individual consults with managers tutors.

Week 4.2 Week 4.3 Week 4.4 Week 4.5	Such vision documents must be aligned with the responsible disciplines, and produced in time, well before the mid-term presentation, to fulfil the directional purpose.	At the mid-term (week 4.5), the team presents one design from the perspective of each discipline. Each discipline can still consider different design variations of the details (e.g. different structures), but all discipline must have agreed on the overall design direction. The main concept and massing cannot be substantially revised or changed after the midterm.
Week 4.6 Week 4.7 Week 4.8 Week 4.9	The beauty of the management role is being in control in an integral process. The downside is that if things are going good, credits are going to the team members, where the manager is to blame when there are problems. Be aware of incidents and malfunctioning facilities.	See section 4. DELIVERABLES (Week 4.9).
Week 4.10 Week 4.11	Tasks and products mentioned above will be finally discussed in the individual report. Especially for elaborating the process management it is advisable to keep track by keeping a log during the course. The role report should have proper citations, however the literature suggestions below (and those of lectures and consults) should be studied for the process and not just for the report.	See section 4. DELIVERABLES

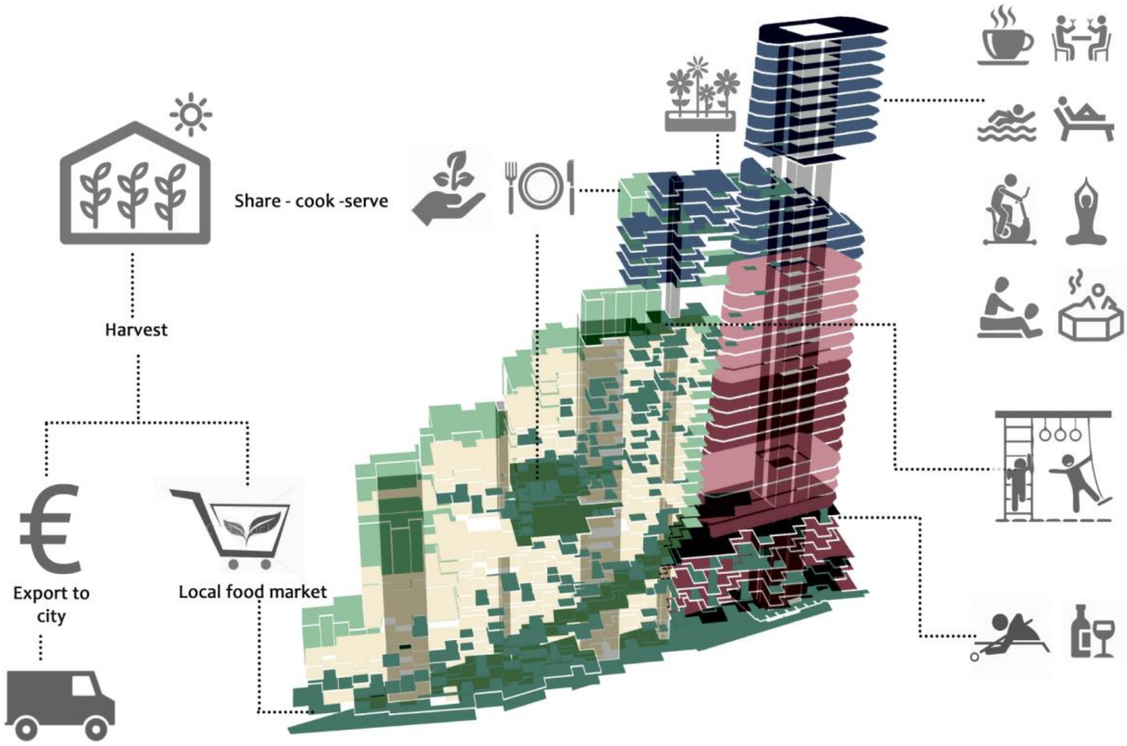
10.2.2 Deadlines and Deliverables

when	what	content	format
Week 4.2	PinUP	First ideas and possibilities for a concept of your building and the role the structure plays in achieving this challenge.	See section 4. DELIVERABLES
Week 4.5	Mid-term	During the mid-term presentation these visions and first steps towards tangible outcomes, e.g. detailed planning and a preliminary budget, are discussed. At the mid-term different alternatives are presented. Elaborate on a vision per alternative versus general visions of the team. The selection between alternatives is also an issue to take care of in advance.	See section 4. DELIVERABLES
Week 4.9	Finals	Converting the visions into reliable end products: • monitoring and securing the sustainable development process, • experimenting with managerial techniques to improve understanding of project management, • elaborate project organization in detail including shifts in stakeholders due to the change of functions • detailed estimate and budget in LCC-perspective, including relevant logistics issues influencing the building process and techniques for improving	See section 4. DELIVERABLES
W 4.11	Deliverables	• Individual report, conveying all relevant information	See section 4. DELIVERABLES
Additionally, a weekly deliverable is expected, as described in section 4. DELIVERABLES			

10.2.3 Assessment Criteria

Assessment criteria for the manager (determining the individual grade for the manager of each team):

Manager (Individual grade) - Assignments Criteria Table	
Learning activity / deliverable	**Grading**
Project management: design management (group work, communication, presentations) and impact of construction (management, contract, time, methods) on design	25%
Finance: Balance of costs (LCC) and revenues for design optimisation (value/efficiency/performance)	25%
Real estate development: SWOT-, stakeholder- and functional analysis/optimisation and strategy in design and operational phase.	25%
Essay: management is supportive for group work. In order to allow an academic perspective upon the daily routine, a chosen topic within that routine (topics will be chosen, discussed and presented in the consults) should be elaborated in detail for the final report.	25%
Professional quality of deliverables and presentation is conditional.	0%



From Computational Design report by K. Agarwal, Team 04 (2018)

LECTURES - WORKSHOPS

11. COURSE ACTIVITIES OVERVIEW

The design studio MEGA is intense. The workload can be perceived as time-demanding. However, understanding the structure of the different activities in the course will allow organizing the time accordingly. In this respect, MEGA offers 1) a series of lectures and 2) workshops that are collective. Additionally, it offers 3) individual consults. The remaining time is for each student to 4) work (self-work) on the design assignment. As outputs, MEGA expects team presentations and final individual deliverables to be delivered by the students.

Total contact hours in MEGA:

- The first week of the course is intensively scheduled with lectures (and a site visit). This is for all students (the entire class all together).
- The second week includes workshops for the entire class + some individual consults per discipline + a pin-up presentation by the entire class.
- The third week includes individual consults per discipline + workshops. Some workshops are for the entire class some for one discipline only.
- After the third week, only individual consults per discipline and meetings/workshops per discipline are scheduled. Each student is mandatorily expected to be only at the activities of his/her own discipline, mostly the individual consults. Each individual consult per each student occurs once per week and takes approximately 30-60 minutes. As student, please be aware that you are welcome to listen/engage also in other disciplines' consults if you wish, but this will lead to a time-commitment that exceeds by far what expected in a 12ECTS course.
- The rest of the time is free for each student to work on the assignment as self-work.

The table below exemplifies the distribution of activities in the first 6 weeks. The remaining weeks follow a similar pattern. Note that the red timeslots mark the presence of tutors. During these timeslots, the individual consults take place. Each student is supposed to have one consult per week, for about 30-60 minutes. This means each student is supposed to use 30-60 minutes per week of the red time. The rest of the red time can be spent for self-work (no contact-hours). The detailed schedule for each week is provided at the end of this brochure.

Week 4.1: April 20 - April 24

		Monday 20/4	Tuesday 21/4	Wednesday 22/4	Thursday 23/4	Friday 24/4
08:45 - 09:30	1					
09:45 - 10:30	2	LECTURES	LECTURES	VIRTUAL SITE VISIT	LECTURES	LECTURES
10:45 - 11:30	3					
11:45 - 12:30	4					WORKSHOP
		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
13:45 - 14:30	5					
14:45 - 15:30	6	LECTURES	LECTURES	FAMILIARIZING WITH SITE	LECTURES	
15:45 - 16:30	7					WORKSHOP
16:45 - 17:30	8					

Week 4.2: April 27 - May 1

		Monday 27/4	Tuesday 28/4	Wednesday 29/4	Thursday 30/4	Friday 1/5
08:45 - 09:30	1					Pin-UP presentation
09:45 - 10:30	2	NO EDUCATION - public holidays (King)		CONSULTS	SELF-STUDY	
10:45 - 11:30	3		WORKSHOP			
11:45 - 12:30	4					
			LUNCH	LUNCH	LUNCH	LUNCH
13:45 - 14:30	5					Pin-UP presentation
14:45 - 15:30	6		WORKSHOP	CONSULTS	SELF-STUDY	
15:45 - 16:30	7					
16:45 - 17:30	8					

Week 4.3: May 4 - May 8

		Monday 4/5	Tuesday 5/5	Wednesday 6/5	Thursday 7/5	Friday 8/5
08:45 - 09:30	1					
09:45 - 10:30	2		NO EDUCATION - public holidays (Liberation Day)	WORKSHOP / CONSULTS	SELF-STUDY	CONSULTS
10:45 - 11:30	3					
11:45 - 12:30	4					
				LUNCH	LUNCH	LUNCH
13:45 - 14:30	5					
14:45 - 15:30	6			CONSULTS	SELF-STUDY	CONSULTS
15:45 - 16:30	7					
16:45 - 17:30	8					

Week 4.4: May 11 - May 15

		Monday 11/5	Tuesday 12/5	Wednesday 13/5	Thursday 14/5	Friday 15/5
08:45 - 09:30	1					
09:45 - 10:30	2		WORKSHOP / CONSULTS	WORKSHOP / CONSULTS	SELF-STUDY	CONSULTS
10:45 - 11:30	3					
11:45 - 12:30	4					
			LUNCH	LUNCH	LUNCH	LUNCH
13:45 - 14:30	5					
14:45 - 15:30	6		WORKSHOP / CONSULTS	CONSULTS	SELF-STUDY	CONSULTS
15:45 - 16:30	7					
16:45 - 17:30	8					

Week 4.5: May 18 - May 22

		Monday 18/5	Tuesday 19/5	Wednesday 20/5	Thursday 21/5	Friday 22/5
08:45 - 09:30	1					
09:45 - 10:30	2		CONSULTS	MID-TERM	NO EDUCATION - public holidays (Ascension Day)	NO EDUCATION - public holidays (Ascension Day)
10:45 - 11:30	3					
11:45 - 12:30	4					
			LUNCH	LUNCH		
13:45 - 14:30	5					
14:45 - 15:30	6		CONSULTS	MID-TERM		
15:45 - 16:30	7					
16:45 - 17:30	8					

Week 4.6: May 28 - June 1

		Monday 25/5	Tuesday 26/5	Wednesday 27/5	Thursday 28/5	Friday 29/5
08:45 - 09:30	1					
09:45 - 10:30	2	*AR0026 MEGA is not running on Mondays. Mondays are for the students to work on other courses. Nevertheless if a student wants to work on MEGA on Mondays, (s)he is welcome to be at the Studio.*	CONSULTS	CONSULTS	SELF-STUDY	CONSULTS
10:45 - 11:30	3					
11:45 - 12:30	4					
			LUNCH	LUNCH	LUNCH	LUNCH
13:45 - 14:30	5					
14:45 - 15:30	6		CONSULTS	CONSULTS	SELF-STUDY	CONSULTS
15:45 - 16:30	7					
16:45 - 17:30	8					

Example: the first six weeks of the course. (It is an example. Please check the real detailed and updated schedule)

12. LECTURES AND WORKSHOPS

The design studio MEGA offers a series of lectures and workshops, sequentially connected, evolving around topics relevant for the collaborative multi-disciplinary design of complex bindings such as high-rise buildings. The overview is provided here following. The details for each lecture and workshop are provided in the next sections.

12.1 OVERVIEW

When	Focus	Who	What information the lecture provides
Monday 20/4	Intro	M. Turrin	It gives practical information on the course
	M4H as a context	W. de Vries	It discusses the urban context
	Automated landscapes	L. Groen	It argues human presence in automated centers
	Design assignment	F. Geerts	It introduces the detailed design assignment
	Architectural Design	N. de Vries	It provides an Architectural vision
	Integral Design	M. Overend	It provides a vision on interdisciplinary integration
	Structural Design	M. Overend	It introduces structural systems and design in HR
Tuesday 21/4	Buildings' value	P. de Jong	It discusses the relevance of the financial perspective
	Computation	S. Sariyildiz	It introduces computational design for HR
	Beyond Sustainability	P. Luscuere	It looks at circularity and concept of positive footprints
	Hybrid Ventilation	P. vd Engel	It introduces natural and hybrid ventilation in HR
	Fire safety	B. Peters	It introduces fire safety in HR
	Tech in HR	R. Tan	It discusses integration of technological innovations
	Vertical Transport	J. Mol	It introduces the design of vertical circulation in HR
W 22/4	Virtual Visit to Site		
	M4H Stakeholders	M. Clarijs	It presents the perspective of stakeholders
	Digital Collaboration	Thomas & Stuckardt	It introduces remote digital collaboration at MVRDV
	Workshop 3D models	Paul de Ruiter	Collaborative 3D modelling of the site
Thursday 23/4	Facades	S. Verkuijlen	It introduces façade systems and façade design in HR
	Computation for facades	J. Heinzel	It looks at computational façade design in practice
	Structures in HR	R. Crielaard	It introduces structural systems in HR in practice
	Digital structures	S. Ren	It looks at computational structural design in practice
	Sustainability in practice	Molenaar & Coolwijk	It looks at building design as integrated designs
	Collaborative design	Alex Christodoulou	About parametric design in interdisciplinary practice
	Digital workflows	OMRT	About simulations in early design
Friday 24/4	(Future) digital design	J. Coenders	It gives current/future digital perspectives from practice
	Economics in HR	IGG Bouweconomie	It gives a perspective on building economics
	Workshop economics	IGG Bouweconomie	Digital tools for economic calculations in design
	Historic overview	F. Geerts	It introduces HR with an historical perspective
	Workshop Architecture	F. Geerts	The workshop initiates the design activities.
28/4 morning	Workshop Coordination	Aser G. Ortega	Architectural interdisciplinary coordination
28/4 afternoon	Workshop Computation	F. Mora, D. Mittal, B. Ekici, P. de Ruiter, M. Turrin	Collaborative digital workflows.
29/4 aft	HR and urban energy	A. vd Dobbelsteen	It discusses high-rises and urban energy transition
6/5 morning	Worksh. Design Builder	W. vd Spoel	Design Builder is introduced as tool for climate design
12/5 full day	Workshop Computation	ESTECO, B. Ekici, P. de Ruiter, M. Turrin	Parametric design, simulations, optimization. In the afternoon, ESTECO offers a full training on modeFRONTIER in connection to Grasshopper.
13/5 morning	Workshop CFD	P. vd Engel + lecture by C. Garcia-Sanchez	The workshop focuses on CFD software. The lecture introduces the theoretic background on wind and CFD.

12.2 LECTURES (details)

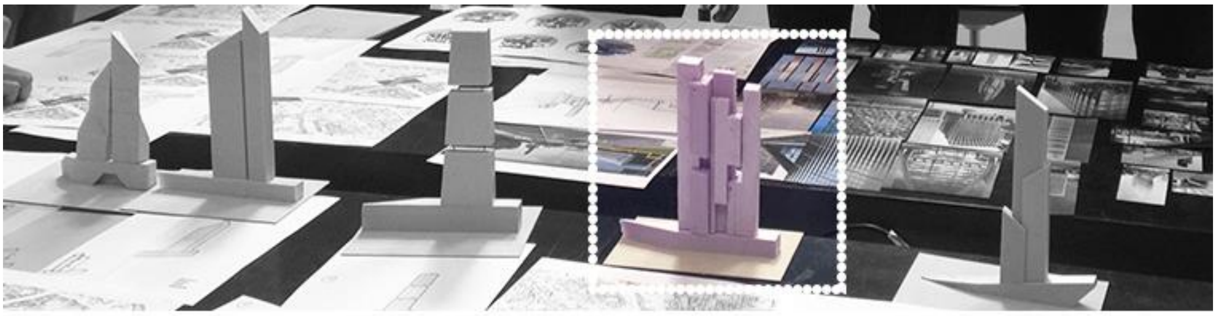
The design studio MEGA offers a series of lectures tackling the design assignment as well as the specificities of each discipline in high-rise buildings. It also offers lectures on collaborative interdisciplinary design for complex projects such as high-rises. The lecture series is presented in this section.

Monday 20 April h. 8.45 to 9.30
LECTURE: Introduction to MEGA 2020 - Michela Turrin

Michela Turrin is is an Associate Professor at the Chair of Design Informatics. She holds a MSc degree in Architecture from IUAV University of Venice and a PhD from TUDelft – both with focus on computational design. She worked as architect in Italy. She was Marie Curie Fellow at Beijing University of Technology, collaborating at Green World Solutions Ltd. She taught in international events, such as the IFoU Summer School 2012 in Beijing and Winter School 2013 in Hong Kong. In 2012 to 2014 she was senior lecturer at Yasar University in Turkey. In 2014 and 2016, she was awarded the Excellent Oversea Instructor grant and a research grant by the Key State Laboratory of Subtropical Building Science in Guangzhou, China. At TUDelft, she leads and/or is involved in national and international research projects, focusing on multi-disciplinary computational design.

My expertise focuses on Computational Design at the intersection of Architectural Design and Building Technology. I put forward Computational Design to integrate engineering aspects into the architectural design conception, toward architectural design innovation with sound fulfilment of performance-criteria. I develop methods of form generation, performance assessment and optimization by means of new computational methods integrating computational engineering optimization in architectural design.

In this lecture, Michela introduces the overall course AR0026 MEGA 2020. She will share a brief overview on the content and approach of the course as well as provide practical information on its day to day activities.



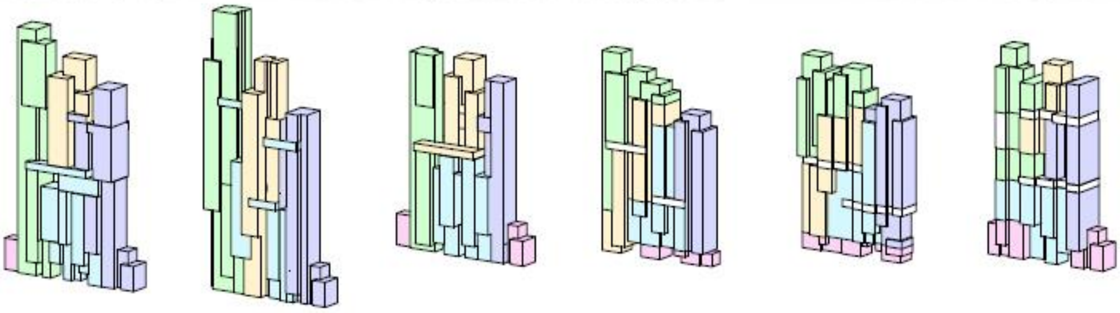


Image: Examples from students' work in Mega 2018.

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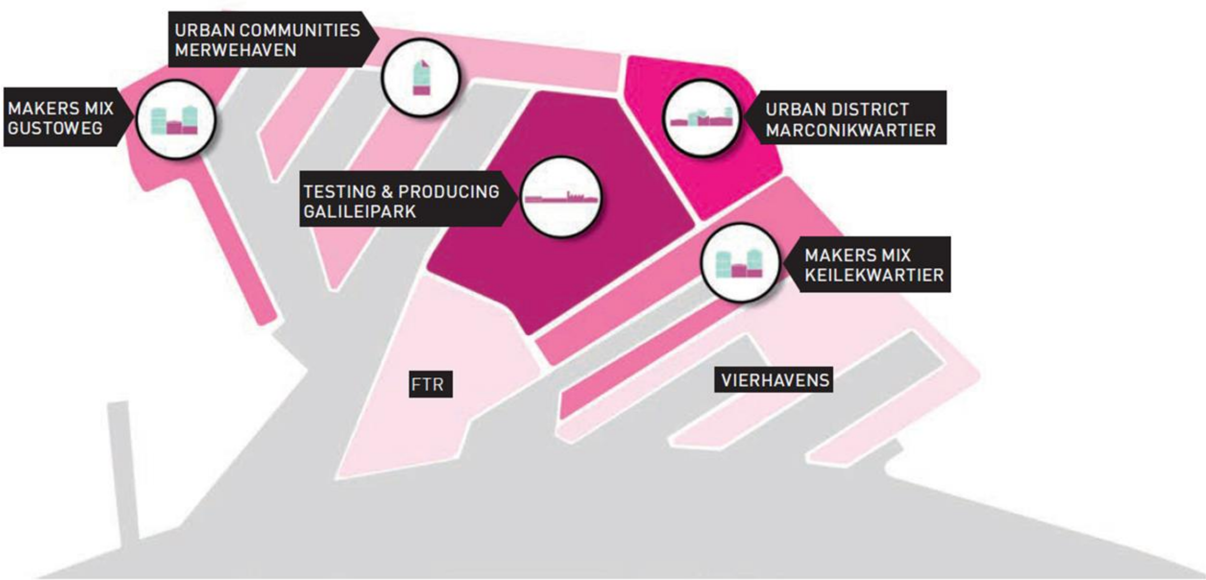
Monday 20 April
LECTURE: M4H – Walter de Vries

Walter de Vries is urban development planner for the Municipality of Rotterdam. He is responsible for spatial planning for M4H.

Walter's work focuses on the port, city and river as central elements of Rotterdam. "I really wanted to work for Rotterdam. Since that succeeded, the port, city and river have been a recurring theme in my work. And it is the most interesting urban development in the Netherlands. Rotterdam is dynamic and loves changes."

In this lecture, Walter introduces the overall vision of Rotterdam City for the M4H Makers District.



De verschillende programma types van het gebied

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Monday 20 April
LECTURE: Reporting from Automated Landscapes – Ludo Groen

Ludo Groen works as a researcher and tutor at the Berlage at Delft University of Technology and the Research Department of Het Nieuwe Instituut in Rotterdam, whilst practicing architecture from his eponymous studio. His writings are published in *StrelkaMag* (2020), *OASE Journal for Architecture* (2019), Architectural Association's *DUE* (2018), and The Berlage's *Necessarily Eurometropolitan* (2018). He contributed to various exhibitions including *I See That I See What You Don't See* at the XXII Triennale di Milano (2019) and Het Nieuwe Instituut (2019), *Together and Apart* at the Venice Architecture Biennale (2018), and *Stucco Storico* at Bureau Europa (2018).

In his most recent *Countryside: A Report*, Rem Koolhaas coins "post-human architecture" as the new forefront of the architect's profession. Reporting from Tahoe Reno Industrial Center in Nevada—the world's largest industrial park—he declares: "The buildings here are not for humans but for things and machines. (…) It is based strictly on codes, algorithms, technologies, engineering, and performance, not intention. Its boredom is hypnotic, its banality breathtaking. A new architecture is born beyond our attention, without any symptoms of humanism." Building upon Het Nieuwe Instituut's "Automated Landscapes" research project, this lecture will argue that human bodies are not absent at all in these meticulously designed centers of production, but instead adopt the uptime rhythm of automation.

LED lights, Koppert Cress. © Jan van Berkel.

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Monday 20 April
LECTURE: 2020 Design Assignment – Filip Geerts

Filip Geerts (1978) graduated cum laude from the Delft University of Technology in 2001. From 2002 until 2010 he was associated in UFO-architecten. Since 2004 he is Assistant Professor at the Chair of Public Building & Architectural Compositions at the TU Delft.

He is an educator and researcher, teaching design studios and seminars, advising thesis projects, and involved with the research programme Borders conditions and Territories. His main interest is the intersection of architecture, city, landscape and infrastructure

In this lectures, Filip presents the detailed design assignment of MEGA 2020. He will discuss the functional requirements of the new buildings as well as the peculiarities of the design plot.

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Monday 20 April
LECTURE: Large scale architecture - Nathalie de Vries

Nathalie de Vries is professor of Architectural Design and Public Building at the TU Delft. She is also one of the founding partners, of MVRDV, an interdisciplinary office that works at the intersection of architecture and urbanism. She has been president of the Royal Dutch Institute of Architects BNA.

Nathalie is renowned for a diverse body of work in a variety of scales and typologies that are grounded in connecting individuals, communities and environments. At the TU she investigates the role of the public in buildings and cities and also investigates 'multiplicity in design' a property that makes buildings and building elements less singular in function, more adaptable, transformative, and resilient.

In this lecture, Nathalie discusses with students how to translate complex design parameters into architectural concepts, what mixing functions in buildings can achieve and the special position of MEGA projects in architecture and urban design.

De Rotterdam, OMA

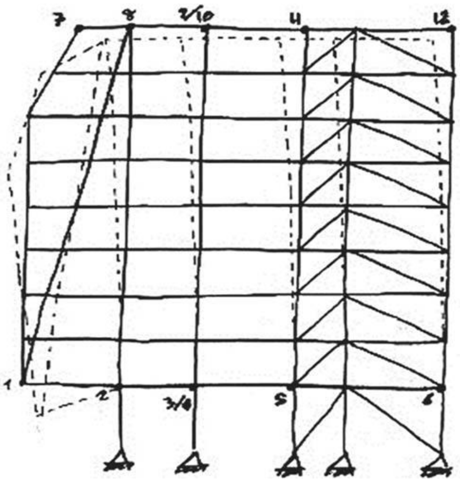
Monday 20 April

LECTURES: Interdisciplinary Integration and Structural Design – Mauro Overend

Mauro is Professor of Structural Design & Mechanics at TU Delft. He joined TU Delft in September 2019 after 12 years at the University of Cambridge. He is a chartered engineer with several years of consulting engineering, teaching and research experience in the fields of structural engineering and façade engineering. Mauro is passionate about interdisciplinary collaboration, in teaching, research and practice.

Mauro is Chair of Structural Design & Mechanics (SDM) at TU Delft. SDM are a multi-disciplinary teaching and research group with expertise in structural mechanics, structural materials and structural design. The group works on the next generation of structures that are resource-efficient and respond more effectively to short and long term needs, ranging from structural optimization and form finding to sustainable glass. Mauro has a track record of research in structural glass and façade engineering. His interests are the interface of structural engineering, materials engineering and building physics which underpin the performance of buildings and sustainable structures. His work has found applications in international design standards and in some of the most challenging buildings globally.

This is a two-part lecture. The first part argues that it is relatively easy to design the individual discipline-specific elements of a large building (i.e. architectural design, structural design. climate design, facade design etc. in isolation). But much harder to produce a well-integrated, holistic design. The case studies in the lecture will demonstrate that the effort is worthwhile. The second part shows examples of good structural design of large structures including long span and multi-storey buildings. The lecture will include conceptual structural design / structural typologies as well as real-world case studies.



Gresham street – photo and sketch

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Tuesday 21 April

LECTURE: Economics of big buildings: a cost and value perspective – Peter de Jong

Working at Management in the Built Environment in the field of Building Economics at object level, logically fit in the section Design and Construction Management the main focus is aiming at financial viability of buildings. In the third and final year of our architectural BSc the main and very rewarding task is the management game, a role play on area redevelopment. In this course I tutor the role of real estate developer. At the MSc the educational focus is on clients, market and location in a sustainable context, using life cycle analysis. Research is also orientated at LCC. Furthermore, I could contribute to a long list of MSc-graduates, writing a thesis on above mentioned subjects.

The focus is green, in existing buildings adaptive reuse and improving environmental quality. An extreme challenge is the Solar Decathlon Europe ’19. Not only to establish a flexible transformation on an energy positive level, inclusive and circular on resources, but also to investigate the financial and managerial aspects of the concept.

In this lecture it’s all about value and whatever it takes. Making a tall building feasible requires focus on optimal concepts in every aspect of the design, and the design team.

Image by Rotterdam Municipality

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Tuesday 21 April

LECTURE: Design Informatics in High-Rise Buildings – Sevil Sariyildiz

Sevil Sariyildiz is Chair and Professor of Design Informatics at the Faculty of Architecture, TUDelft-NL and has been dean Faculty of Architecture-Yasar University-TR (2013-2017), distinguished guest professor at Pennsylvania State University-USA (2011). Her chair deals with Informatics tools, techniques and methods for Architecture and in specific Performance Based Design. She has around 300 scientific publications and ~30 PhD`s. She is assessor of international governmental projects, member of numerous international scientific comities, member of various Dutch ministry advisory councils. Besides having many management & organizational functions, she is the founder of DEWIS (Delft Women in Science) Network and initiator of the TULIP (collaboration between Dutch and Turkish Universities.

Sevil's chair research deals with Informatics tools, techniques and methods for "Performative Architecture":During the conceptual phase of the design, most important decisions are taken. Computational design tools, methods and techniques enable to INTEGRATE these aspects into the architectural design. After the concept form generation, performance of the concept is evaluated in terms of various measures aiming to achieve best performing design result. She has around 300 scientific publications and 30 PhD`s.

In this lecture, Sevil discusses with students the Background of Design Informatics: 1. Informatics & Architecture. 2. Computational Design & Architecture. 3. Complexity in Building Design & Practice. 4. The concept of BIM. 5. Performance Based Design. 6. Contemporary High-Rise Architecture. ￼ Conclusions

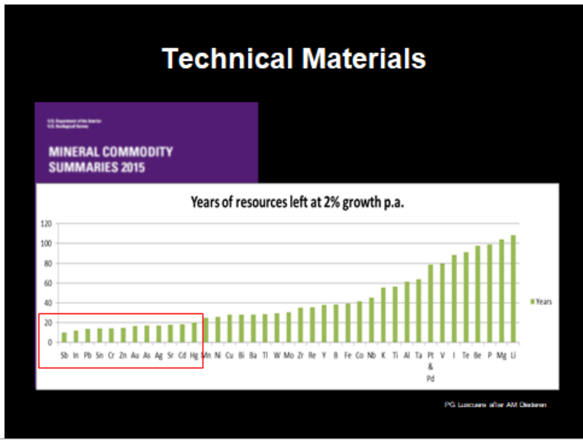
Car park tower Proposal , Mozhao Studio , Japan

Tuesday 21 April
LECTURE: Circularity, Beyond Sustainability and Depletion of Resources – Peter Luscuere

Peter Luscuere is Professor at Delft University of Technology, Building Physics & Services and visiting Professor to Tianjin University in China. As director at Royal Haskoning he was responsible for the company's work in Health Care as well as developing a companywide Cradle to Cradle inspired program on sustainability. In 2010, he established an independent consulting business Inspired Ambitions, while continuing his academic work. During 2016 he has been chairing the Transition Pathway Circular Economy within the Roadmap Next Economy, a project with Jeremy Rifkin for the Metropolitan Region Rotterdam The Hague.

After working together with Michael Braungart on Cradle to Cradle Peter developed a holistic approach 'Beyond Sustainability' in which a positive footprint for all basic natural resources: Energy, Water, Air, Top Soil and Materials is investigated and confronted with consequences on: Ecology, Economy and Equity. This approach is more or less a vocabulary to exchange ideas, challenges and possible solutions in the environmental debate of today.

Circularity is defined in this lecture as renewability for all natural resources we use in the Built Environment: energy, water, air, materials and top soil. We either contaminate these resources to a point of no return or practically deplete the remaining reserves. The concept of positive footprints is introduced to counter these challenges and definitions and examples are given how to achieve these in the Built Environment. For energy the sun is the obvious renewable resource. The systems to convert this solar energy into f.i. electricity however require technical materials which may exceed commercially available reserves. Examples are given how various energy systems capable of powering the world exceed the available material reserves.



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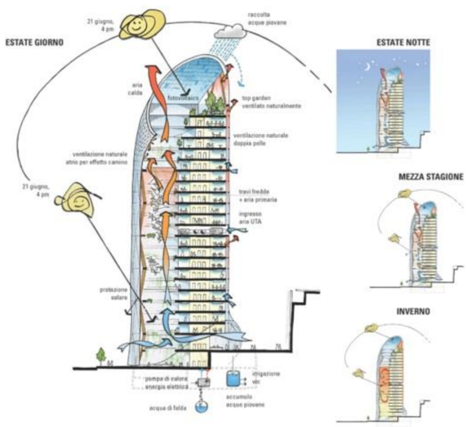
Tuesday 21 April

LECTURE: Hybrid ventilation in high-rises Peter van den Engel

Peter van den Engel studied architecture at the Delft University of Technology (1981) and building physics at the Eindhoven University of Technology (1990). His main focus of interest is natural ventilation in which topic he got his PhD (1995). He works as a climate design consultant and air flow specialist (CFD) and as a climate design teacher and researcher at this university.

The focus of his work is the design of a healthy and comfortable indoor climate, with a low energy consumption. The quality of the climate is analysed with CFD and building simulation programs. Peter has much experience with the simulation and evaluation of transparent facades and atria. He has finished a handbook about hybrid ventilated buildings together with Susan Roaf of the Heriott Watt University (see: Klimapedia).

The lecture gives an overview of hybrid ventilation in recent developed high rise buildings. This makes better user satisfaction and a lower energy consumption possible. A smart thermal design of the façade is a key factor in order to realize low-energy buildings.



Unipol Tower, architect: Mario Cucinella

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Tuesday 21 April

LECTURE: Fire Safety Concepts for high rise buildings – Bjorn Peters

Björn Peters studied at the faculty of Architecture TU-Delft, MSc Building Technology (Building Phyisics). After his final thesis in December 2002 he worked as a tutor within the Building Physics department. From 2003 onwards Björn also partly worked for DGMR, a consulting firm for construction, industry, traffic, environment and software. He decided to leave TU-Delft in 2004, but is still giving lectures for various programs within the TU-Delft. Björn is now partner and senior consultant Fire Safety & Building Technology, based at the office in the Hague.

At DGMR Björn specialised in fire safety engineering, doing various courses at Greenwich University. From 2003 until now he was responsible for the Fire Safety concept of various projects in the Netherlands such as The Rijksmuseum in Amsterdam, Meander Medical Centre in Amersfoort, the new a.s.r. headquarters in Utrecht, all the Cinemec Cinema's in the Netherlands and several high rise buildings like New Babylon, "De Kroon" and "De Haagsche Toren" in the Hague, De Maastoren in Rotterdam and is currently working on the Valley and the Maritim hotel and conference centre in Amsterdam.

In this lecture, Bjorn discusses with students fire safety concepts for High Rise buildings, starting with a short introduction for fire safety engineering using data from the research that has been done after 9-11 for the World Trade Centre towers in New York and the Grennfell Tower incident in London, giving useful tips and tricks for developing the fire safety concept for your team's high rise design.

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Tuesday 21 April

LECTURE: Strategies for integrating smart technology in urban development – Roger Tan

Roger Tan is an experienced leader in the cross-over field of architecture, technology and business economics. He has a MSc degree in econometrics with a specialization in computer science. After a 12-year career in the finance sector he transferred to the domain of architecture in 2010. Since then he has held and holds several board-level positions both in architecture firms and in industry wide bodies like the Royal Dutch Architects Association. The last 3 years his focus has been on integrating advanced innovative digital technologies in cities and in buildings. To this end he set-up UNSense, the new technology sister company of UNStudio, including first new spin-off companies out of UNSense. Currently he is providing strategic advice, amongst others to Royal 3D, one of the lead innovative companies in the M4H area.

Our society is going through major changes driven by digital transformation. However, not all sectors / industries are moving at the same speed, and the building / construction industry is one of the slowest to adapt. But still, this digital transformation will also impact the construction industry on all levels. To prepare for this and even to accelerate, we need a long-term vision and clear strategies for incorporating digital innovation in our built environment. These strategies are not easy and implementation in current projects is even more difficult. But it is important that we learn to start thinking about this now, so the current and future teams working on our building and city projects see digital technology and innovation as an integral part of projects. This is key in unlocking the great potential of digital innovation that is clearly visible and already released in other industries.

In this lecture, Roger will highlight some of the current and expected innovative technologies that are relevant to the built environment. We will also cover strategies on how to implement these technologies in the design of buildings and city developments leading to added value for the inhabitants. The strategies are based on actual and increasingly more demanding requirements set by building owners and city governors to make maximum use of new technologies for new developments.

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Tuesday 21 April

LECTURE: Lift design in High Rise buildings – Jacques Mol, Valstar Simonis

Jacques Mol MSc. graduated in 1988 at the faculty of Mechanical Engineering, section Refrigeration and Climate Control at the TU Delft. After his National Service in Germany he worked for 5 years at an established MEP contractor and switched in 1995 to Valstar Simonis consulting engineers, where he holds the position of senior consultant and Partner. With Valstar Simonis he gained a lot of experience in the design of multi-user and public buildings. New built and renovation of specialized projects like museum, museum depots, datacentre's and industrial production facilities. In all these projects the buildings function and how it is used, are the main driver in the design. Adaptability, flexibility and sustainability are always important topics, in order to make a building better and more "future resistant". During the years Jacques has gained a lot of experience in the University world, including the Faculty of Science, Mathematics and Computer Science (Beta faculty of the University of Amsterdam) with many types of laboratories, Orion for the Wageningen University, Building C for the Erasmus University in Rotterdam and several projects among TNW-Zuid for the TU Delft. A recent high-rise now under construction now is Maritims Y-towers, containing a domestic tower and a hotel tower combined with a large congress centre in Amsterdam.

Complex and demanding projects need special or tailored solutions and get better results when all disciplines are represented at the start. Smart integrated solutions create better environments for people, to function better and enjoy. Especially during the beginning of a project, the roadmap for a successful building is created. Architecture, structure and services need to be balanced in such a way that a sort of symbiosis is created.

Elevator configurations are always a hot topic in a design process of high-rise buildings. Before knowing which user will occupy the building, you must define the most rigid part of the building structure, which will be fixed for the buildings entire life. Occupation, activities, location and security are a few of the aspects that influence an elevator configuration and specifications. Costs, quality and efficiency need to be balanced in order to create a feasible and reliable solution that will fit most of the users. Logistic aspects, type and form of transport systems, sustainability, safety and security, control systems and other aspects will be part of the program.

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Thursday 23 April

LECTURE: High-rise Façades – Stephan Verkuijlen

Current: Architect, partner wv-studio Amsterdam

12/2005 - 07/2014: Architect, Associate Partner, Foster + Partners, London

Member of the Foster + Partners Construction Review Group:

Technical support and quality control for various projects at Foster + Partners.

06/2003 - 12/2005: Architect, project leader (capo projetto) Dutch projects, Studio Fuksas, Rome

06/1998 - 04/ 2003: Architect, Micha de Haas architects, Amsterdam

Education:

08/2001: TU Delft, Faculty of Architecture, Master's degree Architecture (Hons)

06/1998: TU Delft, Faculty of Architecture, Master's degree Building Technology

The focus of Stephan's work is Architecture and Technology.

The lecture focuses on façade systems for high-rises.

University of Southampton Engineering Faculty, UK (Grimshaw Architects)

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Thursday 23 April

LECTURE: Knowledge-based design and engineering applications – Jürgen Heinzel, UN Studio

Jürgen is a Senior Architect and Associate at UNStudio. He graduated from the University of Applied Sciences, HS OWL - Detmold School of Architecture and Interior Design in Detmold, Germany in 2008. Since joining UNStudio in 2006, With his versatile experience in varying scales and typologies he focusses on the definition of analytic design strategies for building organization and routing, spatial experience in relation to interior and exterior building envelopes and the buildability of complex architectural geometries. As all-round design architect, Jürgen is specialized in the conception, design and management of complex 3D geometries, responsible for the technical and aesthetical aspects from concept to construction.

Jürgen has worked on many of UNStudio's most significant and awarded projects of varying scales, including product designs. In the international field Jürgen is responsible for assuring a high level of design quality, in line with UNStudio standards. Raffles City, a large-scale mixed-use development recently completed in Hangzhou, China, and the Ardmore Residences in Singapore, are two of many key UNStudio projects to which Jürgen has substantially contributed.

As a generation of our computationally designed and coordinated projects are completing construction we can see the arc of our developmental trajectory, from the instrumentalisation of intuitive devices to the production space and dissemination of information through computation in the contemporary inventive economy. As one example Raffles City Hangzhou illustrates a methodology to build knowledge-based engineering applications to enable early-stage design integration through the development of a façade Product Model for automatic rule checking and knowledge reuse. The knowledge is established by an integrated, non-linear parametric workflow, which generated both the building's driving envelopes and arrangement of component families which define the facade's evolving systems.



Left: UNStudio_Raffles City_©Hufton+Crow. Right: UNStudio_Raffles City_©Jin Xing

Thursday 23 April

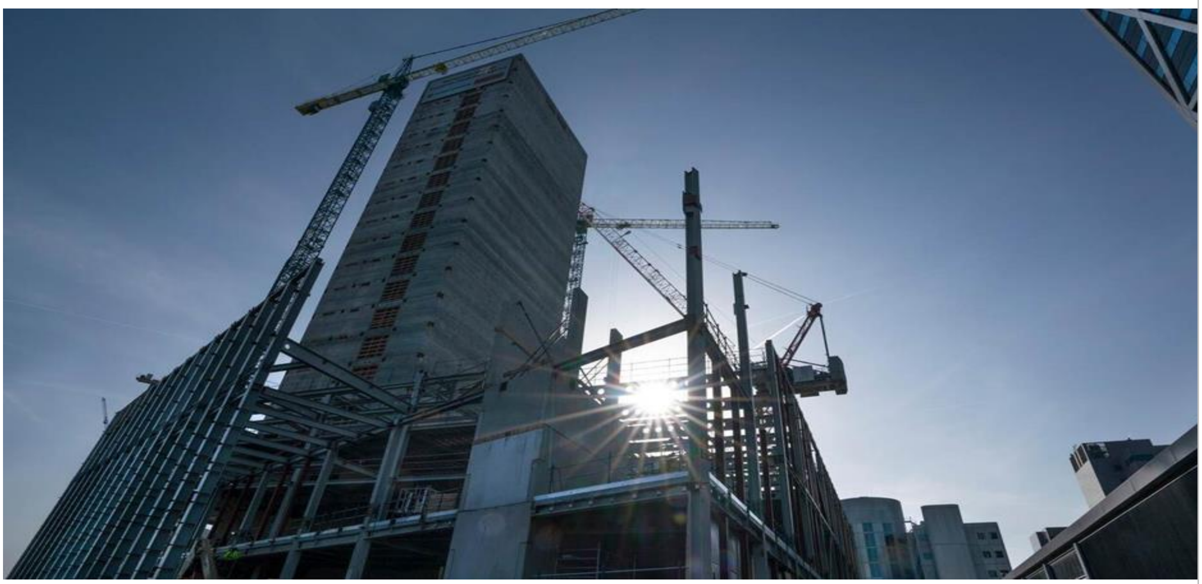
LECTURE: Tall building structures - Roy Crielaard

Roy Crielaard studied Civil Engineering, Building Engineering, at Delft University of Technology, graduating on the topic of fire safety in timber high rise structures. He went on to work as an engineer at Arup in London, where he gained broad experience in structural design, particularly with various international high-rise projects as a member of multidisciplinary teams.

After that Roy started working at Dutch construction company Heijmans, to expand his experience and knowledge into the realisation phase. In order to remain involved in education, Roy is a part-time lecturer at Delft university. Roy is also member of the board of The Royal Dutch Society of Engineers, KIVI.

As a structural engineer I am responsible for the design and analysis of the main load-bearing structure of my projects, as well as its presentation and communication within the multi-disciplinary design team and towards the client. My project portfolio includes large international commercial high-rise developments up to 320m tall, but also small- and medium sized projects in the Netherland. I am also frequently involved in various competitions and bids. Within my projects I focus on acquiring a broad technical base of structural engineering experience in the design and engineering of steel, concrete, and timber structures. I extensively use computer analysis, parametric and digital design, and optimization techniques - but I also highly value the qualities of a good sketch and a hand calculation.

In this lecture, Roy will talk about the technical aspects of tall structure design in general, but also about the interdisciplinary workflow. I will try to teach you some of the key structural considerations, helping you to avoid the mistakes I made. I will also focus on working from coarse to fine, starting with simple hand-calculations and working towards to full digital structural analysis model.



EMA, Amsterdam. Source: Heijmans

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Thursday 23 April

LECTURE: Digital Matters: Computational and Parametric Thinking in Structural Design – Shibo Ren ARUP

Shibo Ren is a senior structural engineer and computational designer at Arup Amsterdam. He received his Master degree with distinction on structural engineering from Delft University of Technology and received another Master degree on architecture from Architectural Association School of Architecture in London. He has been gaining diverse professional experience on complex and multidisciplinary projects in the Netherlands, UK and Denmark since 2007. His practices and interest focus on the development of integral design at the intersection of structural engineering and complex geometry, employing computational design strategies and digital fabrication for designing, thinking and analysing.

His work covers and integrates structural engineering, computational design, complex geometry, digital fabrication, parametric modelling, topology optimisation, and advanced structural analysis from the early stages of design to fabrication at various building scales.

In this lecture, Shibo discusses the potentials of digital and computational procedures for structural design will be discussed and various projects will be presented from small building component to large scale structure where integrated digital approaches and computational strategies have been implemented in the design process.

ARUP

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Wednesday 24 April

LECTURE: Integrated & sustainable design - Rik van Coolwijk & Rik Molenaar, Techniplan

Rik van Coolwijk is a consultant at Techniplan Adviseurs and is specialized in sustainability and integrated design of building services. Rik competed the BBE at the The Hague university of applied sciences with specialization in Building physics,. He started working at Techniplan in 2017 after working as a consultant building physics at DGMR for 2 years and Smitst van Burgst raadgevend ingenieursbureau as a consultant building services and sustainable energy concepts for 7. Rik has contributed in integrating energy saving and renewable energy measures in new and existing buildings.

Rik Molenaar is working as a consultant at Techniplan Adviseurs since 2003. He studied Building Services at Hogeschool Rotterdam (bachelor) and Eindhoven University of Technology (master). After his graduation at Hogeschool Rotterdam in 2003 he started working as a Consultant at Techniplan and he started his master at the TU/e . Rik is specialized in sustainability and integrated design of building services, especially in heating and cooling systems, ground source heat pumps, geothermal energy and business case calculations. Rik is also board member of the association BodemenergieNL and of author of various guidelines and legislation (ISSO-107, BRL 6000:21).

Techniplan advisors is a building services consultant. The company focusses on integrating the design of systems with other design disciplines. We advise in projects with a high level of complexity in technical requirements and sustainability ambitions

The lecture will be about what makes a building design an integrated designs, and examples of how you can integrate the architectural design with technical requirements and sustainability ambitions.

Left: De Sax, Rotterdam (architect MVRDV) Right: Zalmhaventoren, Rotterdam (architect Dam & Partners)

techniplan adviseurs bv

RAADGEVEND INGENIEURSBUREAU

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Thursday 23 April

LECTURE: Parametric Design Optimisation at Arup – Alex Christodoulou, ARUP

Alex Christodoulou is a Computational Design Engineer working for Arup in Amsterdam, specialised in using advanced digital methodologies to enhance design decision-making in engineering and design. He graduated from the Civil Engineering department of the University of Patras in 2010 following the Structural Engineering track and then pursued a second master's degree in TU Delft, with a specialisation in Building Engineering and a Thesis project on Parametric Massing Optimisation, which he concluded in 2013. Since then he has been working for Arup in Amsterdam. He has presented papers on his computational and parametric design research in conferences like IASS, SimAUD and the Design Modelling Symposium.

Alex works predominantly on parametric building design optimisation and computational building stock analysis projects. Some of the recent computational building optimisation projects he has worked on include the projects Valley, Sax and Ijburg Agora (MVRDV), Smakkelaarspark (Lingotto, Studioninedots, ZUS, Arup, VKZ) and Elements (Kondor Wessels Vastgoed, Koschuch, Arup).

In this lecture, Alex discusses parametric building design optimization from the specific perspective of interdisciplinary collaboration.

Image: Parametric design evaluation and exploration for Valley, architect: MVRDV

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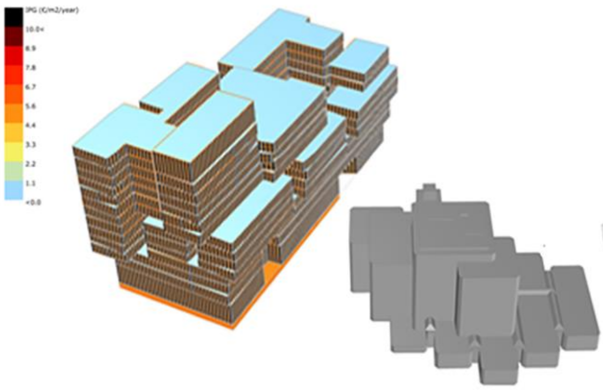
Thursday 23 April

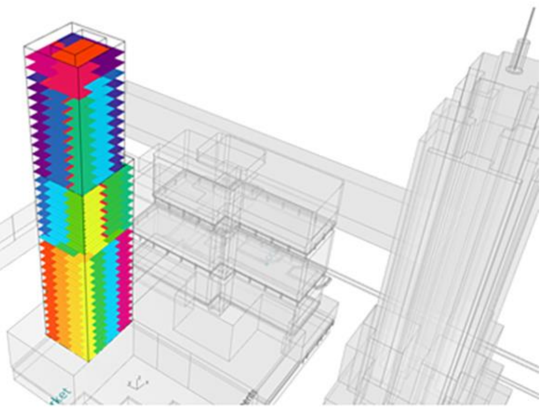
LECTURE: Smart and quick predictions of energy, comfort and sustainability for buildings - OMRT

OMRT is a parametric software enterprise that digitally enhances the design process in the AEC-industry. Our vision is to create an all-knowing computational brain that facilitates the full design process towards the most optimal built environment on all technical levels.

OMRT builds algorithms that contain different engineering disciplines which provide understandable outcomes and easy visuals in 3D. With those smart algorithms we make digital tools to compute complex problems. Making predictions of complex designs in terms of energy, comfort and sustainability quickly possible. These smart tools we apply, in collaboration with real estate developers, to several large projects in the Netherlands and other countries. On these projects we give in a early design phase insights in the performance by generating thousands of variants that steer the design in the right direction. With the help of several AI methods the generation of these solutions is just a matter of minutes.

In this lecture, we will introduce the endless possibilities of parametric performance based design that is driven by AI solutions. Followed up on the introduction we will give an overview on why this is very helpful for very tall or big buildings and how this can be applied in MEGA. We will end the lecture with a set of example projects we did in such way to give the students a clear overview of how we apply this in practice.





omrt

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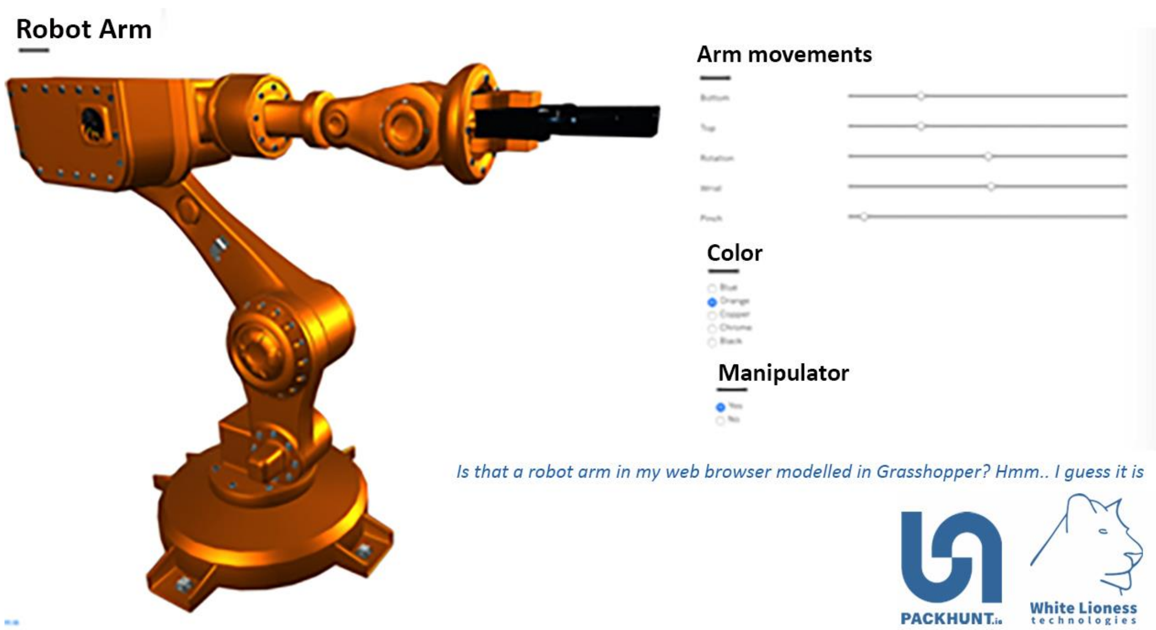
Wednesday 24 April

LECTURE: From Parametric Design to Digital Twins - Jeroen Coenders, White Lioness

Jeroen Coenders is CEO and founder of White Lioness technologies, a company which develops Packhunt.io, a next generation parametric design platform on the cloud. This platform is used in many different industries to facilitate design and production processes through parametric modelling. Prior to White Lioness technologies Jeroen has worked for Arup in Amsterdam where he has founded one of the first computation groups and work on projects such as NSP Arnhem.

White Lioness technologies develops Packhunt.io (http://www.packhunt.io), a revolutionary new platform which helps sales, design, engineering and production of products and projects by building parametric Digital Twins that can be used online in a web browser. Our mission is to make advanced technology (artificial intelligence, machine learning, parametric design, programming, augmented reality, virtual reality, etc) a commodity: something which is available to everyone and can be employed by anyone. We work with start-ups to market leaders to develop new solutions and business models. For example, we are heavily involved in software development for rising business of 3D concrete printing, and other novel digital manufacturing concepts. We are not limited to the Architecture, Engineering and Construction industry, but also work for industries such as eyewear, medical, sports, fashion, maritime and automotive.

Jeroen will focus his lecture on what changes and trends White Lioness experiences day-to-day in various industries and how that might affect the professions of architects and engineers. Jeroen will furthermore share his view where parametric design technology is heading (or at least where White Lioness is pushing it) and where we all might be going.



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Friday 24 April
LECTURE: Digital management of value and costs – Djordy van Laar, IGG Bouweconomie

Djordy graduated in 2015 at the University of Technology in Delft (MSc Building Engineering). During his graduation project he optimized the structural design of the Plug & Play Core stadium concept of Ballast Nedam. In retrospect, this stadium design can be called ‘modular’ and ‘circular’. This is where Djordy gained his first experiences in sustainability, innovation and construction costs. After graduation, he worked at Octatube as a structural engineer. Afterwards, he arrived a IGG Bouweconomie. Starting as a cost engineer, he’s become a project lead now. Also he’s responsible for the research and knowledge development on innovation and sustainability.

IGG Bouweconomie is a consulting firm in the real estate and construction industry. Mostly Djordy’s projects concern high complexity residential and utility buildings. Examples are the new headquarter office of Booking.com and the tallest wooden residential tower in the Netherlands called HAUT (both projects are in Amsterdam). Djordy is driven by innovation and sustainability. He keeps pushing existing boundaries and manages to achieve maximum business value for his clients. In his work he constantly balances ecological, social and financial value with life cycle costs. Djordy’s skills are best deployed in preliminary design phases where he’s able to empower strategic decision making. In these project phases he’s able to translate ambitions like ‘circular’, ‘low carbon’ and ‘healthy’ to quantified value and costs.

In his lecture, Djordy will tell you about digital management of value and costs. The technology that is available today is transforming IGG into a data driven company with a highly innovative culture. This changes the role, activities and tools of the value and cost manager in general and the data IGG uses. The lecture will address: the ‘language’ that is used in professional management of building economics; the reliability of data; and the most important parameters that drive building value and costs of high rise buildings.

igg bouweconomie.

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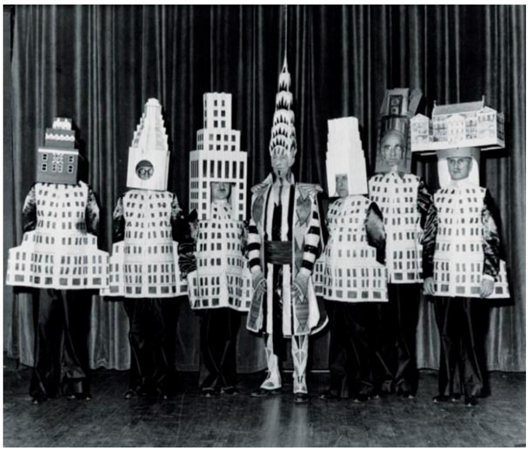
Friday 24 April

LECTURE: The skyscraper in Architecture culture'– Filip Geert

Filip Geerts (1978) graduated cum laude from the Delft University of Technology in 2001. From 2002 until 2010 he was associated in UFO-architecten. Since 2004 he is Assistant Professor at the Chair of Public Building & Architectural Compositions at the TU Delft.

He is an educator and researcher, teaching design studios and seminars, advising thesis projects, and involved with the research programme Borders conditions and Territories. His main interest is the intersection of architecture, city, landscape and infrastructure

In this lecture, Filip discusses with the students the skyscraper in Architecture culture. The tall building plays, beyond being a product of ongoing technical innovation, a particular role in architecture culture, as it addresses the proportionate relationship between plan, section and elevation in ways that produce endless speculation.



Left: Wiener & Co, Amsterdam, Netherlands. Right: Architects dressed as their buildings at the 1931 Beaux-Arts Architect Ball, NYC

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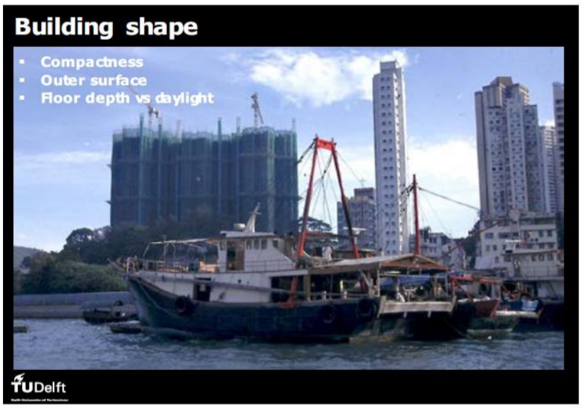
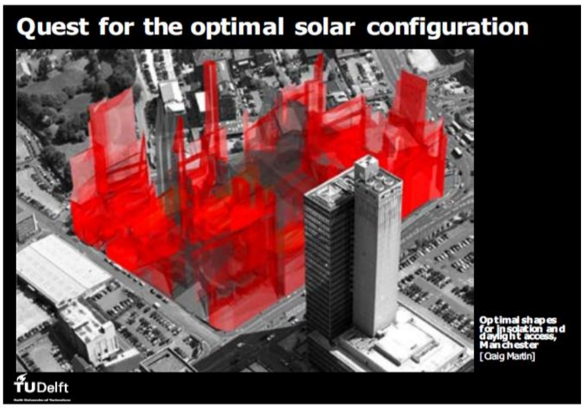
Wednesday 29 April
LECTURE: Building design in the urban energy transition - Andy vd Dobbelsteen

Andy van den Dobbelsteen is full professor of Climate Design & Sustainability and head of department of Architectural Engineering + Technology at TU Delft. He is board member of the Dutch Green Building Council and chair the scientific advisory board of NL Greenlabel. In the year 2016-2017 he was Francqui professor at Antwerp University.

A central focus of Andy's attention is how to design sustainable, energy-positive buildings and leads research projects on urban energy transition.

In this lecture, Andy discusses with students how to design sustainable, energy-positive buildings and leads research projects on urban energy transition.





12.3 VIRTUAL VISIT TO M4H

Wednesday 22 April 2020 – morning
VIRTUAL TOUR and MEETING THE STAKEHOLDERS
FOR ALL STUDENTS

8.45 to 9.30	Students familiarize with the area on-line. They look at maps and videos of the area. Rotterdam's brochures on the future visions on development are provided.
9.45 to 10.30	Markus Clarijs (Port of Rotterdam) presents the perspective from the client side on the demand for real estate. The presentation is followed by debate and interactive Q&A.
10.45 to 11.30	Students work on the analysis of the area, based on the inputs Markus Clarijs provided

12.4 WORKSHOPS (DETAILS)

The course offers a number of specialised workshops, providing skills and knowledge on specific topics relevant for MEGA. The workshops include both lectures and presentations about theoretic knowledge and applied examples as well as hands-on exercises and assignments.

Wednesday 22 April 2020
FAMILIARIZING WITH SITE and ON-LINE COLLABORATION by Paul de Ruiter + Lecture by MVRDV
FOR ALL STUDENTS

A lecture by MVRDV will introduce the topic of remote digital collaboration. Examples will be shown from MVRDV's projects.

In the afternoon, Paul de Ruiter will guide the students toward the collaborative making of the 3D model of the site, to be later explored in VR.

- 14.45 –15.30 – Use of datasets and VR for the analysis of the building location.
- 15.45 – 17.15 - Creating together a VR model of the location.
- 17.15 - 17.30 – Wrapping up the workshop

Remote on-line collaboration: The example of MVRDV – B. Thomas & L. Stuckardt, MVRDV

Boudewijn graduated at The Why Factory at TU Delft. He was an intern at ARX in Shanghai, China. Currently he is a Next Computational Specialist & Designer at MVRDV. Boudewijn main interest focuses the combination of computational technologies and design. It is important to have a clear understanding of the different design tools and how they can help us tackle problems in the design process. Recognizing these situations can bring a significant amount of quality to a project.

Leo Stuckardt is a practicing architect with a focus on emerging technologies, computational tools, and speculative design. Since 2015 he has worked as an Architect at MVRDV where he has been predominantly involved in architecture and urban design projects in Europe, India, and South Asia. In 2017 he co-founded MVRDV Next, an in-house R & D department centered around computational design strategies. He teaches design studios at The Why Factory (TU Delft).

Boudewijn and Leo will share perspectives and experiences on remote digital collaboration at MVRDV.

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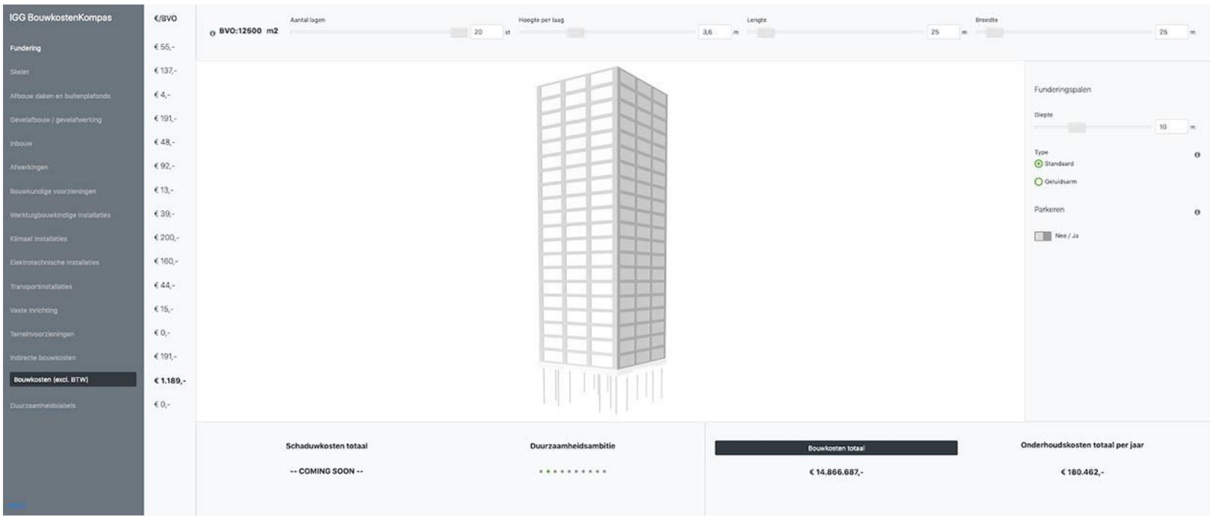
Friday 24 April 2020 – morning

BUILDING MANAGEMENT and ECONOMICS - by Djordy van Laar IGG Bouweconomie BV

FOR ALL STUDENTS

Throughout the workshop students will learn what tools are available for digital value and cost management. Furthermore, Djordy will give some practical advice on how to start your own business case for this MEGA course.



Friday 24 April 2020 – afternoon

ARCHITECTURAL WORKSHOP: volumes and functions – by Filip Geerts

FOR ALL STUDENTS

The Workshop initiates the overall design activities. As Architectural tutor, Filip Geerts leads the workshop in order for each team to start hands-on with the design. The workshop focuses on design requirements; site analysis; calculations of gross and net surface areas; preliminary understanding of (vertical) circulation schemes. Based on a set of assignments and interactive exercises, each team is asked to work on these factors. During the workshop, each team will produce preliminary outputs to be used on the next workshop on Tuesday 28 April, morning.

Image: A shot from the Architectural workshop in Mega 2018.

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Tuesday 28 April 2020 – morning

INTERDISCIPLINARY COORDINATION – by Aser Giménez Ortega, MVRDV

FOR ALL STUDENTS

Aser Giménez-Ortega (Murcia, Spain, 1979) is a Spanish architect and associate director at MVRDV. He studied at TU Eindhoven, the Netherlands and Universidad Politécnica de Valencia, Spain, graduating with a Masters in Architecture in 2005. Before joining MVRDV, he worked as an architect and urban designer in Spain, Brazil, and the Netherlands. He joined MVRDV in 2007. Aser's other works include the transformation of a former concrete factory into Roskilde Festival Folk High School and The Vertical Village research in collaboration with The Why Factory. He is also responsible for a range of interior and retail projects both in Europe and in Asia, such as the façade for the BVLGARI flagship store in Kuala Lumpur, Malaysia and a temporary Dolce & Gabbana store in Paris. He has lectured and conducted student workshops in different cities and universities such as The Hague, Oslo, Istanbul, Lisbon, Jerusalem and Plovdiv.

At MVRDV, Aser has experience leading projects of various scales and phases, ranging from masterplan to interior design and from concept to construction. Aser overlooked the conceptualization and realization of Oslo's DNB bank headquarters and Shanghai's Hongqiao CBD, both exemplary green projects with a fast, smooth construction process.

The workshop will focus on architectural convergence in interdisciplinary collaboration. With students, Aser will present and discuss how different complex inputs can be coordinated toward one coherent architectural design project, having one strong identity. The graphic and communication strategy will be discussed as crucial in expressing the identity of each project. Each team will be guided to define their own graphic templates, to be then used during the entire course.

Tuesday 28 April 2020 – afternoon
COMPUTATIONAL WORKSHOP: Collaborative Computational Design
FOR ALL STUDENTS

The Workshop initiates digital modelling. It is organized based on lectures and software examples. As following:

- **13.45-14.00: Lecture: Introduction. By Michela Turrin.** It introduces Computational Design in MEGA. It refers to the theoretic approach and explains the practical tasks during the course – with distinction between a) collaborative design; d) parametric design, simulations and optimization for Performance-based Design.
- **14.45-16.30: On-line remote collaboration - Lectures and software examples. Collaborative Design: the example of Speckle. Collaborative Design: the example of BIM 360. By Fredy Fortich Mora and Divyae Mittal.** The lectures introduce collaborative design and the use of shared core models versus individual models. Different options to share data and information across disciplines will be presented and discussed. The specific case of Speckle and BIM 360 will be introduced. Examples will be shown mostly in Speckle.
- **16.45-17.30: Lecture and software examples: Introduction to Optimisation. By Berk Ekici**

Needed Material: All students should have their laptops, with installed Rhino 6 and Grasshopper; BIM 360. See also: Speckle: http://wiki.bk.tudelft.nl/toi-pedia/AR0026-speckle Revit: http://wiki.bk.tudelft.nl/toi-pedia/Revit Work-sharing in Revit: http://wiki.bk.tudelft.nl/toi-pedia/Worksharing_in_Revit#Ideal_Workflow

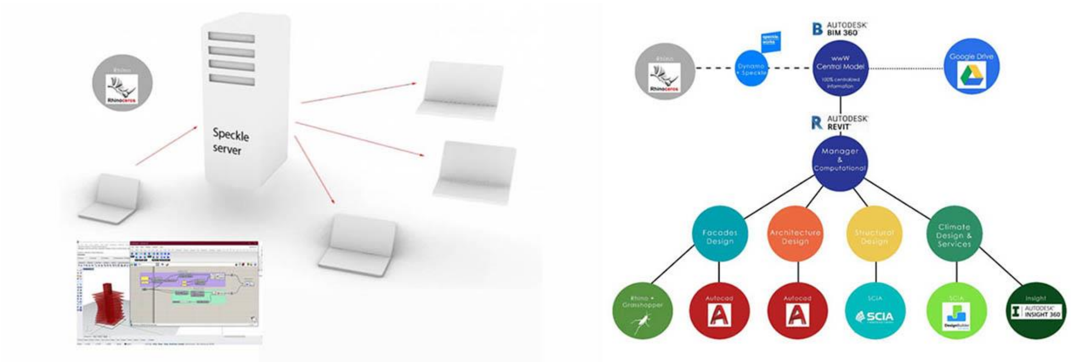
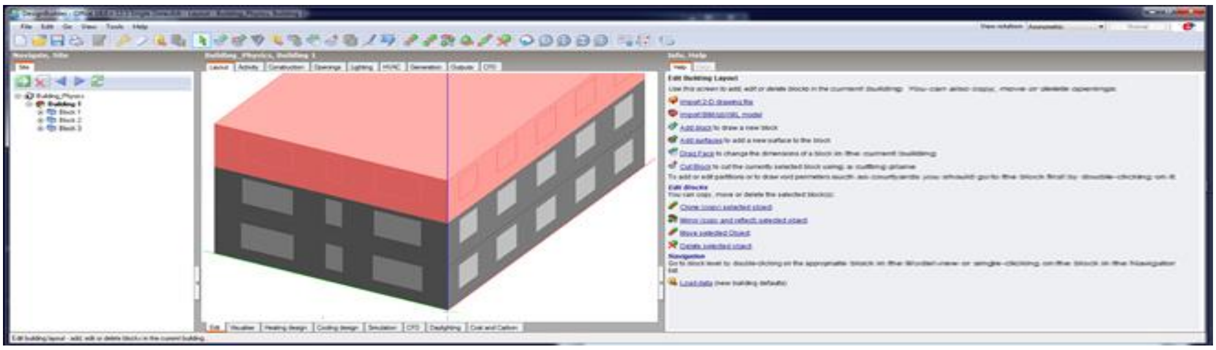


Image: Examples from students' work in Mega 2019.

Wednesday 6 May 2020 – morning
CLIMATE WORKSHOP: Energy demand and indoor comfort by Design Builder
OPEN TO ALL STUDENTS, ESPECIALLY RECOMMENDED FOR CLIMATE DESIGN AND FAÇADE STUDENTS

Willem van der Spoel leads the workshop. The workshop focuses on the use of DesignBuilder for calculation of energy demand and indoor comfort. Building Technology students previously used this software in the Building Physics course, while others may be completely unfamiliar. The latter group is strongly advised to have seen or at least scanned the 12 video tutorials of the DesignBuilder playlist '3. Basic Model Data' on YouTube. The workshop guides the students through DesignBuilder with a view on the understanding of the software, especially with regard to low-energy strategies while maintaining a good indoor thermal comfort. All students are welcome, but especially students focusing on Climate and Façade Design are advised not miss the workshop.

Needed Material: All students should have their laptops, with DesignBuilder version 5.5.2 installed. DO NOT use a demo version of version 6 because of a lack of backward compatibility. TU Delft currently has a license for version 5. You will be provided with an activation code during the workshop.



Tuesday 12 May 2020 – full day

COMPUTATIONAL WORKSHOP: parametric design and optimization

OPEN TO ALL STUDENTS, MANDATORY FOR COMPUTATIOANL DESIGN STUDENTS

The Workshop is meant to focus on Performance-based Design by means of parametric design, simulation and optimization. It is organized based on lectures and software examples. As following:

- **8.45-10.30: Lecture and software examples: Optimisation. By Berk Ekici**
- **10.45-17.30: ESTECO SEMINAR – training and examples on Computational Optimization using modeFRONTIER.** The workshop introduces modeFRONTIER. modeFRONTIER is a comprehensive solution for process automation and optimization in the engineering design process. The workshop will offer both a theoretic introduction and applied examples. In addition to the general use of modeFRONTIER, the workshop addresses also the specific use of modeFRONTIER in direct connection with Grasshopper, using a connection node developed by ESTECO in close collaboration with the Chair of Design Informatics at TUDelft.

10:45	11:00	Introduction to ESTECO and Academy Program
11:00	11:15	Applications of modeFRONTIER to AEC
11:15	11:45	Process integration and workflow creation
11:45	12:30	Demo on Process Integration
12:30	14:00	LUNCH BREAK
14:00	14:30	Basic Visualization Tools - Demo
14:30	14:45	Introduction to Optimization
14:45	15:15	Statistics, Response Surfaces and MultiVariateAnalysis - Theory
15:15	15:45	BREAK
15:45	16:30	Statistics, Response Surfaces and MultiVariateAnalysis - Demo
16:30	17:15	Application examples integrating Grasshopper with modeFRONTIER
17:15	17:30	Q&A

Needed Material: All students should have their laptops, with ESTECO modeFRONTIER installed. Licenses will be provided in advance.

Alberto Clarich, ESTECO

He received his PhD in "Innovative Parameterisation and Optimisation Methodologies in Aeronautic Field", University of Trieste (2003), in collaboration with Dassault Aviation, having a background as Mechanical Engineer. He has published several articles in journals and conference proceedings, in Multi-Disciplinary Optimization field, and is member of NAFEMS Italy Steering Committee. Since 2004 he is working at ESTECO as Optimization expert, and from 2010 he is Manager of Engineering Service & Support Department of ESTECO.

Luca Battaglia, ESTECO

He received his Msc degree in Mechanical Engineering at University of Trieste (2018), collaborating during his thesis with ESTECO for the European project Gasvessel on the optimization of composite materials for pressure vessels. Since 2018 he joined ESTECO as Support Engineer.

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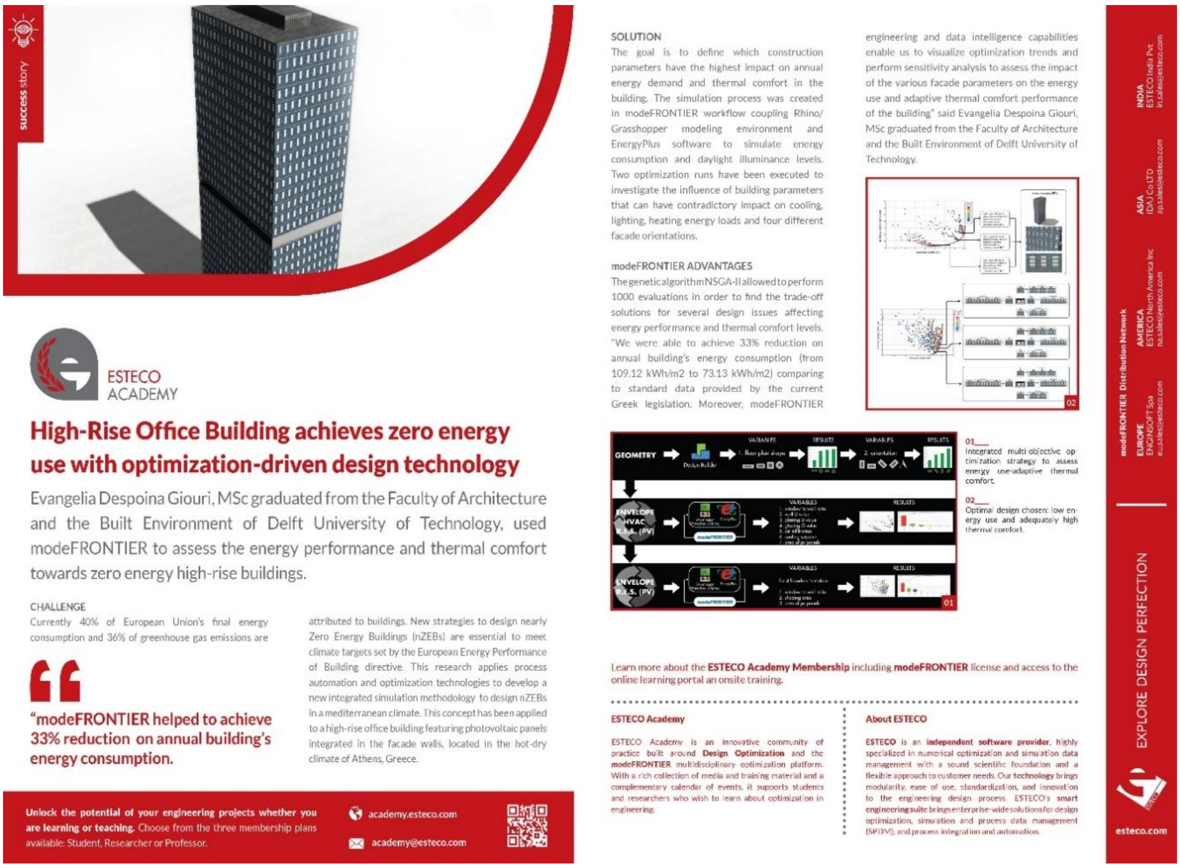
WORKSHOP BY ESTECO

ESTECO is an independent software provider, highly specialized in numerical optimization and simulation data management with a sound scientific foundation and a flexible approach to customer needs. Among other products, ESTECO develops modeFRONTIER.

ESTECO Academy is an innovative community of practice built around Design Optimization and the modeFRONTIER multidisciplinary optimization platform. With a rich collection of media and training material and a complementary calendar of events, it supports students and researchers who wish to learn about optimization in engineering.

modeFRONTIER is a comprehensive solution for process automation and optimization in the engineering design process. It is a platform and modular environment to manage the logical steps of an engineering design process. Its workflow and the integration with third party tools (such as geometry modelers and simulation software) enable the automation of the simulation process. A suite of design of experiments and optimization algorithms drive the search for optimal solutions. Advanced computational tools for data analysis and visualization support the decision making process and the understanding of the different choices' implication, helping to identify of the right design alternative.

The workshop focuses on modeFRONTIER and on modeFRONTIER in connection with Grasshopper (McNeel Rhino). The workshop introduces several topics with focus on Optimization-Driven Design, including Design of Experiments; Optimization Algorithms; Response Surface Modeling; Simulation Data Management; and others. The workshop provides theoretic knowledge and includes several examples and hands-on exercises.


success story

ESTECO ACADEMY

High-Rise Office Building achieves zero energy use with optimization-driven design technology

Evangelia Despoina Giouri, MSc graduated from the Faculty of Architecture and the Built Environment of Delft University of Technology, used modeFRONTIER to assess the energy performance and thermal comfort towards zero energy high-rise buildings.

CHALLENGE

Currently 40% of European Union's final energy consumption and 36% of greenhouse gas emissions are attributed to buildings. New strategies to design nearly Zero Energy Buildings (nZEBs) are essential to meet climate targets set by the European Energy Performance of Building directive. This research applies process automation and optimization technologies to develop a new integrated simulation methodology to design nZEBs in a mediterranean climate. This concept has been applied to a high-rise office building featuring photovoltaic panels integrated in the facade walls, located in the hot-dry climate of Athens, Greece.

"modeFRONTIER helped to achieve 33% reduction on annual building's energy consumption.

SOLUTION

The goal is to define which construction parameters have the highest impact on annual energy demand and thermal comfort in the building. The simulation process was created in modeFRONTIER workflow coupling Rhino/Grasshopper modeling environment and EnergyPlus software to simulate energy consumption and daylight illuminance levels. Two optimization runs have been executed to investigate the influence of building parameters that can have contradictory impact on cooling, lighting, heating energy loads and four different facade orientations.

modeFRONTIER ADVANTAGES

The genetic algorithm NSGA-II allowed to perform 1000 evaluations in order to find the trade-off solutions for several design issues affecting energy performance and thermal comfort levels. "We were able to achieve 33% reduction on annual building's energy consumption (from 109.12 kWh/m2 to 73.13 kWh/m2) comparing to standard data provided by the current Greek legislation. Moreover, modeFRONTIER engineering and data intelligence capabilities enable us to visualize optimization trends and perform sensitivity analysis to assess the impact of the various facade parameters on the energy use and adaptive thermal comfort performance of the building" said Evangelia Despoina Giouri, MSc graduated from the Faculty of Architecture and the Built Environment of Delft University of Technology.

01 Integrated multi objective optimization strategy to assess energy use-adaptive thermal comfort.

02 Optimal design chosen: low energy use and adequately high thermal comfort.

Unlock the potential of your engineering projects whether you are learning or teaching. Choose from the three membership plans available: Student, Researcher or Professor.

academy.esteco.com

academy@esteco.com

Learn more about the **ESTECO Academy Membership** including **modeFRONTIER** license and access to the online learning portal an onsite training.

ESTECO Academy

ESTECO Academy is an innovative community of practice built around **Design Optimization** and the **modeFRONTIER** multidisciplinary optimization platform. With a rich collection of media and training material and a complementary calendar of events, it supports students and researchers who wish to learn about optimization in engineering.

About ESTECO

ESTECO is an **independent software provider**, highly specialized in numerical optimization and simulation data management with a sound scientific foundation and a flexible approach to customer needs. Our **technology** brings modularity, ease of use, standardization, and innovation to the engineering design process. ESTECO's **smart engineering suite** brings enterprise-wide solutions for design optimization, simulation and process data management (SPDM), and process integration and automation.

modeFRONTIER Distribution Network

EXPLORE DESIGN PERFECTION

esteco.com

https://www.esteco.com/corporate/high-rise-office-building-achieves-zero-energy-use-optimization-driven-design-technology

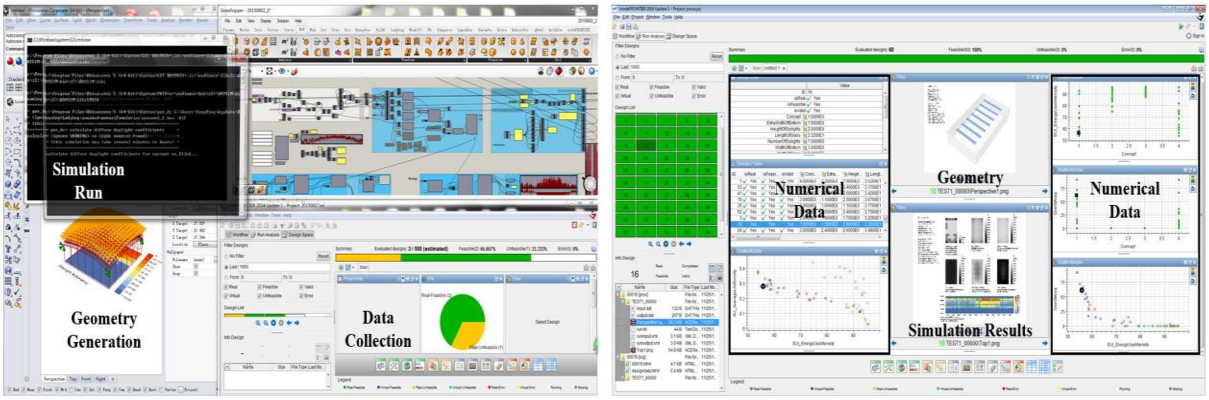


Image source: Yang, D., Ren, S., Turrin, M., Sariyildiz, S. and Sun, Y., 2018. Multi-disciplinary and multi-objective optimization problem re-formulation in computational design exploration: A case of conceptual sports building design. Automation in Construction, 92, pp.242-269.

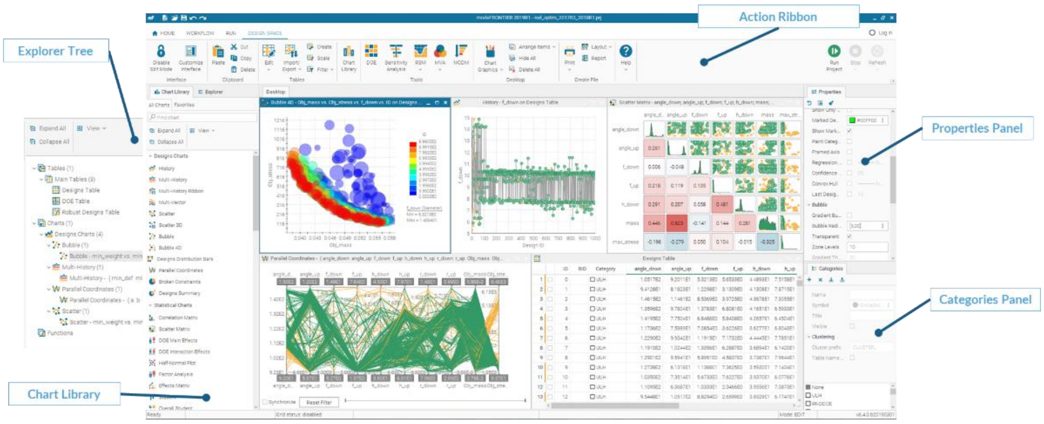


Image: Examples of functionalities in modeFRONTIER, ESTECO (https://www.esteco.com)

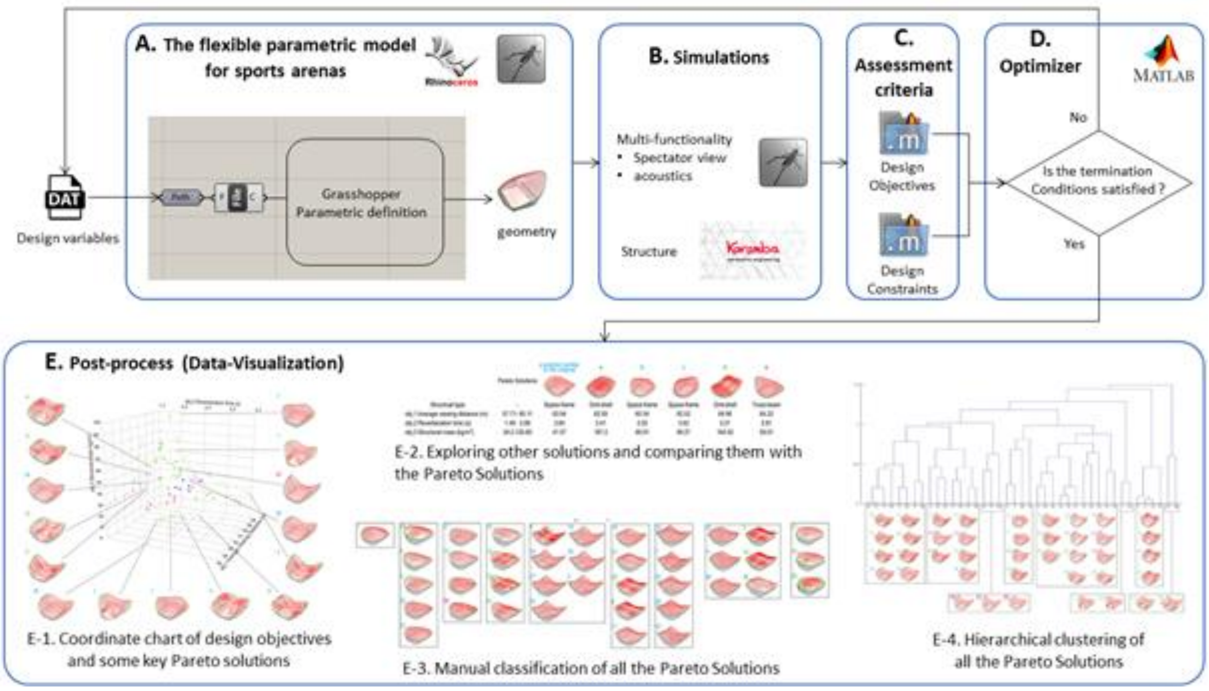
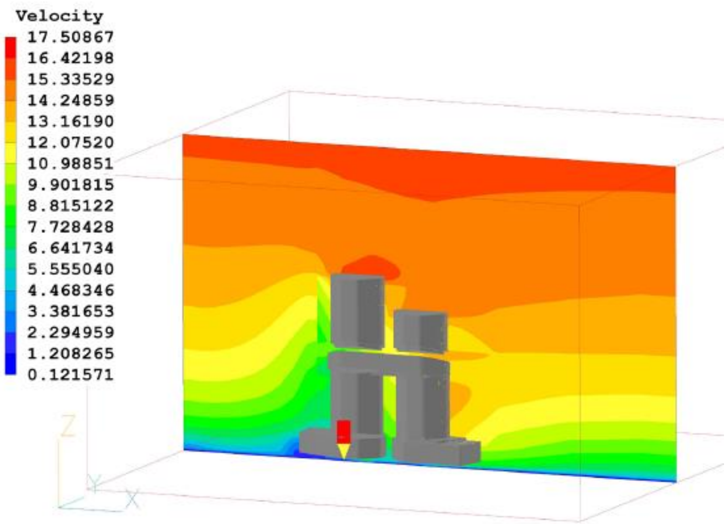


Image source: Pan, W., Turrin, M., Louter, C., Sariyildiz, S. and Sun, Y., 2019. Integrating multi-functional space and long-span structure in the early design stage of indoor sports arenas by using parametric modelling and multi-objective optimization. Journal of Building Engineering, 22, pp.464-485.

Wednesday 13 May 2020 – morning
CLIMATE WORKSHOP: CFD analysis and software
OPEN TO ALL STUDENTS, MANDATORY FOR CLIMATE DESIGN STUDENTS

Peter van den Engel leads the workshop. The workshop will start with air-flows around buildings. Other subjects that will be discussed are air flows in atria, large spaces or auditoria and second skin façades. Insights in air flows around buildings are important for several reasons. For example, for wind nuisance; comfort-cooling options in summer; air quality, due to exhaust of chimneys and traffic; air quality around parking garages; options for energy for wind-turbines; options to support ventilation systems in buildings (inlets and/or outlets); options for natural ventilation. Additionally, indoor air flows are also crucial both for thermal comfort and for air-quality. In this light, the workshop offers an overview on CFD, computational fluid dynamics. It will focus also on hands-on exercises in Phoenics.



Example of a wind study around a building from Stamatia Kounaki (MEGA 2018)

INVITED WORKSHOP TUTORS/LECTURES

Clara Garcia-Sanchez, PhD - Assistant Professor at TUDelft
Clara completed her degree in aerospace engineering in 2011 at the Polytechnic University of Valencia, Spain. After finishing her degree, she completed the research master in fluid dynamics at the von Karman Institute, Belgium. One year after, she was awarded a grant for Strategic Basic Research (IWT) to pursue her PhD degree in physics. Her PhD was a collaboration between the University of Antwerp and the von Karman Institute, where she graduated in 2017. During her PhD, she performed collaborations at Columbia University and Stanford University, USA. Before joining the 3D geoinformation group, she was a postdoctoral research scientist in the Global Ecology department at Carnegie Institution for Science, where she worked on wind energy related topics. Her main research focuses on wind engineering problems, specifically addressing dispersion and airflow predictions in the built environment with computational fluid dynamics and uncertainty quantification methodologies.

13. TUTORS AND STUDIO CONSULTS

ARCHITECTURAL DESIGN

Filip Geerts

Filip Geerts (1978) graduated cum laude from the Delft University of Technology in 2001. From 2002 until 2010 he was associated in UFO-architecten. Since 2004 he is Assistant Professor at the Chair of Public Building & Architectural Compositions at the TU Delft. He is an educator and researcher, teaching design studios and seminars, advising thesis projects, and involved with the research programme Borders conditions and Territories. His main interest is the intersection of architecture, city, landscape and infrastructure.

Nicola Marzot

Nicola Marzot (1965) has taught as a lecturer at the Faculty of Architecture of Firenze, Ferrara and the Faculty of Engineering of Bologna, where he obtains his PhD in “Building and territorial engineering” in 2000. Nicola focuses on theory and method of architecture and urban design strategies in close relation to Urban Morphology and Building Typology.

Oscar Rommens

Oscar Rommens (1968) graduated from the Hoger Architectuur Instituut Sint-Lucas Gent in 1994. He completed a postgraduate Urban Design program in Chicago, Archeworks (1995-97). In 1999 he co-founded Import Export Architecture (IEA) in Antwerp that operates from various urban biotopes and the in-between of public and private opportunities engaging with design of buildings, landscapes, urban areas, furniture or its transformation and development of theoretical concepts, models and prototypes. He teaches architectural design at the TU Delft and taught at the Academy of Architecture in Tilburg and the PHL Architecture Diepenbeek.

Micha de Haas

Micha de Haas (1964) studied at the Bezalel Art and Design Academy in Jerusalem and the Delft University of Technology. In 1997 he started his independent practice in Amsterdam. He won architectural awards and competitions and his work has been published in the Netherlands and abroad. He teaches at the Chair of Public Building & Architectural Compositions at the TU Delft and the Academie van Bouwkunst Amsterdam.

CLIMATE DESIGN

Peter van den Engel

Peter van den Engel is fascinated by natural or hybrid ventilation and low energy buildings with an excellent (evaluated) occupant comfort. Architectural space, shape, thermal mass, insulation and adaptive façade design are some points of attention. Daylight, solar heat, buoyancy, wind and diurnal temperature differences could be used in a more effective way. His PhD was focussed on draught free natural air supply. At the moment he is an air flow specialist in general, making use of CFD and thermal or mass flow simulations. Subjects of interest are large public buildings, factories, green houses, data centres, operating and clean rooms. At the Delft University of Technology he is teaching climate design and building physics.

Regina Bokel

Dr. R.M.J. Bokel works since 1999 as an assistant professor at the Delft University of Technology, section Architecture and Building Technology, Building Physics. Her expertise is applied building physics, mainly the sub aspects Daylighting (1999-2003) and Energy and Ventilation (1999-present). She supervises several PhD's and is involved in several research projects such as Annex 62, EOS and TKI projects. She was directly involved with the EOS project "Earth, Wind and Fire" led by Ben Bronsema (finished 2012) and the TKI project "BESTE". She was co-promotor of Zhiming Yang (2012) on a "Method to assess the performance of domestic ventilation systems considering the influence of uncertainties" and Bas Hasselaar (2013) in which a facade is designed, partly built and tested. She now supervises the PhD's Yayi Arsandrie (comfort and health in low-income dwellings in Indonesia) and Xiaoyu Du (passive cooling techniques in Chinese Rural Residential buildings). She coordinated the graduate students Building Technology from 2007-2013 and is actively involved in teaching Master and Bachelor students.

Wim van der Spoel

Wim van der Spoel is Assistant Professor at TUDelft since 2001, focusing on eat and mass transfer in buildings and building constructions; energy in buildings. He is is a senior consultant at Landstra bureau voor bouwfysica since January 2006, on research and development building physics and energy. He has been Assistant Professor at Eindhoven University of Technology from 1999 to 2001, focusing on building physics, radon gas transport in concrete, moisture transfer in porous media. Between 1998 and 1999 he has been a Post-Doc at Delft University of Technology

COMPUTATIONAL DESIGN

Michela Turrin

Michela Turrin is an Associate Professor at the Chair of Design Informatics. In both teaching and research, her focus is on computational design, including parametric design and optimization. She works at TUDelft since 2006, where she received her PhD diploma. In 2012 she was Marie Curie Fellow at Beijing University of Technology, collaborating with international companies and at Green World Solutions Ltd. She taught in a number of international events, among which the IFoU Summer School 2012 in Beijing and Winter School 2013 in Hong Kong. From 2012 to 2014 she hold a position as senior lecturer at Yasar University in Izmir-Turkey. In 2014 and 2016, she was awarded a grant as Excellent Oversea Instructor and a research grant by the Key State Laboratory of Subtropical Building Science in Guangzhou, China. At TUDelft, currently she leads and/or is involved in a number of national and international research projects, focusing on multi-disciplinary computational design (parametric design; interdisciplinary optimization; customized manufacturing/3D printing).

Paul de Ruiter

Paul de Ruiter started in 2006 as teacher/researcher at the chair of Design Informatics. He was responsible for developing and co-developing a wide range of bachelor, master courses and international workshops related to computational design and digital manufacturing. Paul worked for several years as Head of the Section Computation and Performance and was co-founder of the TOI Additive Manufacturing lab and the VR lab.
Topics: Holistic approach in sustainable computational design and digital manufacturing.

Berk Ekici

Berk Ekici is a guest teacher and a Ph.D. candidate at Chair of Design Informatics in TU Delft, Faculty of Architecture and the Built Environment. Ekici has collaborated in many projects and publications related to algorithmic modelling, building performance simulation, and computational optimization in the conceptual design phase. As part of the Ph.D. research, Ekici is focusing on self-sufficient high-rise buildings using building performance simulation, machine learning, and heuristic optimization to investigate the most adequate design solution.

Shibo Ren (3 consults)

Shibo Ren is a senior structural engineer and computational designer at Arup Amsterdam. He received his Master degree with distinction on structural engineering from Delft University of Technology and received another Master degree on architecture from Architectural Association School of Architecture in London. He has been gaining diverse professional experience on complex and multidisciplinary projects in the Netherlands, UK and Denmark since 2007. His practices and interest focus on the development of integral design at the intersection of structural engineering and complex geometry, employing computational design strategies and digital fabrication for designing, thinking and analysing. His work covers structural design, computational design, complex geometry, large-span and high-rise structure, digital fabrication, parametric modelling, topology optimisation, and advanced structural analysis from the early stages of design to fabrication at various building scales.

FACADE DESIGN

Arie Bergsma

Arie Bergsma studied Aerospace Engineering at Delft University of Technology. After graduation in 1995 he worked as materials researcher at Hoogovens R&D, Product Application Centre (nowadays TATA steel). From 1998 till 2004 he studied Architecture and Building Technology at Eindhoven University of Technology. Before and during this period of part-time study he worked at several engineering offices in the Netherlands: Prince Cladding BV (facade contractor), D3BN Structural Engineers and Peutz Consulting Engineers in Zoetermeer. At Peutz he worked as consultant on building physics, acoustics and energy performance from 2001 till 2006 and was involved in several large-scale building projects in the Netherlands: Shell head office in The Hague, Hydron head office in Utrecht, Municipal Archives Amsterdam, high-rise residential tower Montevideo Rotterdam, Cinema complex Spuimarkt in The Hague, etc. Since 2006 his work focuses on facade research and design, teaching and education coordination at the TU Delft (part-time) and own consulting activities and projects within GAAGA.

Stephan Verkuijlen

Stephan Verkuijlen is one of the founding architects at wv-studio. Stephan studied at the TU Delft where he received a master’s degree in Architecture (hons) and a master’s degree in Building Technology. After his studies he worked for “Micha de Haas Architects” in Amsterdam where he was involved with the construction of the Dutch Aluminium Centre (Aluminium Bos) which received the European “Architecture and Technology” award. He worked at “Studio Massimiliano Fuksas” in Rome, Italy where he was responsible for various retail projects and a masterplan design in the city centre of Eindhoven, the Netherlands. Stephan spent nine years at “Foster + Partners” in London, UK where he was an Associate Partner working on, and being responsible for, projects of varying scales in different locations around the world. Next to his work at wv-studio, Stephan teaches at the “Faculty of architecture TU Delft” and the “Academie van Bouwkunst Amsterdam”.

STRUCTURAL DESIGN

Mauro Overend

Mauro is Professor of Structural Design & Mechanics Department of Architectural Engineering + Technology. Although the structural engineering is widely perceived as a mature discipline, there is the potential for improvement. "The primary objective remains to construct efficient buildings that don’t collapse. We should sustain a high level of education and training to keep it that way," explains Overend. "However, efficiency is typically limited to the cost-efficient use of materials in the construction phase. The building sector has yet to address the fact that buildings, or rather their materials, can and should be reused and recycled at the end of their lives. So, for instance, over the past two decades the building industry has managed to reduce the energy required to keep our buildings comfortable, e.g. warm in winter, cool in summer and well-lit throughout the year, but in the process of doing so we have introduced composite components and structures that are very hard to deconstruct. This creates a real barrier for the basic materials to be reused. Structures have a service life, but what about their afterlife?”

Sander Pasterkamp

Sander Pasterkamp graduated in 1998 from the faculty of Civil Engineering at the TU Delft. Between 1998 and 2007 he worked at Corsmit Consulting Engineers (now part of RHDHV) and Pieters Bouwtechniek. He was the structural designer for buildings such as the KPMG headquarters in Amstelveen and the office building Victoria (now The Mark) in Rotterdam. He became a lecturer at the faculty of Civil Engineering, chair Building engineering in 2007. He currently works part-time as a lecturer in Delft and part-time as a consulting engineer for Pieters Bouwtechniek in Amsterdam.

Karel Terwel

Karel (1975) studied Civil Engineering at Delft University of Technology (DUT) and graduated in 2001. From 2001 until 2007 he worked as a structural designer/ project leader at Zonneveld Engineers on complex structural designs like two office towers (height: 146m) for the government in The Hague (awarded Dutch concrete prize 2013) and the Palace for music in Utrecht. Since 2007 he has been a lecturer (from 2015: assistant professor) focusing on structural design and safety at DUT. He teaches courses in structural design and in forensic engineering. Terwel finished his PhD on human and organizational factors influencing structural safety in 2014. Apart from this research, his research interest focuses on causes of structural damage. In 2013 Terwel founded Coenraedt B.V. He is committed to providing consultancy in investigations of structural failures, second opinions and structural risk management. He is vice-chair of IABSE's TG5.1 Forensic Structural Engineering and member of the editorial advisory board of ICE's journal Forensic Engineering.

Roy Crielaard

Roy is a structural engineer who highly values an integrated and holistic approach to building design. He loves working together with (up-and-coming) talented architects, engineers, and clients. Roy graduated with honours from Delft University of Technology with a Civil Engineering Master's degree in 2015. He went on to work as a structural engineer at Arup's Building Engineering group in London, where he primarily worked on high rise buildings as a member of multidisciplinary teams. His projects included towers in Bogota, Paris, and Taipei. To expand his experience and knowledge into the realisation phase, Roy recently switched to contractor Heijmans where he now works at the Design and Engineering department. Roy teaches at Delft University one day a week.

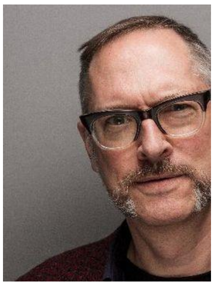
Marco Schuurman

After working for almost ten years at Royal HaskoningDHV, I was curious about how it went with one of the other major players in the Dutch construction world. ABT really appealed to me because of the fact that innovation and development are of paramount importance. I prefer to work as broadly as possible. Concrete, wood, steel or glass; I find it all interesting - as long as it challenges me and I can go deep. I prefer to combine designing with the client's team with my affinity for advanced calculation tools (for example FEM software, such as DIANA and SCIA Engineer, but also MathCAD) and Computational Design (Rhino + Grasshopper, Revit + Dynamo). Due to my background in engineering, I am not only a constructor, but I also got an up-to-date overview of the challenges for architect, building physicist and installation consultant. I also like to use advanced and / or new (computer) techniques to take the designs to a higher level.

MANAGEMENT

Peter de Jong

Peter de Jong works at TUDelft. After his studies in Civil Engineering, he developed his experiences in the fields of: Appropriate Technology for Developing Countries (CICAT-DUT); Ecological building (CICAT-DUT); Research on Building Informatics – CAD/BIM (VIBI); Building Informatics/application development/tools sustainability (own company); Building economics/building management.



John Heintz

John Heintz is associate professor and head of the section Design and Construction Management. His research Interests are Project Design, Project Management Education, Project Management for the Circular Economy and Architectural Practice, Li-censure & Firm ManagemenT.

STUDENT ASSISTANTS

Divyae Mittal

Divyae Mittal is a master student pursuing Building Technology track at Faculty of Architecture and Built Environment, TU Delft. He is primarily interested in improving user experiences in the built environment through the modern technology. He is trying to make it possible by combining knowledge of computational design, simulation, and psychology.

Fredy Fortich

Fredy Fortich is studying Building technology Master track at the Faculty of Architecture and Built Environment at TU Delft. He has worked at architecture offices in Bogota and London. He has ample experience with BIM methodology with up to 340,000 m² of designed and coordinated Autodesk Revit projects and competitions. He is especially interested in innovative and pragmatic computational methods applied to the built environment.

The course is extremely grateful also to **dr. Serdar Asut** for his great contribution and support in setting up the on-line teaching of MEGA2020 facing the COVID-19 lockdown.

FIRE SAFETY CONSULTS **(See dates in schedule)**

Björn Peters - consults sponsored by dGmR

Björn Peters MSc. graduated in Building Technology at The faculty of Architecture, Delft University of Technology in 2002. After that he is worked as a lecturer in Building Physics at the same faculty. After switching to DGMR he followed a few post-doc courses fire safety engineering, regarding fire modelling and evacuation modelling at Greenwich University. Now working for 14 years at DGMR, he is Senior Consultant Fire Safety and Building Technology and Associate. At DGMR Björn is responsible for the fire safety concept of several special projects, like the Rijksmuseum (Amsterdam), the a.s.r. office building (Utrecht), Meander Medical Centre (Amersfoort), the exisiting buildings of Noordwest Medical Centre (Alkmaar) and Westfries Gasthuis (Hoorn) and several high rise projects like the "Maastoren" (Rotterdam), New Babylon and the Crown (The Hague) and Maritim congress centre and Valley (Amsterdam), and has been doing research mainly on evacuation strategies, especially for hospitals and vulnerable people.

VERTICAL TRANSPORT CONSULTS **(See dates in schedule)**

Jacques Mol

As a consultant I am involved in renovation, sustainability and complex integrated projects. I like to look for smart solutions in the field of energy saving and reliability. This applies to offices, laboratories and data centres.

My motto for renovations: keep the good and improve the rest. Striving for the affordable, sustainable and best solution. The organization surrounding a renovation process plays an important role, especially in relation to the user of an inhabited building.

In recent years I have gained a lot of experience in the University world, including the Faculty of Science, Mathematics and Computer Science (FNWI) of the University of Amsterdam with many types of laboratories. I am also proud of my projects for TU Delft, Wageningen University and Erasmus University in Rotterdam. As director I am responsible for all internal ICT matters.

14. MAIN EXTERNAL SPONSORS MEGA 2020

MEGA 2020 thanks the 2020 main external sponsors (Techniplan; Stichting Hoogbouw) for the great support they provided to the course. Without the wonderful enthusiasm of their support, the budget and in-kind contributions they generously provided, special activities possibly would have been unfeasible. The support of Techniplan and Stichting Hoogbouw is a long-lasting tradition, which span over many years and is still greatly appreciated. MEGA 2020 also thanks all the other 2020 contributors that supported the course. The in-kind contributions by MVRDV, Esteco, WhiteLioness, dGmR, IGG Bouweconimie, and the contribution from Arup, UNSTUDIO, Valstar Simonis, OMRT, offer to the course an amazingly valuable opportunity of exchange between academia and professional practice. Also based on past years, this in-kind support results greatly appreciated and rewarding for all students.

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Stichting Hoogbouw

MEGA 2020 GOLD SPONSOR

Stichting Hoogbouw is in 1984 opgericht om bouwend, bestuurlijk en ontwerpend Nederland enthousiast te maken voor hoogbouw. Dit was een tijd waarin er een taboe rustte op hoogbouw. Massaal en eenvormig geïntroduceerd in moderne buitenwijken creëerde hoogbouw niet alleen ruimte maar ook onstedelijkheid. Stichting Hoogbouw wilde duidelijk maken dat er vele verschillende verschijningsvormen van hoogbouw bestaan, elk met hun eigen eigenschappen, en dat het een middel kan zijn om met name de Nederlandse binnensteden aantrekkelijker te maken.

Het taboe op hoogbouw is al enige tijd doorbroken. Als zodanig is het enthousiasmeren niet langer een primaire doelstelling van Stichting Hoogbouw. Vandaag de dag probeert het vooral kennis en netwerk te maken over hoogbouw in Nederland door regelmatig partijen bij elkaar te brengen en kennis te delen, dit om hoogbouw in Nederland niet alleen letterlijk maar ook figuurlijk naar een hoger plan te tillen. Daartoe organiseert het bijeenkomsten en studiereizen publiceert het nieuwsbrieven en is het betrokken bij studies en publicaties die relevant zijn voor haar focus.

https://www.stichtinghoogbouw.nl/category/studiereis/

Stichting Hoogbouw wordt ondersteund door een netwerk van donateurs. Dit zijn veelal bedrijven maar ook individuen die beroepsmatig betrokken zijn bij het ontwerp, bouw en realisatie van hoogbouw in Nederland. Daarmee ondersteunen ze niet alleen de activiteiten van Stichting Hoogbouw, maar tevens stelt het ze in staat kennis te maken met andere hoogbouw-professionals in Nederland.

Het onbezoldigde bestuur van de Stichting Hoogbouw wordt gevormd door:

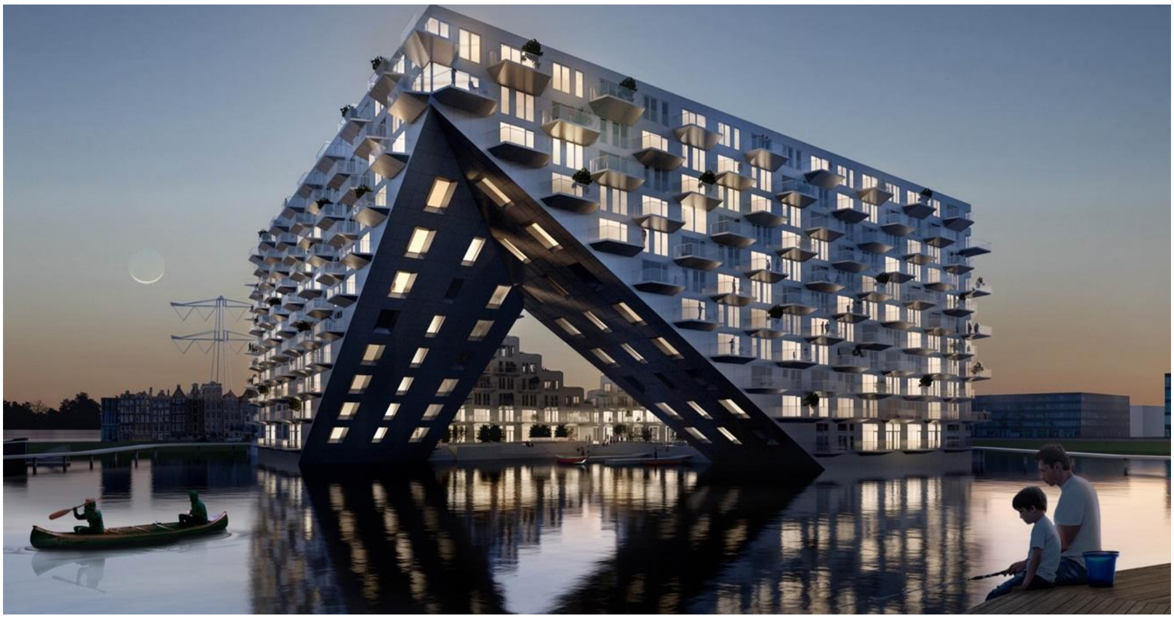
- Erik Faber, ai voorzitter - Fakton, Rotterdam
- Piet Jan Heijboer - Croon&wolterdros, Rotterdam
- Frank van der Hoeven - TU Delft
- Ronald Huikeshoven - AM, Utrecht
- Edvard van Luijn, penningmeester - Syntrus Achmea Real Estate & Finance, Amsterdam
- Caro van de Venne - Barcode Architects, Rotterdam
- Frans de Zwart - Royal HaskoningDHV, Rotterdam

Caro van de Venne

At MEGA, Stichting Hoogbouw is represented by Caro van de Venne as contact person and jury member.

Caro van de Venne founded Barcode Architects together with Dirk Peters in 2010, after having worked at Herzogt & de Meuron (2004-2006) and as an Associate at Foster + Partners (2006-2010). She is involved in all projects from concept design through construction and building completion. Her strengths lie in the organization and design of complex, multidisciplinary projects that require an interactive design process with advisors, clients and users. Next to her activities at Barcode Architects, Caro has been a guest professor at the TU Delft, TU Eindhoven, and the academies of Amsterdam and Tilburg.

Barcode Architects is a Rotterdam-based architecture and urban design office founded in 2010 by Dirk Peters and Caro van de Venne. It comprises an international team of 50 creative professionals, including architects, urban designers, and technologists. Our projects are driven by the ambition to realize high-quality buildings that revitalize and transform their context, offer a moving experience that awakens an aesthetic awareness, and that users can identify with. By setting our standards high, we hope to inspire our collaborators to do the same.
We have building experience both in the Netherlands and abroad. Our work ranges from urban masterplans to mixed-use public buildings, high-end residential and office towers, and villas. Each project is the result of extensive concept-driven experimentation of function and form, bringing apparently "finished" designs to the next level. In this process, making design decisions together with our clients and consultants is key. The resulting designs are highly site-specific, with an unexpected twist. This fresh and contemporary "twist" is the newness, the "above and beyond", the added value that a project gives to its clients, users, and surroundings.



Sluishuis, Amsterdam

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Techniplan Adviseurs is a future-oriented consultancy company, based in Rotterdam, of about 55 employees which is very experienced in designing highly complex technical systems for buildings and building surroundings and especially in high rise projects in the Netherlands and abroad. In the view of our firm, the traditional consultancy procedures in which the architect and the different consultants make their contributions one after another are not the most effective ones. We strongly believe in a more integrated project approach where the different disciplines could start the design process simultaneously. We have applied this procedure in several smaller and large scaled projects and have experienced a much higher level of quality. Especially in High Rise projects integration of various designing activities is one of the key success factors for the feasibility of these projects.

This integrated approach has led to our involvement in some of the most ambitious and sustainable projects of the Netherlands, for example the new football stadium for Feyenoord (De Kuip) in Rotterdam, the new Booking.com campus and Nhow Amsterdam RAI hotel in Amsterdam, the redevelopment of Mall of the Netherlands in Leidschendam en New Hoog Catharijne in Utrecht and in Rotterdam among others, the Sax, Rotterdam, Zalmhaven and the Maastoren. Employees working for Techniplan are highly motivated, committed, creative and trained to pay much attention to the integration of technical installations in the architectural design. Sustainability and the reduction of energy consumption are two integrated elements of our advisory. The Student Integrated Design Award in the High Rise Course of the Technical University of Delft was initiated by our office in 2003, on the occasion of our 25th anniversary. The purpose of the prize is to encourage today's students as the architects and decision makers of tomorrow during their study to integrated design. Indeed, the integration of architecture, construction and technical installations is in our opinion the way to obtain better and more sustainable, economic and flexible buildings. It is our pleasure to share our experience for the sixth year in a row with our co-sponsors all of the participants and students.

Possibilities for students include internships, master projects, graduation projects, and jobs for starting engineers interested in building services and integrated sustainable design of buildings.

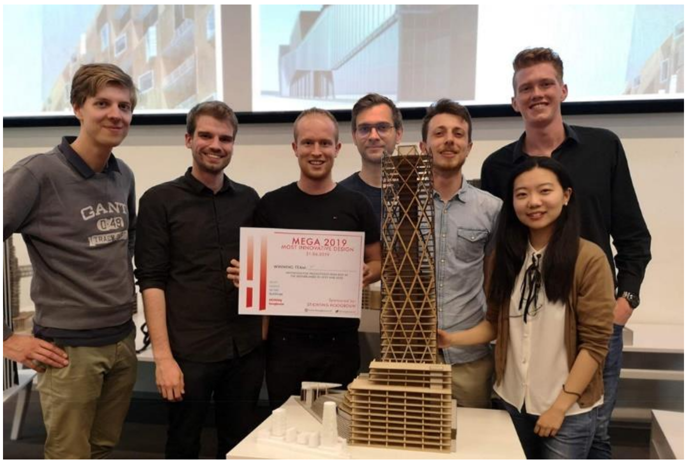
Left: nHow Amsterdam RAI hotel (architect OMA), Right: Booking.com Campus in Amsterdam – Headquarters Booking.com (architect: UNStudio)

15. STUDENTS AWARDS MEGA 2020

Techniplan Adviseurs - Award for the most Integrated Design

2019 Winners

Stichting Hoogbouw - Award for the most Innovative Design



2019 Winners

DGMR - Award for the most innovative fire safety concept

2019 Winners

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WL & IGG - Most innovative Computational design process

NEW in 2020

It rewards the most innovative Computational process for integrated collaborative design

TU Delft Delft University of Technology