Midterm evaluation
Research 2016-2018

Delft University of Technology
Faculty of Architecture and the Built Environment

TU Delft
BK Bouwkunde

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Bouwkunde (Architecture and the Built Environment)

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FIG. 1.1 Glass research at BK

1 – **Scope and strategy**

The research of TU Delft's Faculty of Architecture and the Built Environment (Faculteit Bouwkunde) covers the full spectrum of design, engineering, planning, and management of the built environment. Its research portfolio comprises the research that is conducted by four departments:

- Architecture
- Architectural Engineering + Technology (AE+T)
- Management in the Built Environment (MBE)
- Urbanism

The faculty's research focusses specifically at improving the design and performance of buildings, districts, cities and regions in order to better meet the requirements and expectations of their users and communities. From that perspective, much of the research that is conducted can be understood as applied science, appealing to the curiosity and the needs of other researchers, practitioners and the broader public alike.

The research is a blend of humanities, social and engineering sciences. The humanities are strongest represented in the Architecture department, social sciences in the MBE and Urbanism departments, while the engineering sciences find their strongest representation in AE+T.

Realignment

TU Delft has further consolidated its research in the field of architecture and the built environment in the past four years. The Faculty of Architecture and the Built Environment reorganised in the summer of 2019 the OTB department. OTB's remaining staff members were divided over the departments MBE and Urbanism. This closed off a long process of integration.

In this new setup, it makes sense to organise the faculty's research using its simplified department structure. The alignment of research along departments was a long-standing wish of TU Delft's Executive Board and answered essential comments made by the 2016 research assessment committee that struggled to understand the links between research programmes and departments.

It should be understood that in 2019 two shifts took place more or less at the same time. The faculty moved from so-called research programmes to departments, while the number of departments was reduced from five to four.

In consultation with the Executive Board of TU Delft, the faculty decided to use the department as aggregation level in this midterm review. It offers the best way for looking ahead, for presenting the visions and strategies that determine the faculty's research in the years to come.

However, reporting on past performance covers the years 2016-2018. In that period the faculty counted still five departments. In this faculty chapter, we report on the achievements of the current departments, including the OTB department. The following chapters on the departments combine where possible overviews of the department as they were, plus a projection what the impact is of the new configuration after absorbing the former OTB staff.

The new research framework streamlines management and communication but carries the risks of creating academic silos. The faculty is about to introduce strategic and urgent themes (or initiatives) that combine the research interests of all four departments as platforms for collaboration. Dick van Gameren, as the faculty's new dean, has shortlisted such themes but stresses that these are just the starting point and not necessarily the outcome of a careful selection process. These are the preliminary themes:

- 1 Million Homes;
- Circular Built Environment;
- Digitisation;
- Climate Change;
- Urbanisation;
- Heritage.

Strategy

The faculty's strategy is firmly focused on positioning it as a leading research and design-oriented institute for architecture and the built environment with strong roots in the Randstad as one of the key metropolitan regions in Europe, with a firm international ambition. The frameworks it need for this mission are still in place:

The Graduate School of Architecture and the Built Environment has firmly established itself in the faculty as the main environment for conducting PhD research and providing doctoral eduction.

Nationally TU Delft's Faculty of Architecture and the Built Environment is still part of the 4TU.BOUW, the Research Centre of the 4TU. Federation, the Federation of four Dutch Universities of Technology: TU Delft, TU Eindhoven, Twente University, and Wageningen University.

A new strategic collaboration between TNO, 4TU. BOUW, the universities of applied sciences, the branch organisation in the field of engineering and construction, plus three ministries was set up: BTIC. BTIC is the so-called 'Bouw en Techniek Innovation Centrum' that has to stimulate innovations in the construction sector. As large consortium is has the capacity to acquire large national research programmes.

Internationally the faculty is a founding partner of the BauHow5 alliance between TU Delft, UCL Bartlett, Chalmers, TU Munich, ETH Zürich with active groups on topics such as circularity, inclusion, diversity and equality (IDE), and doctoral education.

The Amsterdam Institute for Advanced Metropolitan Solutions (AMS), set up five years ago by TU Delft, WUR and MIT, is maturing. AMS is a strategic institute in Amsterdam that valorises TU Delft's knowledge and expertise in the area of metropolitan solutions.

Targets

The faculty is well on course to maintain the quality of it research, as well as its excellent international academic reputation as a leading design academy; to be an international platform for innovation in architectural design, architectural engineering, urban planning, landscape architecture, real estate management, housing, urban studies and geoinformation; and to be a platform for debate on current societal themes in the fields of architecture and the built environment. The best proof of this achievement is the fact TU Delft is firmly positioned 3rd in the field specific ranking for Architecture and the Built Environment of the QS World University Ranking.

In terms of scientific output, the faculty has achieved a shift from predominantly professional output to a more balanced portfolio that includes a growing share of peer-reviewed journal publications. This shift is still taking place. In this context a quantative target was set to motivate each staff member to (co-)publish at least one indexed academic journal article, each year. This target is also known as 1-1-1. The simplicity of the rule was instrumental in this.

Environment

The impact of the global financial crisis and the following slump in the Dutch housing market and the architectural services industry in the Netherlands has passed. The numbers of incoming (Dutch) bachelor students as well as the job opportunities beyond Delft's academic environment bounced back notably.

The governments policy on so-called top-sectors has improved the opportunities of research in the fields of urban energy and creative industry. Europe's H2020 programming with declining overall success rates.

Collaboration between the universities of technology was continued. Wageningen University joined the 3TU.Federation, effectively turning it into a 4TU.Federation. Wageningen's relevance for us lies in it's programmes in the areas of landscape architecture, urban and spatial planning.

TU Delft also maintains a position in the regional alliance between Leiden University, TU Delft and Erasmus University: Leiden-Delft-Erasmus or LDE in short.

The government initiated the Dutch National Research Agenda: a process in which citizens and organsiations could suggest research questions. The agenda is communicated as a source of inspiration for those interested in research, without clear implications for existing policies. It seems that societal relevance is gaining importance across the board and from a perspective of architecture and the built environment this can only be a good thing.

In 2018 the Building and Technology Innovation Centre was initiated to organise and boost the required innovation in the building and technology sector to be able to reach the 2050 goals in the build environment. These goals include: a CO2 free, circular and climate adaptive build environment. The BTIC stimulates and facilitates the initiation of long term, broad integral research and innovation programmes on:

1. Energy transition of existing buildings;
2. Circular Building Economy;
3. Digitization;
4. Renewal of infrastructure;
5. Climate adaptation.

BTIC is a collaboration between Knowledge institutions (4 TU Bouw, Universities of applied science, TNO), the Building industry (Bouwend Nederland, Techniek NL, Koninklijke Ingenieurs NL) and the Government (Ministries of Inner Affairs, Infrastructure and Water and Economic Affairs). On behalf of 4 TU Bouw, Henk Visscher is as scientific director part of the management of BTIC, together with a representative of Bouwend Nederland (Richard Mulder) and TNO (Huib Keizers).

Recognition

The Faculty of Architecture and the Built Environment resides within a university of technology. Here the predominant publication culture is based on indexed peer-reviewed journal articles. In a world that uses these as a benchmark the academic performance of a design faculty may appear modest compared to that of so-called science faculties. With the emergence of field specific rankings, a new picture emerged recently that reflects on the relative performance of the faculty compared to its peers.

Another indicator that provides a good sense of the recognition of the faculty is its capacity to obtain research project grants. Special attention to grants allows us to highlight specific individuals and groups that contribute a significant role in the overall performance of the institute.

Rankings

QS World University Ranking

In 2015 QS World University Ranking issued for the first time a field specific ranking for Architecture and the Built Environment where TU Delft was positioned 3rd worldwide. The QS World University Ranking uses six criteria: academic reputation, employer reputation, faculty student, citations per faculty, international faculty and international students.

URAP University Ranking by Academic Performance

The main objective of URAP University Ranking by Academic Performance is to develop a ranking system for the world universities based on academic performance indicators that reflect the quality and the quantity of their scholarly publications. URAP uses six criteria: article, citation, total documents, international collaboration, article impact, and citation impact.

Over 2018-2019 two relevant ranking are provided: architecture and urban planning. In the field of architecture TU Delft ranks 6th and in the field of urban planning its position is 1st world wide.

Personal Grants

The Faculty of Architecture and the Built Environment is home to a number of successful personal grantees:

TABLE 1.1 Personal grants

DEPARTMENT	STAFF	PROJECTNAME	FUNDING	GRANT K€	TIME
Architecture	J.G. Gosseye	"The Postwar European Shopping Centre: A Place for Encounter between Avant-garde Discourse and Daily Building Practices, 1945-1973"	NWO-Veni	229 K€	01/02/2013 31/12/2016
Urbanism	M. van Ham	Socio-spatial inequality, deprived neighbourhoods, and neighbourhood effects (DEPRIVEDHOODS)	FP7-ERC	1.599 K€	01/08/2014 31/07/2019
Urbanism	J.E. Stoter	"Urban modelling in higher dimensions: embedding generalisation of 3D data in a 4D model (UMnD)"	H2020-ERC	1.498 K€	01/09/2016 31/08/2021
Urbanism	E.J. Meijers	Beyond Agglomerations: Mapping Ecternality Fields and Network Externalities	NWO-Vidi	800 K€	16/11/2015 15/11/2020
Urbanism	J.E. Stoter	5D Data Modelling: Full Integration of 2D/3D Space, Time and Scale Dimensions	NWO-Vidi	800 K€	01/06/2011 31/12/2017
Urbanism	M. van Ham	Neighbourhood choice, neighbourhood sorting and neighbourhood effects	FP7-MC	100 K€	01/09/2012 30/11/2016

2 – **Research in numbers**

TABLE 2.1 Research output faculty 2016-2018

	2016	2017	2018
MAIN RESEARCH OUTPUT			
Refereed articles	212	206	257
Non-refereed articles	5	16	17
Books	16	6	12
Book chapters	103	95	115
PhD-theses	23	24	38
Conference papers	234	183	178
Professional publications	265	223	173
Publications aimed at the public	34	12	11
Total Main Research Output	**892**	**765**	**801**
OTHER RESEARCH OUTPUT			
Media contritbutions and coverages	218	192	293
Abstracts	42	41	36
Editorial work: editorial activity	58	38	55
Editorial work: publication peer review	21	14	36
Bookediting	27	33	34
Exhibition	18	19	33
Memberships	75	49	77
Talk or presentation (conference)	122	119	160
Total Other Research Output	**581**	**505**	**724**
TOTAL	**1473**	**1270**	**1525**

TABLE 2.2 Staff members faculty

STAFF		**2016**		**2017**		**2018**
	NR	FTE	NR	FTE	NR	FTE
Scientific Staff	166	50,31	162	50,35	157	50,41
Researchers (incl Postdocs)	114	52,83	115	57,84	129	56,72
PhD candidates	183		191		193	
Total research staff	463	103,14	468	108,19	479	107,13
Visiting Fellows	126	22,41	126	27,96	119	20,76
Total Staff	**589**	**125,55**	**594**	**136,15**	**598**	**127,89**

TABLE 2.3 Research income 2016-2018

	2016		2017		2018	
	K€	%	K€	%	K€	%
FUNDING						
Direct funding [1]	8.709	49%	8.526	47%	8.059	44%
Research grants [2]	2.443	14%	2.981	17%	2.317	13%
Contract research [3]	6.371	36%	6.175	34%	7.218	39%
Own contribution	-1.788	-10%	-2.128	-12%	-2.098	-11%
Other [4]	2.101	12%	2.404	13%	2.871	16%
Total Funding	**17.836**	**100%**	**17.958**	**100%**	**18.366**	**100%**
EXPENDITURE						
Personnel costs	-15.428	84%	-15.280	83%	-15.243	84%
Other costs	-3.000	16%	-3.085	17%	-3.001	16%
Total Expenditure	**-18.428**	**100%**	**-18.365**	**100%**	**-18.245**	**100%**
RESULT	**-592**		**-406**		**121**	

[1] Direct funding (basisfinanciering / lump-sum budget).
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and the Royal Academy).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations industry, government ministries, European organisations and charitable organisations.
[4] Funds that do not fit into the other categories.

TABLE 2.4 Length of PhD candidacies and success rate

ENROLMENT		**STARTING YEAR**					
		2010	2011	2012	2013	2014	TOTAL
GENDER	Male	17	16	14	11	15	**73**
	Female	8	10	8	12	5	**43**
	Total	**25**	**26**	**22**	**23**	**20**	**116**
GRADUATED							
≤ 4 years [1]	NR	2	3	1	1	2	**9**
	%	8%	12%	5%	4%	10%	**8%**
≤ 5 years [1]	NR	6	6	5	10	7	**34**
	%	24%	23%	23%	43%	35%	**29%**
≤ 6 years [1]	NR	11	9	11	13	7	
	%	44%	35%	50%	57%	35%	
≤ 7 years [1]	NR	15	11	14	13	7	
	%	60%	42%	64%	57%	35%	
Total Graduated	NR	**20**	**14**	**14**	**13**	**7**	**68**
	%	**80%**	**54%**	**64%**	**57%**	**35%**	**58%**
Not yet finished	NR	1	6	4	4	9	**24**
	%	4%	23%	18%	17%	45%	**21%**
Discontinued	NR	4	6	4	6	4	**24**
	%	16%	23%	18%	26%	20%	**21%**

[1] In the case of the started PhD's in a given year the lead time was considered and cumulatively drawn over the years. A PhD who graduated in "≤ 4 years", is therefore again included in "≤ 5 years", in "≤ 6 years" and in "≤ 7 years". The table "Total Graduated" shows the total number of PhDs candidates that successfully completed there studies.

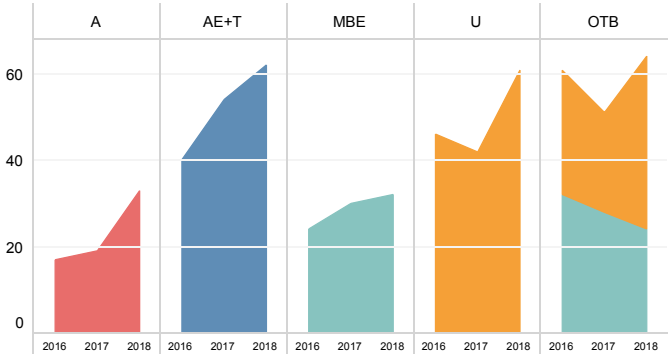


FIG. 2.1 Refereed articles 2016 - 2018

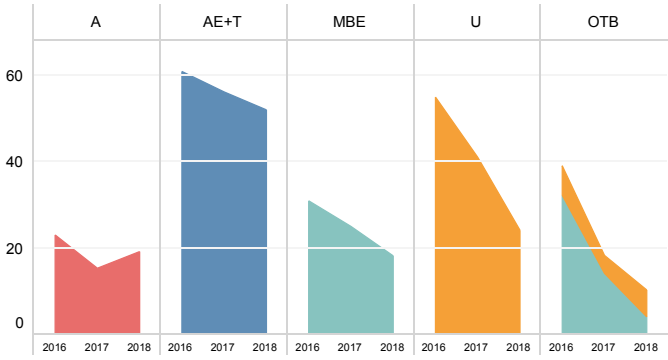


FIG. 2.2 Conference papers 2016 - 2018

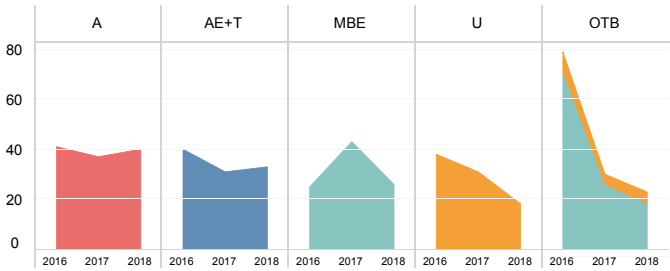


FIG. 2.3 Professional publications 2016 - 2018

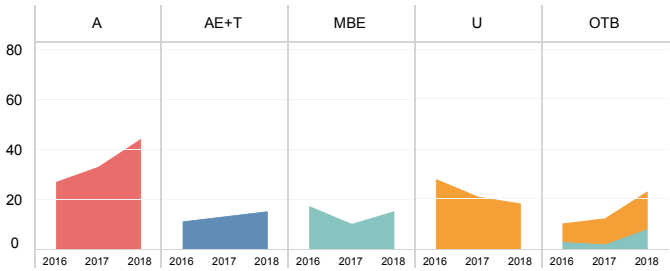


FIG. 2.4 Book chapters 2016 - 2018

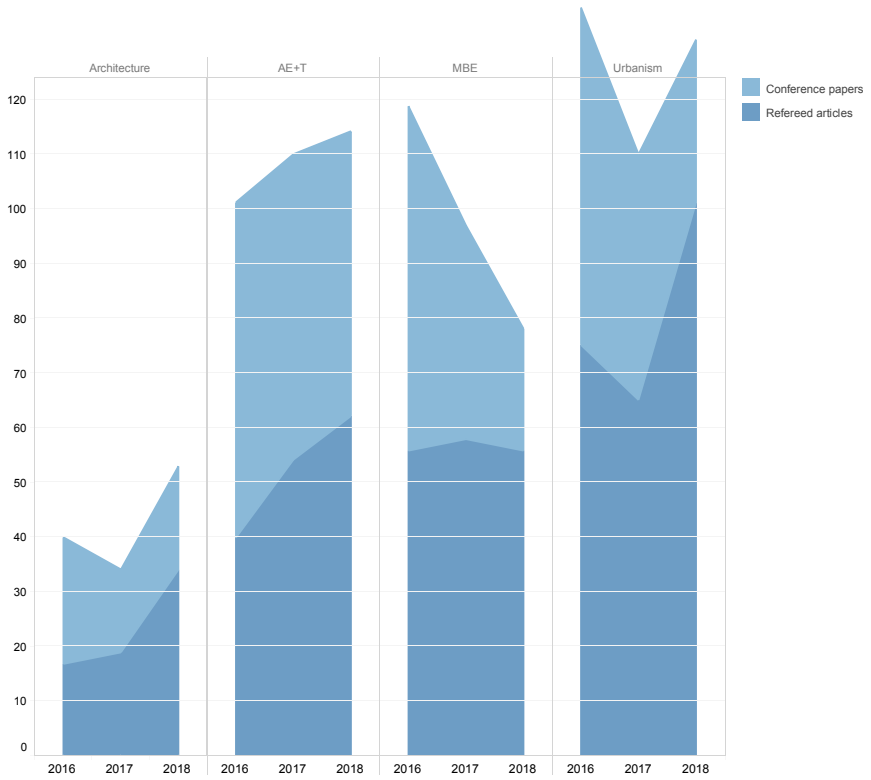


FIG. 2.5 Academic outputs 2016 - 2018

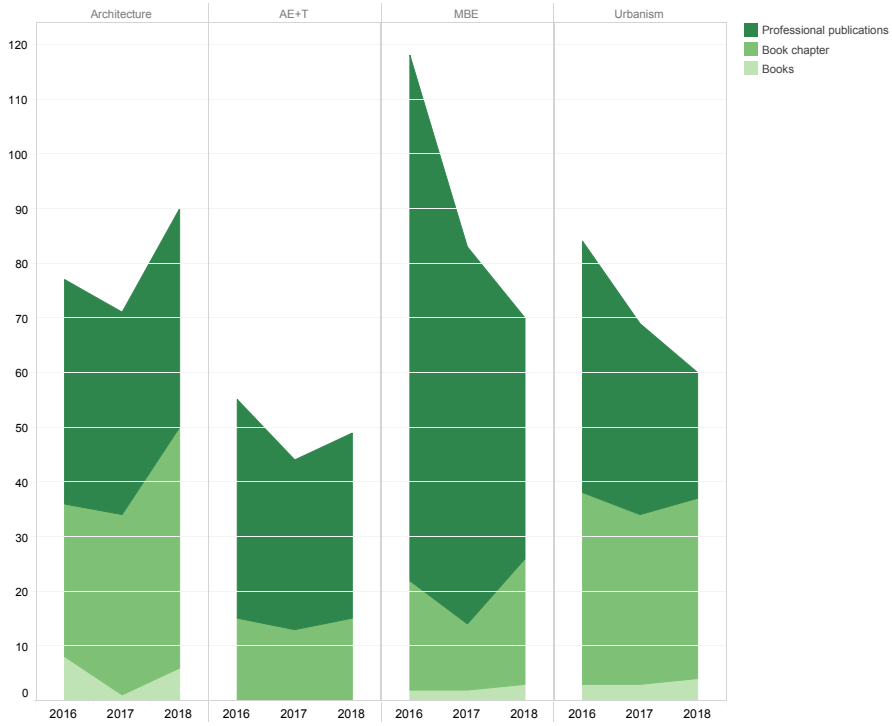


FIG. 2.6 Professional outputs 2016 - 2018

3 – **PhD research**

Context, supervision and quality assurance

The Graduate School for Architecture and the Built Environment (GS A+BE) is TU Delft's framework for all PhD studies at this faculty. It was launched in September 2011 as a 'local school' in the framework of the TU Delft Graduate School (GS). The GS ensures that doctoral candidates receive excellent skills training, supervision and mentoring and deliver a high quality dissertation. Furthermore, the GS distinguishes itself by supporting a structured, transparent PhD process. This is facilitated by a monitoring system that keeps track of their progress. All efforts are geared towards producing doctors who have developed valuable skills for their future career; either in academia or elsewhere.

The Doctoral Regulations require that all Doctoral candidates follow an educational programme aiming at obtaining skills and knowledge related to their discipline, to scientific research in general and to their overall personal development (transferable skills). A tailored Doctoral Education (DE) programme should be completed before the defence of the doctoral dissertation. The Faculty Graduate School is responsible for training related to research (in general and domain specific) and for the advancement of discipline related knowledge, competences and skills. Such courses could be offered by national domain specific Research Schools. For the faculty of Architecture and the Built Environment such schools are maily lacking. Therefore, we have put much effort in developing highly appreciated courses that support the needs of our PhD candidates. The TU Delft GS offers transferable skills training courses and support to further improve doctoral candidates' professional development.

The GS strives for excellent supervision and support for its doctoral candidates. A Code of Good Practice has been developed for both supervisors and doctoral candidates. The Code is a practical guideline which helps to explain the (sometimes delicate) relationship between supervisor and candidate. Candidates discuss certain aspects of this Code during the PhD Start Up workshops with which their Doctoral training starts.

The University GS board with a support staff develops the guidelines of the programme and its regulations and facilities. This is further detailed within the faculty graduate schools where there is also a local GS board, a director and dedicated staff. The TU Delft believes it is important to keep a user-centred perspective. Therefore, the GS regularly holds inquiries to improve the TU Delft Graduate School and its services (surveys 2011, 2014 and a four-year survey as from 2015). Also, the Rector, the director of the GS and other staff members regularly meet with doctoral candidates and supervisors at formal and informal gatherings. In the faculty we have set up a PhD council by and for the PhD's. The PhD council supports the social network of the PhD's and they give re- and pro-active feedback on the programme of the GS.

Participation in research schools

In the academic fields of the research programmes of A&BE only a few national research schools are relevant. These are Nethur (Netherlands Graduate School of Urban and Regional Research) and OSK (Onderzoeksschool Kunstgeschiedenis – Research School for Art History).

Some PhD's, mainly from the departments of Urbanism and MBE, are members of or just take part in some courses of these schools. However, for the majority of the PhD candidates there is no relevant national research school. As an alternative PhD candidates participate more and more in international PhD oriented summer schools providing discipline related courses.

Selection and admission procedures

Obviously, the candidate's background and competences are crucial to the success of their research and their academic and personal growth. That is why guidelines have been developed by the Human Resources department to ensure good recruitment practices. After recruitment, the TU Delft GS initiates the registration process, followed by a further welcome at the Faculty GS. GS A+BE developed a central procedure for the applications of PhD candidates with a scholarship. In recent years this category became the majority of newcomers. Before, applicants approached a professor (or multiple) directly. This caused a chaotic situation with much burden for the staff and not always up to date information for the applicants. Now the A+BE website provides insight in and access to the application process. Applicants are asked to provide all the necessary information about their master diploma's, their scholarship, research plan and level of English. A+BE Graduate Office screens the documentation and forwards it to the relevant professor(-s), who only need to concentrate on scanning the quality of the candidate and the proposal. Full proposals are send to the relevant Professors and selection committees with the departments. The selections are based on the quality of the proposal, the cv of the candidate and the performance in one or more (on line) interviews. Standard PhD candidates appointed in the faculty and financed by external funded projects are recruited via international advertised calls.

Supervision of PhD candidates internally and guidance of PhDs to labour market

The supervisory team typically consists of two supervisors: a daily supervisor (Assistant or Associate Professor) and at least one promotor (a full Professor). The team may include additional researchers. Furthermore, a mentor is appointed to support the doctoral candidate during the doctoral process. There are standards for the time supervisors should reserve for supervision on the candidates (daily supervisor 70 h/y; promotor 35 h/y). The faculty monitors (through yearly R&D reviews) that professors and daily supervisors are responsible for a number of PhD's that can be handled. The availability of suitable supervisors is a critical factor for decisions about appointment of new PhD candidates. The quality and progress of the candidates are monitored within the prescribed and registered steps of the development cycle.

After six months there is a first formal progress meeting with the supervisors to check if the candidate lays on track for a successful Go-No Go (GNG) meeting after the first year. In the GNG meeting candidates present their detailed research plan, first research results and Doctoral Education (DE) plan. Here, a decision is made about the continuation for the full period of four years. The purpose is to stop inadequate projects and candidates in an early stage and to give presenting candidates useful recommendations in order to finish their PhD successfully in time. The committee contains at least one independent professor. The GNG session is followed up by yearly formal progress meetings.

Every department has appointed a mentor who has the task to support the PhD candidates if they have questions and problems with their supervisors or finding suitable Doctoral Education courses. Furthermore, the faculty holds a yearly survey among the candidates to get feedback on the progress of their individual projects and the quality of the supervision.

The success rates of PhD candidates in the faculty as well as in the TU Delft as a whole remains quite low over the past years. This was one of the most important reasons to develop the GS with more emphasis on supervision, educational support and monitoring of progress. A normal PhD process in the Netherlands takes 4 years for a full time PhD candidate. There are 4 categories of PhD candidates: Standard PhD's: full time employed candidates. Contract PhD's: full time PhD candidates with a guest status, supported by a scholarship or other external funding; Internal PhD's: employed candidates with less than 50% time to work on the PhD and External PhD's: guest PhD's that work only less than 50% off their time on the PhD. These two last categories are not included in the monitoring of the success rates. The goal of TU Delft is to increase the numbers of full time candidates that have successfully defended their theses within 5 years' time.

The table below shows the success rates of full-time PhD candidates in the faculty. The results from the 2013 and 2014 cohorts show an improvement in the five-year completion rate of 43,48% and 35,00% respectively. This improvement is an indication that the formalisation of the GS and the introduction of measures for supporting doctoral education and monitoring of progress is paying off. On average, PhD candidates in the 2014 cohort took 4,33 years to complete their thesis; this is an improvement from the average of 5,13 years in the 2011 cohort (the year the GS started). There is still room for improving the completion rates. A trial will be under way shortly to introduce a mid-term review milestone to better support candidates in writing up their thesis.

4 – **Diversity**

In the past three years there has been a gradual trend towards a more diverse staff at the faculty of Architecture and the Built Environment.
The MBE department is the first that reached gender parity in terms of their full professors.

However, the overall gender change is rather slow in the categories scientific staff and researchers. With the current pace it will take another decade before Bouwkunde reaches a balanced workforce that reflects its current PhD population..

TABLE 4.1 Gender

		2016		2017		2018	
Scientific staff	Male	35,74	71%	34,5	69%	33,95	**67%**
	Female	14,56	29%	15,8	31%	16,46	**33%**
	Sub Total	50,31	100%	50,3	100%	50,41	**100%**
Reseachers	Male	35,82	68%	39,0	67%	36,92	**65%**
	Female	17,01	32%	19,1	33%	19,80	**35%**
	Sub Total	52,83	100%	58,0	100%	56,72	**100%**
Phd candidates	Male	96	52%	101	53%	104	**54%**
	Female	87	48%	90	47%	89	**46%**
	SubTotal	183	100%	191	100%	193	**100%**

TABLE 4.2 Gender full professors 2019

MALE

Architecture	**AE+T**	**MBE**	**Urbanism**
Gameren, DE van	Dobbelsteen, AAJF van den	Gruis, VH	Timmeren, A van
Kaan, CHCF	Luscuere, PG	Verdaas, JC	Zonneveld, WAM
Rosbottom, DJ	Russell, PJ	Boelhouwer, PJ	Dijkstra, RJ
Vermeulen, PELJC	Klein, T	Korthals Altes, WK	Ham, M van
Maas, WGM	Knaack, U	Wamelink, JWF	
	Asselbergs, MF	Visscher, HJ	
	Overend, M	Chan, P	
	O'Callaghan, J		
	Jonge, W de		
	Nijsse, R		

FEMALE

Architecture	**AE+T**	**MBE**	**Urbanism**
Hein, CM	Sariyildiz, IS	Itard, LCM	Stoter, JE
Vries, NA de	Pottgiesser, U	Chao-Duivis, MAB	
	Pereira Roders, AR	Bluijssen, PM	
		Hermans, MH	
		Bueren, EM van	
		Heijer, AC den	
		Elsinga, MG	

FIG. 7.1 BauHow5 event on Diversity

TABLE 4.3 Age

		2016		2017		2018	
Scientific staff	>30	6,2	12%	6,7	13%	6,6	**13,1%**
	>40	19,0	38%	18,6	37%	17,8	**35,3%**
	>50	17,8	35%	18,5	37%	20,1	**39,9%**
	>60	7,3	14%	6,5	13%	5,9	**11,7%**
	Sub Total	50,3	100%	50,3	100%	50,4	**100%**
Researchers	>20	12,2	23%	12,2	21%	8,7	**15%**
	>30	16,0	30%	20,6	36%	25,3	**45%**
	>40	13,3	25%	14,3	25%	12,8	**23%**
	>50	6,5	12%	5,9	10%	6,3	**11%**
	>60	4,7	9%	4,8	8%	3,6	**6%**
	Sub Total	52,8	100%	57,8	100%	56,7	**100%**
PHD candidates	>20	22	12%	29	15%	41	**21%**
	>30	99	54%	102	53%	103	**53%**
	>40	44	24%	41	21%	34	**18%**
	>50	12	7%	13	7%	9	**5%**
	>60	6	3%	6	3%	6	**3%**
	Sub Total	183	100%	191	100%	193	**100%**

TABLE 4.4 Nationality

		2016		2017		2018	
Scientific staff	EU	10,0	20%	10,8	22%	12,3	**24%**
	NL	36,0	72%	35,2	70%	33,7	**67%**
	Non-EU	4,2	8%	4,4	9%	4,3	**9%**
	Total	50,3	100%	50,3	100%	50,4	**100%**
Reseachers	EU	11,2	21%	15,4	27%	17,6	**31%**
	NL	36,3	69%	34,8	60%	30,7	**54%**
	Non-EU	5,3	10%	7,7	13%	8,4	**15%**
	Total	52,8	100%	57,8	100%	56,7	**100%**
Phd candidates	EU	41	22%	47	25%	41	**21%**
	NL	52	28%	55	29%	56	**29%**
	Non-EU	90	49%	89	47%	96	**50%**
	Total	183	100%	191	100%	193	**100%**

5 – **Integrity**

TU Delft strives to be articulate and explicit with respect to its ideals, values, principles and responsibilities and the means it utilises to implement its vision in day-to-day practices, procedures and operations. TU Delft assumes that all staff involved in research and education will take personal responsibility in matters concerning academic and scientific integrity within the organisation.

Two policy frameworks offer binding guidance at this point: The Netherlands Code of Conduct for Academic Practice 2004 (Version 2014) laid down by the Association of Universities in the Netherlands (VSNU), and TU Delft's own Code of Ethics that formulates ideals, responsibilities and rights that should be taken as guidelines for everyone who is part of TU Delft.

TU Delft also has its own Scientific and Academic Integrity Complaints Regulations, which include a complaints procedure for situations involving breaches of scientific or academic integrity that may occur within the organisation. In addition, TU Delft's Executive Board set up a committee to monitor the quality and independence of our policy on integrity.

Peer-review

The communication on research outcome takes increasingly place in peer-reveiwed scientific journals and is thus subjected to the checks and balances of a larger community of like-wise researchers.

Data stewardship

The faculty is developing a policy on research data management, with the objectives to support academic staff to manage their research material and output. The initiative of advocating good data management practices aims to drive for a culture change at the faculty, to perform more transparent, reproducible and responsible research.

This policy helps create effective practices for working with research data at the faculty, and defines data management roles and responsibilities of the different stakeholders within the faculty. Research leaders and departmental chairman are responsible for ensuring good data management practices within their groups. Individual researchers are encouraged to adopt good practices in daily work and take data management trainings. In addition, PhD students who start in 2019 are required to make a data management plan for their research and deposit data that supports their thesis work before graduation.

The faculty is integrating data management support as a standard service in the research project management workflow. A dedicated data steward is positioned at the faculty level. All the research activities that requires specific ICT facility, safety and security, or ethics approval are helped during the data management planning phase.

Professors' ancillary activities

The registration of professors' ancillary activities has been made a high priority. These ancillary activities of all professors are explicitly and transparently listed online as part of their personal pages.

Graduate School

As part of the procedures of the new graduate school all PhD theses are scanned for plagiarism before the thesis is defended before the committee.

As part of doctoral eductation scientific Integrity is a mandatory course as part of the PhD StartUP (C9.M1). The programme focuses on (moral) questions that are important to consider for researchers at the start of their academic career. It will help them to gain insight into societal, moral and public aspects of your work (e.g. duty to society, intellectual property, co-authorship, etc.).

6 – **SWOT**

Strengths

- Staff is increasingly PhD-educated and is well integrated into the rich practice of Dutch architecture, urban design, spatial planning, housing and the built environment.
- A stable body of excellent PhD research, attracting PhD students from all over the world.
- A sense of a vibrant young community of researchers interested in each other's work.
- Scoring high in field specific world rankings.
- A more consistent organisation after the integration of the OTB department into the other departments.

Weaknesses

- The Faculty's success in obtaining research grants from the Netherlands Organisation for Scientific Research (NWO) or Horizon 2020 (H2020) is not equally distributed among the departments;
- Architecture is a field with a weak academic journal culture;
- PhD duration and completion rates need to move up significantly;
- Too little continuity in the top management of the faculty;
- Collaboration between departments can be stronger.

Opportunities

- With its large contingent of PhD students, the Faculty of Architecture and the Built Environment can become a centre for research, not just in the Netherlands but in Europe and beyond.
- Design and engineering are increasingly accepted as mature academic activities;
- Cooperation with TU Eindhoven, University Twente, Wageningen University in the 4TU. Federation Centre for the Built Environment;
- Cooperation with Leiden University and Erasmus Univeristy in LDE;
- The new BTIC center for contruction and technology opens up new opportunities;
- BauHow5 cooperation with UCL Bartlett, Chalmers, ETH Zürich and TU Munich;
- Top sector policies on Creative Industries and Urban Energy pushes for more national research funding in these key areas;
- Formulation of new strategic themes such as 1M Homes, Circularity, Digitalisation.

Threats

- Becoming complacent with the apparent accomplishments so far;
- A need to direct the research towards growing business, still needs to be addressed;
- Uncertainty on Dutch governmental science policy (topsectors, NWA);
- Balancing teaching duties with research time, overall workpressure issues;
- Lacking prospect of tenure for promising PhD researchers;
- Slow processes of attractiing new professors.

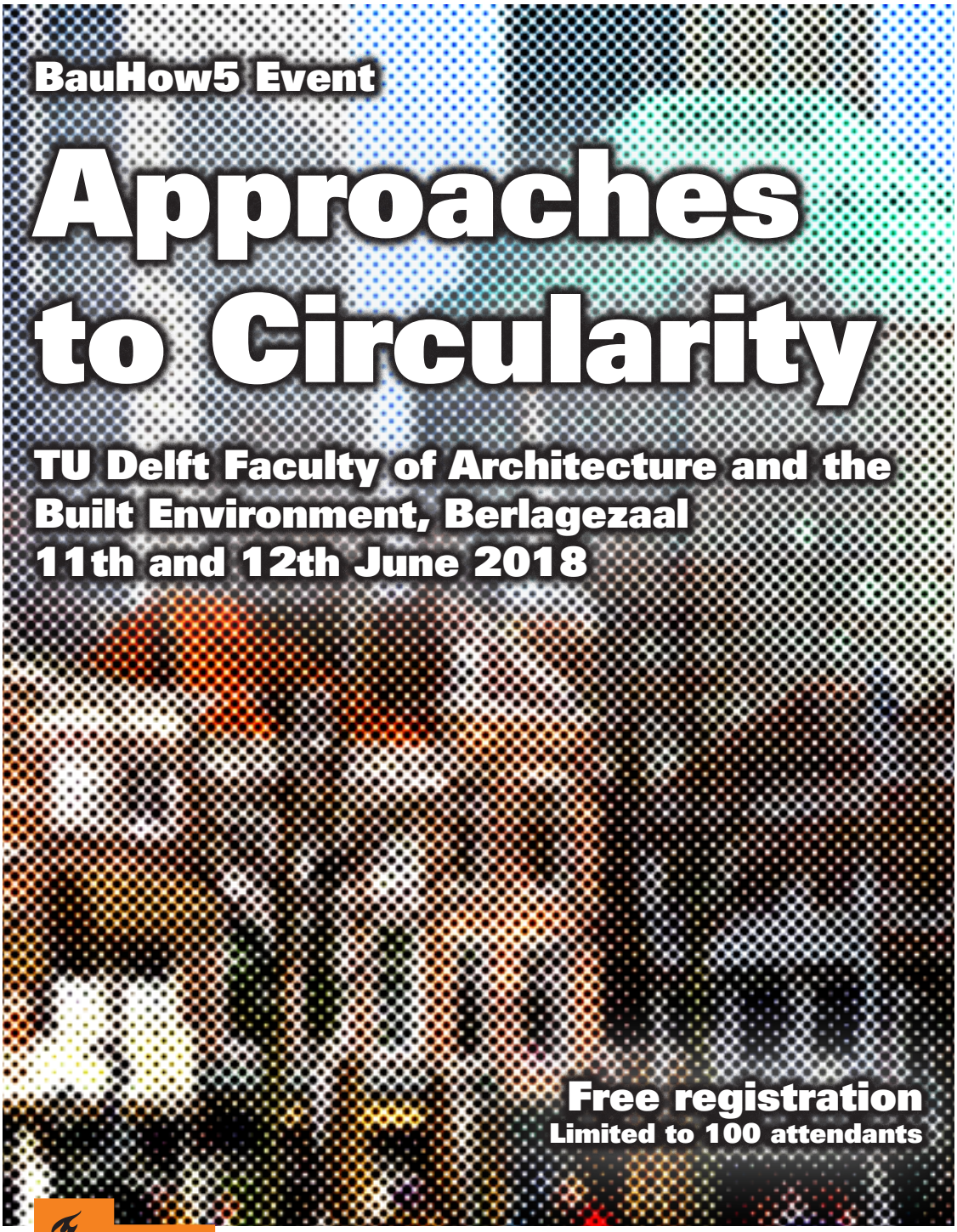


FIG. 7.2 BauHow5 event on Circularity

7 – **Labs, facilities and collections**

The Bouwkunde faculty developed over the years a number of labs and facilities that support researchers in their work:

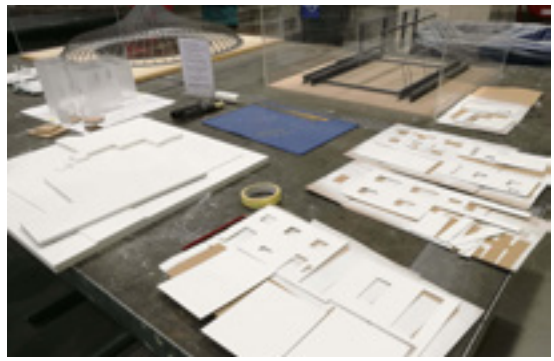
- Modelling workshop
- Heritage Technology lab
- The Sandbox
- Virtual Reality lab
- Product Development Test lab
- Senselab
- Bouwkunde library
- Lightvan
- Chair collection

Modelling workshop

The state of the art modelling workshop has a central position within the faculty as a whole, and in the Form Studies programme in particular.

These facilities are used extensively by the faculty's student population and especially by MSc diploma students. Apart from more or less traditional workshop facilities, the computer aided modelling opportunities of the faculty's CAM-lab play an increasingly important role in education and research (notably in an explorative Form Studies course entitled Ornamatics).

Furthermore, modelling applications play an important role in several composition and materialisation studies and exhibitions. Since the spring of 2009 the Form and Modelling Studies cluster is housed in the centrally located, transparent Southern Atrium of the BK City complex.



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Heritage & Technology Laboratory

For a successful intervention on cultural heritage buildings, the effectiveness and compatibility of conservation materials and techniques should be assessed in laboratory, prior to application. The Heritage & Technology Laboratory has been set up for the development and assessment of solutions for the conservation of historic buildings. Materials, methods and theories are tested, which are relevant for the field practice of building conservation.

The laboratory includes facilities for characterization and testing of inorganic porous materials, such as optical and digital microscopes, digital linear measuring transducers, precision balances. New (conservation) materials, such as additivated (repair) mortars, can be prepared (mortar mixer and flow table are available), their physical properties (e.g. hygric behaviour, water absorption and drying) determined and their durability assessed by accelerated testing. In a climatic cabinet, weathering processes can be reproduced, giving insight into damage mechanisms affecting building materials in the field. Besides, facilities for on-site testing, monitoring and sampling are available.

Research performed in the lab includes the study of damage processes (e.g. moisture and salt related problems) in heritage buildings and the development of conservation solutions (e.g. desalination, self-healing mortars and surface treatments). Research is carried out for - or in collaboration with - public and private parties active in the field of conservation and rehabilitation of built cultural heritage.

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The Sandbox: Lab for collaborative innovations

‘The Sandbox’ offers a creative space to develop new innovations and to make research visible within BK Bouwkunde.

The lab offers a dynamic environment for different types of (heavy) machinery, depending on the necessities of each individual research project. In this communal space researchers of different areas of expertise can work together. This stimulates a natural interaction between the different areas. The lab is therefore not defined by the hardware, but by the researchers themselves. New collaborations can lead to new research niches, opening up new opportunities.

“If you want to collaborate, it is often very helpful to just look around and see what is happening. You get inspired by the research of others.”

Currently, research focused on Additive Manufacturing in Architecture and Robotic Building is carried out in the lab. Researchers and students at BK Bouwkunde are welcome to disc

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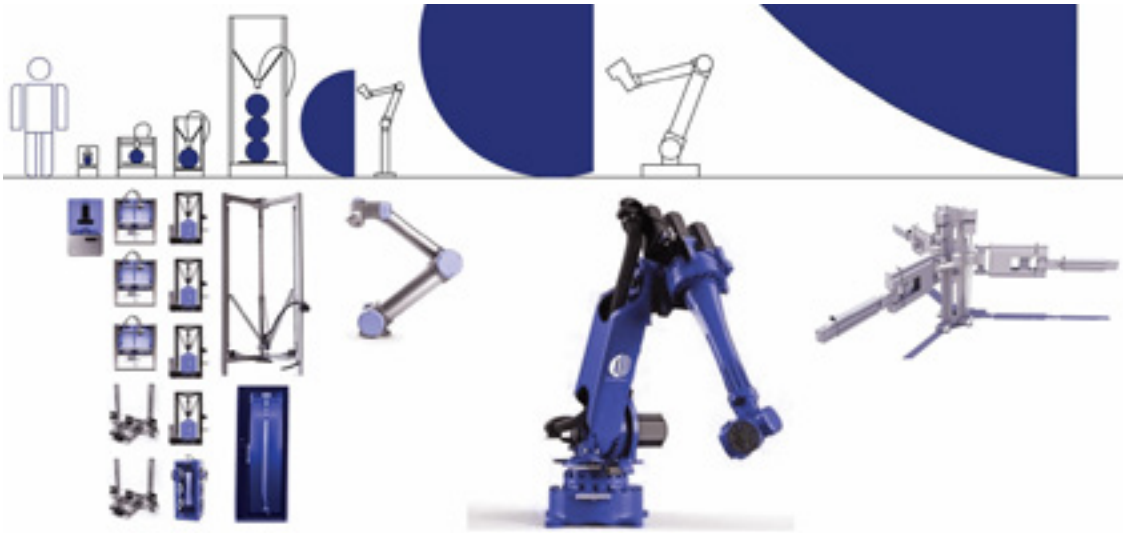
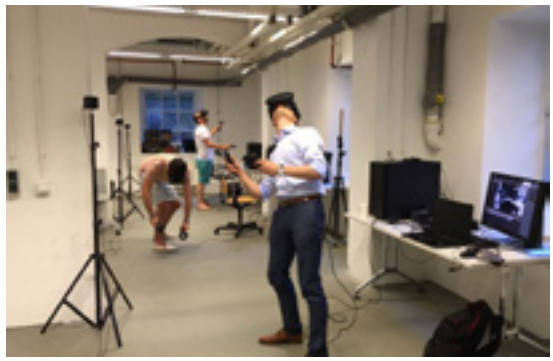


VR-Lab

The BK faculty houses one of the best academic labs in virtual reality when it comes to visual representation. Anyone interested in new technologies for design and engineering is welcome.

From detail to urban design and from visualization tool to design method. The possibilities with VR are endless, and the same goes for its use in design and engineering. As part of the bachelor curriculum the VR-Lab provides support for students in several courses. In addition to that, students in their masters can choose an elective in which they learn to model their own fictitious virtual reality environment. Both will provide the student with extra tools for design and research.



Outside of the courses, the VR-Lab provides assistance to students who are interested in using virtual reality in their graduation project. This can range from merely helping with turning a 3D-model into a VR-model to supplying the necessary tools for using virtual reality in research.

Students with varying topics from different faculties know their way towards the BK VR-Lab. Not only students are welcome in the VR-Lab but also researchers, professors and people from outside the faculty and TU Delft can contact them.

Currently, the lab houses four separate VR booths equipped with all the tools needed. However, the lab is in constant movement, innovating and expanding their research on different tools such as augmented reality.

Projects they have been supporting, range from testing façades, to modelling a complete design in VR, to real-life feeling and seeing the impact of sunlight and wind in a virtual room (in collaboration with Senselab).

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PD Test Lab

At the West entrance of the faculty stands a small white building high up on scaffolding. This building, by the name of Product Development Test Lab, offers students and researchers the possibility to test (their) theories.

By itself, the building is already a test. Designed as part of a two-year research project, it was built by students and meant to be learned from. Meaning that, later versions of the building should be an improvement of the current one, and so on. The complete structure of the building was made to size by a milling machine, making the parts fit together like Lego bricks. Other elements, like wall and floor elements, are prefabricated and easily replaceable. Thanks to the use of wood and sustainably produced OSB board, the PD Test Lab is a bio-based product. The aluminium cladding can be recycled and the wall and floor elements as well as the entire facade can be reused in other buildings.

Initially, the PD Test Lab is supposed to test product innovations that are mainly focused on digital construction, the circular economy and energy saving. However, also acoustics and integrated installations design can be tested. The lab is open to researchers, teachers as well as students and others interested in using the building. Besides the examples given, other ideas for the use of the PD-lab, ranging from a photo shoot to a meeting, are more than welcome.

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SenseLab

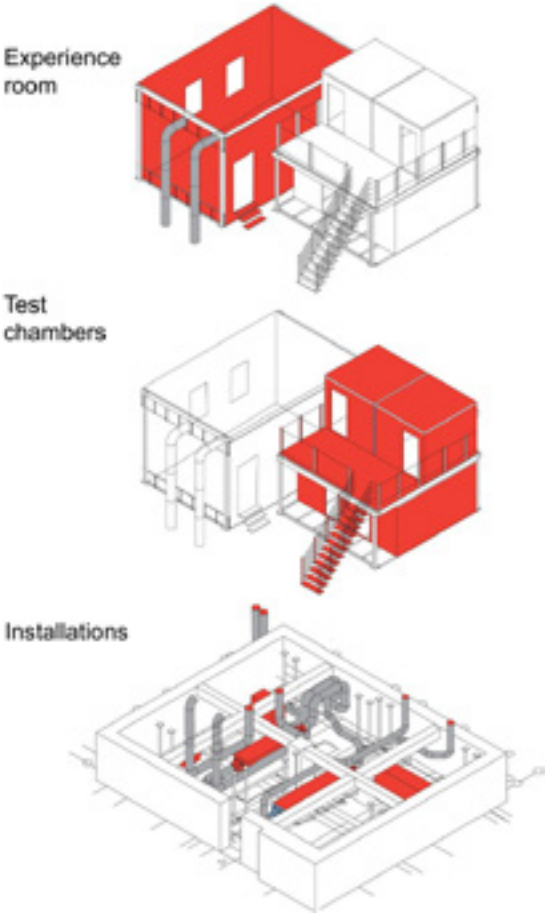
Research has shown that staying indoors is not good for our health. People spend more and more of their time indoors. Therefore, providing a healthy and comfortable indoor environment is very important. The SenseLab, a laborary for testing and experiencing single and combinations of indoor environmental conditions, will contribute to the understanding of and coping with the indoor environment. Students, teachers, researchers, but also the general public are able to experience and test different combinations of environmental conditions.

The research performed in the SenseLab will contribute to the development of a new assessment approach, which takes account of the combined effects of stress factors in buildings on people (patterns) as well as their individual profiles, and can be used to determine requirements (to prevent negative effects) and preferences (to stimulate positive experiences) for (re)designing healthy and comfortable buildings.

The SenseLab is built around the four IEQ factors (air, thermal, lighting and acoustical quality) in a room of the Science Centre in Delft and comprises the experience room and the test chambers.

In the experience room, it should be possible to study the effects of different combinations of environmental conditions in different scenarios by changing the interior design and choice of materials and systems:

1. Change the light by changing materials, but also by changing the light itself.
2. Changing the sound by changing materials or make use of movable panels, or by introducing noise on purpose or not.
3. The effect of different heating and air conditioning means on personal climatization and well-being.
4. Choice of design, materials and systems in relation to air quality.
5. Assessment of total experience and well-being.



In each of the four test chambers, several features are present with which the environmental parameter in question can be illustrated and tested. These exhibits will be flexible.

Air quality

1 To visualize and perceive how a portable HVAC system operates.
2 To smell and evaluate different furnishing materials under different conditions with smelling devices
3 To demonstrate and apply human performance testing equipment.
4 To demonstrate and apply environmental monitoring devices.
5 To experience different ventilation rates and learn about source control.

Thermal quality

1 To demonstrate effects of light, and the distribution of light by interior design and choice of materials
2 To learn, experience and test responses of people to different situations in order to optimize the resulting light distribution in the space depending on task and context – in terms of functional, perceptual and atmosphere attributes.

Lighting quality

1 To demonstrate effects of light, and the distribution of light by interior design and choice of materials
2 To learn, experience and test responses of people to different situations in order to optimize the resulting light distribution in the space depending on task and context – in terms of functional, perceptual and atmosphere attributes.

Acoustical quality

1 To demonstrate, experience and learn about the perception of different acoustical sources and low frequent vs. high frequent sounds.
2 To learn, experience and measure the perception of different acoustical situations by changing materials, changing the sound and using subjective perception as well as human physical testing.

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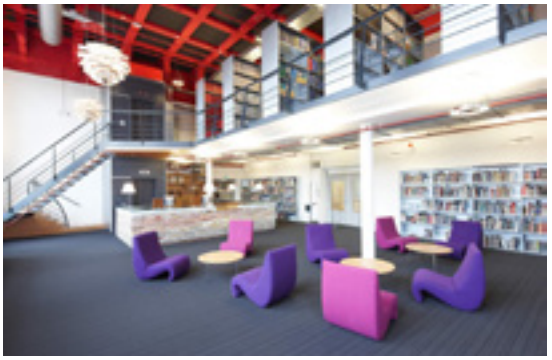
BK Library

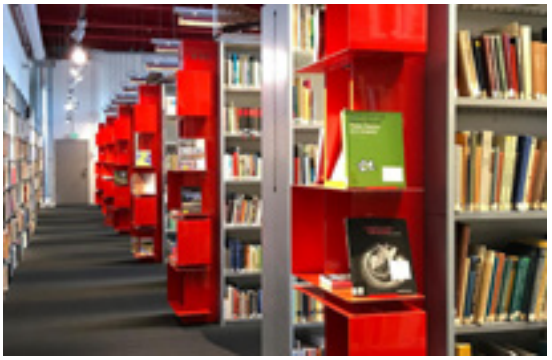
Bouwkunde hosts one of the few remaining faculty libraries. The TU Delft Library has developed here a dedicated overview for Architecture to make the enormous quantity of information accessible.

The collection is arranged according to subject and is presented in an open-plan layout. A sign shows where the different subject areas can be found in the bookcases. There is also a systematic description of the layout of the public PCs, and a glossary of the most common technical terms.

The entire TU Delft Library collection can be accessed through the online catalogue, and can be searched by author, publisher, title keywords, location codes, etc.



Articles can be found using bibliographic databases like British Architectural Library Catalogue and Avery Index to Architectural Periodicals (see Databases).



Only ‘regular’ books can be borrowed from the library. Bound annual volumes or individual issues of magazines, loose-leaf publications, reference works and old books of historical importance (generally anything printed before 1900) can only be consulted in the library for reference purposes. As long as they are not valuable or vulnerable, they may be copied, using the library’s copying and scanning facilities. See this page for a list of valuable and vulnerable works.

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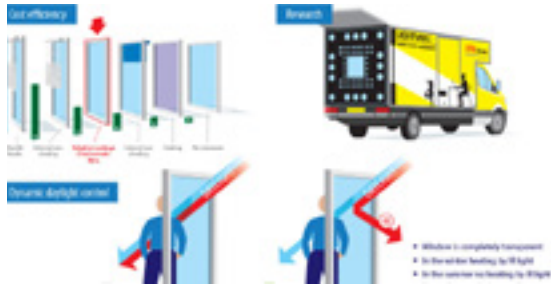
Lightvan

The ‘LIGHTVAN’ research aims to optimize the lighting design for healthy schools and modern senior housing and care homes with regards to the use of light as a cheap and important source of energy.



A multi-functional mobile light laboratory was built into a delivery van, the LIGHTVAN. This LIGHTVAN has two clear aims: With this mobile light laboratory we can travel to the living environment of specific groups of people, such as children and seniors, so that they may be subject to specific age-dependent light studies. In this moving laboratory measurement equipment is present for this purpose and a table and chairs for the various subjects. Testing of luminance and color contrasts are possible, as well as the testing of “light and shadow” patterns. Even small eye tests can be performed.

In addition, the rear side of the delivery van is adapted so that with opened doors all kinds of innovative façades can be tested. The LIGHTVAN travel to different locations to be accommodated and be positioned towards various sun directions.

Several passe-partouts are available for building physics measurements of different façades sizes in order to allow test-subjects to indicate their preferences for specific façades in terms of comfort.

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Chair collection

Containing over 300 chairs collected for teaching purposes since 1957, the collection is currently under the supervision of the Chair History of Architecture and Urban Planning.

It is acknowledged as one of the most important furniture collections in the Netherlands and is a source of knowledge about materials, construction and typologies for students and designers alike.

In the past, the chairs were used as examples during lectures and as models during drawing lesson, but we now also use them as point of departure for research and design courses.

Preliminary evaluations show that the close engagement with these unique objects improves students' design processes and products.

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Architecture

Research

Overall coordinator
— Dr.ir. Klaske Havik

Coordinator History
— Prof Dr.-Ing. Carola Hein

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FIG. 1.1 Securing Democratic Society; State Policies, Technological Surveillance and Spatial (Cross-) Boundary Practices'

Introduction

The faculty research programmes over the period 2010-2015 were reviewed by an external committee of peers in 2016, following the assessment protocol of the Association of Universities in the Netherlands (VSNU). Three aspects are assessed: research quality, relevance to society and viability, on a four-point scale ranging from 1 (world leading/excellent) to 4 (unsatisfactory). For a full explanation of the indicators and scores see the Standard Evaluation Protocol 2015 – 2021 on the VSNU website).

In the 2016 Research Review, the Architecture department took part in two research programmes, the Architectural Project and its Foundations (APF) programme, and the Design & History programme (D&H).

At the moment of this mid-term review, it has become clear that the Design & History programme, that used to run between different departments, will most likely take a different shape in the near future. The part of that programme that was located in the Department of Architecture, in the Chair of Urban and Architectural History led by Prof Carola Hein, is now included in the general report of the Department of Architecture. In the new research structure of the Department that will be presented in the following pages, “History of Architecture and Urban Planning” is a research group in itself and the basis for one of the strong discursive lines that acts transversally throughout the programme.

As during the 2016 Research Review (until today), two research programmes existed within the department of Architecture, the Architectural Project and its Foundations (APF) programme, and the Design & History programme (D&H), this chapter of the report will consist of two parts: a) Architecture and b) Design & History.

1 – Organisation, vision and strategy

PART A. ARCHITECTURE

Architectural Project and its Foundations

In December 2016, the research programme of the Department of Architecture, “the Architectural Project and its Foundations” has been assessed by an international committee. For this event, the Department provided a self-reflection, and presented the research output of 2010-2016 in the form of an exhibition and a catalogue. The results were very positive: the research programme was evaluated as World leading/excellent.

The APF programme was awarded:

- research quality 1
- relevance to society 2
- viability 2

The recommendations made by the assessment committee were the following:

- Further strengthening of collaboration (defining research topics) across departments – beyond Urbanism and Design & History;
- To gain external funding must be highly prioritized – strong ambitions in terms of attracting external funding must be kept through clearly defined strategies, general support of research activities and securing tenure positions;
- Further clarification and development of research areas/topics in regard of securing societal relevance and to sustain research quality through critical mass (size of research groups) ought to be pursued;
- Take advantage of the strong network of partners from practice and academia in the Netherlands in order to extend and strengthen the international research collaboration.

In the period 2017-2019, we have focused our efforts on solidifying the high quality of our research, while recalibrating the structure of our programme to address the above recommendations.

In the following paragraphs, we will address the steps we have taken:

- to ensure that research groups will have enough critical mass, to become substantial centres of expertise;
- to ensure more external funding, and to formulate a funding strategy in connection to the research groups
- to explore inter-departmental and international collaborations
- to enhance the peer-to-peer research exchanges and PhD tutoring within the groups
- to enhance the level of incoming PhD candidates and the appropriateness of their projects to the research topics and approaches within the department.

Some ten years after the introduction of the Architectural Project and its Foundations programme, the international assessment gave us the opportunity to reflect on our research programme. In the course of a decade, staff members have left and new colleagues have arrived, dissertations have been finished, new PhD students have started research. Also, new topics have emerged in the work of the department. In the past years, the distinction between the two pillars of the former research programme the Architectural Project and its Foundations has faded. In fact, the coming together of projects and foundations can be seen as a productive insight for further development of the research of the department: instead of separating “foundation” and “project”, a new structure is formed with thematic research groups which have both a “foundations” and a “project” component.

Acknowledging the shared interest of researchers within the department in the idea of architecture as a cultural field of expertise, the research structure has been reformulated along these lines, as to guarantee a continuous cross-fertilisation between theory and practice, and from the past, to the present and the future.

Architecture as a cultural field of expertise

The department's research focuses explicitly on architecture as a field of expertise, a field in which making and thinking are inextricably linked. The programme regards the 'architectural project' as the cornerstone of architectural practice and reflection, and cherishes the strong connection the Department of Architecture in Delft holds with architectural practice. Through a large number of high-profile practitioners in this group, relations with stakeholders in contemporary architectural practice (and the building industry) are continuously activated.

The research regards the architectural project as the junction where a complex combination of cultural, social, functional, economic and ecological factors is articulated as a concrete spatial proposal. This articulation requires a specific expertise that characterizes the discipline of architecture. Precisely this expertise is at the centre of the research programme. In this view, the structure of the research departs from this idea of expertise, acknowledging that architecture as a cultural field of action and reflection is multi-layered, entailing many connections to other fields.

Thus, from a reflection on the work of the past decade, and from a very positive evaluation of our work, the Department has set new steps to tried to consolidate that position and set a new agenda that could accommodate new research within a more flexible programme. Building upon the good work of the part years, following the recommendations of the assessment and providing new opportunities in line with the new researchers and research directions, the Department has taken the opportunity to rethink the organisational structure of the programme. The new structure might also help provide linkages to the valuable research of the Chair History of Architecture and Urban Planning who up till now had been working in the Design & History programme.

Towards a New Structure: Thematic Research Groups

The collective work for the Research assessment 2016, the positive evaluation and the reflection on our research that was part of this process, offered a momentum to recalibrate the structure of the Department's research programme. In Spring 2016, we provided a questionnaire to research staff to propose improvements for already existing research groups, and to propose potentially new groups. Crucial criteria for the viability of research groups is the societal and scientific relevance of their thematic focus as aspect of architectural expertise. In terms of the structure and organisation, the ambition to see research groups as strong centres of expertise comes with a number of commitments. We therefore requested research groups to:

- have a clear field of investigation which is thematically defined and shared by its members;
- this field of investigation spans from discourse to practice, building upon well-defined historical, theoretical and methodological foundations while addressing architectural practice (in the form of critical analysis, case studies or explorations in practice itself);
- consist of a substantial critical mass of experienced research staff (holding a PhD), PhD candidates, postdocs, and other researchers;
- organize within their group a structure of peer-to-peer discussions and PhD guidance;
- have a publication strategy;
- have a funding strategy;
- be chaired by experienced permanent staff with PhD and capacity to supervise PhD's;
- link to broader research themes in the faculty, university or (inter)national collaboration.

We received multiple proposals for existing and new groups, and took four months to speak with all proposers and develop a proposal for a new structure. The new structure, that will be explained in the following paragraphs, is based upon the input received from the research staff, and consists of five thematic groups and three discursive lines within a dynamic model. The ambition of this structure is to encourage cross collaborations and to ensure an active research culture within the department.

Research structure

The new research structure of the Department of Architecture takes the form of a matrix, with thematic research groups which can be distinguished by their focus on a particular aspect of architectural expertise that is relevant in addressing societal and scientific questions, and discursive groups that provide historical, methodological and theoretical grounding to all groups. The thematic groups are composed of staff from across the different sections and chairs of the department, and always include a number of staff members who have a connection to practice.

The three discursive chairs of the Department: History, Methods & Analysis and Theory have a responsibility to provide a historical, theoretical and methodological base for the entire research programme of the department. They have a leading role in developing graduate school courses for PhD candidates in the Department of Architecture, and they conduct research on specific historical, methodological and theoretical topics. Also, these chairs are foreseen a role in the wider agenda of the Faculty, linking to faculty-wide investigations (such as pedagogy, ecology, digitalization).

These are the five thematic research groups:

- Architecture and the City;
- Situated Architecture;
- Global Housing;
- Borders & Territories;
- Architecture, Culture and Modernity.

These are the transversal lines:

- History: History of Architecture and Urbanism;
- Theory: Ecologies of Architecture;
- Methods: Architectural Pedagogy.

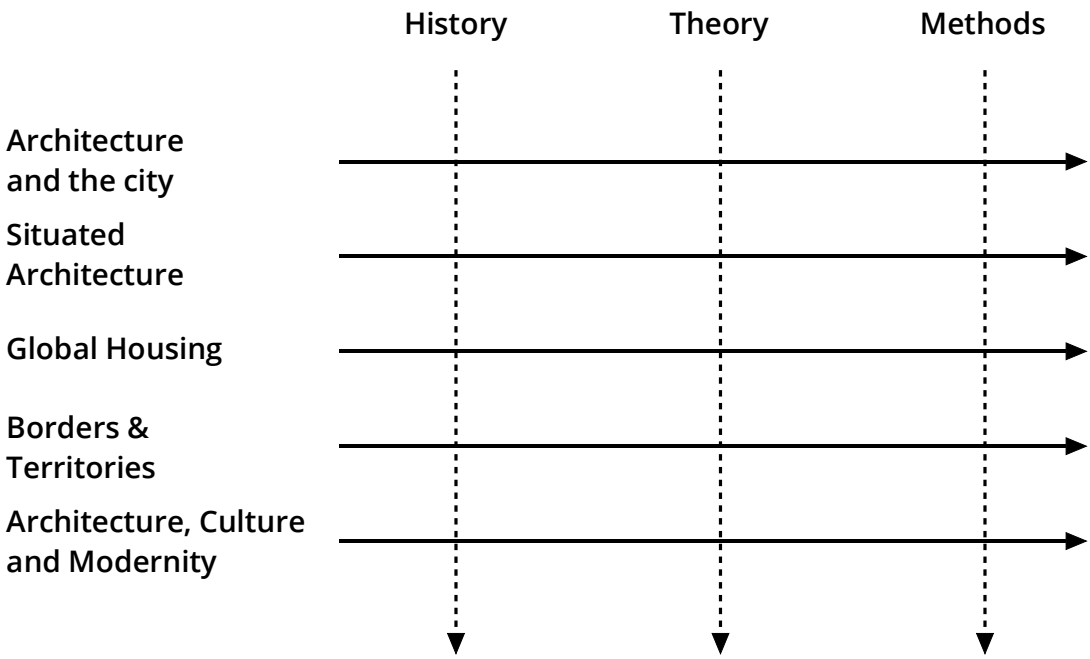

FIG. 1.1 New research structure department Architecture.

PART B. History

Design & History

The Chair History of Architecture and Urban Planning located in the Department of Architecture formed a substantial part of the Design & History programme, chaired by Prof Dr.-Ing. Carola Hein. The reflection on this part of the D&H programme is included in the report of the Architecture department. At the 2016 research Assessment, the programme was awarded:

- research quality 2
- relevance to society 2
- viability 3

The new faculty research framework requires research programs to be aligned with departments. Cross-faculty research programmes are no longer used as a framework to coordinate and communicate research. However, the faculty is now considering faculty-wide themes. In this context the Design & History group received the explicit request of the dean to make a case for a faculty-wide “Heritage” initiative. History applies a notion of heritage and landscape that includes the long-term development of cities, water systems, infrastructure, and food and energy landscapes, and the social reality, the systems of government and governance that determine the spatial structures and the relationships between city and country. The discussion on such initiatives is subject to this midterm review.

Regarding the Design & History Programme, the assessors notably commented that cultural historical research needed to be focused and “properly highlighted and addressed” in a revised research structure. For the last research assessment, we identified five different themes that linked our cross-over interests and that are indicative for the large territories that we cover. We have refined our approaches for the current setup of the research. The assessors encouraged us to rethink and refine the structure as they found it difficult to see Design & History as a single research programme. We understand this criticism and have in the past years been searching for a clearer focus within history and balanced collaborations with other chairs.
The assessors also recommended that the new focus needed to be “carefully monitored in view of the required need for synergy” with the Heritage section where two Chairs were then empty. Since 2016, we have deliberately and actively kept the Design & History collaboration alive, because it has proved to be the most fruitful platform for collaboration around themes of heritage at all scale throughout the faculty.

Since the arrival of the new Chair holders of Heritage and Technology and Heritage and Values in 2018, we have established intensive contacts with these sections that are leading to a fine-tuning of the key issues notably around the theme of heritage. We have highly promising interactions notably around cultural heritage, which is a part of the History Chair’s broader interest in long-term development and its impact on the present and the future. Together with the Chairs Heritage and Technology and Heritage and Values, we have strategically organized our shared interests around the themes of “documenting and archiving,” “design and fabrication,” “dissemination and outreach.” In this setup, History plays an important role particularly in the first and third stage.
The LDE collaboration is highly relevant for the Chair History of Architecture and Urban Planning. Our desire to combine historical analysis with future planning is evident in the role that we have played in leading the world port city focus of the LDE Metropolis and Mainport Center, focussing on the changing relationship between port and city over time and the meaning of this historic relation for the future. In 2018, we have been called upon to lead research on space, culture, and partnerships in the port city region. Building on this research, the LDE PortCityFutures research program led by Carola Hein will start in early 2020 with two PhDs and a postdoc and will allow us to bring our interests in water, ports, commodity flows and digitization into one collaborative investigation.
Research related to the Chair Collection has also led to university-wide collaboration with the TU Library Heritage and Open Spaces teams notably on the topic of university heritage, and to repeated and ongoing cooperation, resulting in exhibitions. The digitization of the university heritage in our care was updated by the building of a new database containing completed and updated

documentation of the items belonging to the Chair Collection. A website that is to be completed during the first half of 2020 will offer new opportunities for outreach to design professionals, students and alumni.
In the field of Health and Architecture and Heritage we are closely connected to the Institute of History of Art, Architecture and Landscapes at University of Groningen through the work of one of our staff members, Cor Wagenaar, who also holds the Chair of History and Theory of Architecture and Urbanism in that institute, and is the head of the Expertise Centre of Architecture, Urbanism and Health, a joint venture of the faculties of Arts, the Spatial Sciences and the University Medical Centre. Our cooperation extends the field of health-related issues and also addresses contemporary heritage issues.
Our interest in dynamic values, that is the ways in which the built environment embodies the values of the past and shapes the approaches of the present as well as the future, has led us to participate in the Delft Design for Values Institute. Several members of the History Chair have received funding from the DDfV Institute's Open Subsidy Seed Fund, to develop a methodology on value deliberation or on 3D Virtual Modeling for Value Assessment in Heritage Debates. Amy Thomas has also initiated a project on Teaching Design for Values which links staff from 5 faculties on the subject through workshops and a publication.

Despite our limited number of staff members, we have been able to accomplish our aim to use our specific knowledge and methodologies on long-term development to connect with peers and colleagues.

Research foci History

History of Architecture and Urban Planning as a Humanities and Social Science based discipline with a focus on historic long-term development holds a special place in a university oriented towards technology. To connect to our forward-looking colleagues, who plan for the future, we aim to connect design practices with critical analysis, providing a foundation for colleagues who re-imagine the existing built environment of the relevance of the past. History of Architecture and Urban Planning as a research group has its own methodological and thematic focus, while working closely with multiple Chairs across the Faculty, the univer-sities and the Leiden-Delft-Erasmus collaboration. In the last decade we have come to realize that that we need to engage with cutting edge digital technologies to enrich the data of the past and increase the relevance of history for the future.
The History Chair examines the multiple facets and entangled political, economic, social, cultural conditions created in long-term developments and inscribed in the built and non-built environment. Our methodological approach, which stresses the impact of time on all de-velopments, is what brings us together. In the History Chair we see history as a broad discipline that explores aspects of the built and non-built environment through all scales (material, to building, city and landscape) and conditions. Historical analysis can focus on spaces that no longer exist physically but that are still present in the collective memory. It can also (but is not limited to) deliver specific information for the making of technical, architectural or policy heritage decisions.

International Planning History

The Chair History of Architecture and Urban Planning plays a key role in the International Planning History Society (IPHS). In 2016, we organized the bi-annual IPHS Conference with some 550 attendees, documented in 7 volumes of Proceedings (open access).

Several PhD students work on issues related to this theme, specifically: Elmira Jafari, Gabriel Schwake.

Urbanism-Landscapes-Watersystems

In collaboration with the Heritage Agency of the Netherlands/Rijksdienst voor het Cultureel Erfgoed (RCE) we work on the project The urban delta: a diachronic system approach to urban development, water, energy and food in the landscape of the Netherlands. On the basis of data and analyses, maps and stories can be made about the long-term development of the Dutch urban delta that serve as examples and inspiration for the present and the future.

Researchers:
Reinout Rutte, Thomas van den Brink, Yvonne van Mil and Arnoud de Waaijer. A new PhD will be hired to work on this topic as part of the LDE PortCityFutures research program.

Energy Landscapes / Petroleumscape

The Chair's research on networks and flows is exemplified through our publications, con-ferences, exhibitions, keynotes, and grant-funded research on energy landscapes and notably on the global petroleumscape.

PhD students:
Penglin Zhu, Rose Sarkhosh, Stephan Hauser.

Port Cities/North Sea

Research into networks and flows and into energy landscapes is closely related to our interest in port city development. Collectively the Chair has started to explore the North Sea as the example of how a body of water can shaped landscapes, cities and buildings.

PhD students:
Paolo De Martino, Fatma Tanis.

Heritage

Heritage, understood as the built environment at large, is a key aspect of our work, focused on heritage and climate change, heritage and new technologies (including heritage in the history of the profession). In collaboration with the LDE Centre for Global Heritage and Development and ICOMOS NL, we developed the Water and Heritage for the Future initi-ative. Water heritage is not only a very Dutch theme, but a topic with global significance.

PhD students:
Kaiyi Zhu, Gül Aktürk

Digitalization

Digitalization is one of the main keys to interpreting and understanding the past. Big data of the past becomes accessible through interdisciplinary collaboration with specialists in advanced artificial intelligence and linked data. This is explored in the ArchiMediaL project for research into the automated recognition of buildings in historical images and the development of mixed-method strategies (see paragraph Funded projects and Highlights).

Architectural History

The traditional ways of looking at architectural history have played a substantial role in some of the research projects and publications.

In many of these the Dutch context is the main point of departure as we can make use of the extensive archives of the HNI in Rotterdam. The Staal Research Project: Arthur Staal around the Mediterranean, has been mounted with the help of this Institution and was funded by the Dutch Stimuleringsfonds.

PhD students:
Jean-Francois Lejeune (finished in 2019) Phoebus Panigyrakis, Gabriel Schwake, Li Lu, and John Hanna.

Health and Health Care

Research into the concept of Healthy Cities is one of the linking pins between the Chair of history and theory of architecture and urbanism at the Institute of History of Art, Architecture and Landscapes of Groningen University. In Delft, this topic is accommodated by the Health@BK platform. Oscillating between historical studies and research in contemporary cities, and linked to ongoing research in healthcare architecture, this topic is partly rooted in research into Enlightenment thinking about the role of the (physical, spatial and social) environment and its performance in terms of health, happiness and well-being.

PhD students (promotor Cor Wagenaar):
Giuseppe Lacanna, YingYing Gan, Dejian Peng.

PERFORMANCE INDICATORS

As a result of its particular profile, coupling fundamental and applied research, discourse and architectural practice, the Department of Architecture has a long tradition in valorising its research not only through standard academic channels, such as peer-reviewed journals and academic lectures, but also through public debates and seminars, as well as exhibitions for a broader public. All of these are understood as systematic research outcomes that con-tribute to scientific knowledge. Below a selection of the research output of the Department of Architecture 2016-2018.

The research results of the Department of Architecture are typically disseminated through edited or authored thematic books that are aimed not only at academics but also at a broader readership, specifically in the professional and cultural field. Therefore, next to publications with highranked academic publishers, also publications with professional -though not specifically scientific- publishers in the Netherlands, such as Nai010, SUN, Vantilt and Architectura&Natura are highly valued.

Researchers of the department publish in, and take place in editorial boards of peer-reviewed academic journals such as The Journal of Architecture, The Journal of Architectural Education, Architectural Theory Review, Architecture and Culture, the Journal of the Society of Architectural Historians, Planning Perspectives, Journal of Urban History, KNOB, Planning Perspectives, Portus Plus, and Simiolus. Netherlands Quarterly for the History of Art. Staff members are also active in international journals as board members, notably KNOB, Planning Perspectives, Journal of Urban History, histories of Postwar Architecture, Simiolus.

In addition, staff members are active as editors of themed academic journal and book series that the Department actively supports, and that have a high impact on the professional and academic debate in the field of architecture. These journals are DASH (Delft Architectural Studies on Housing), OverHolland, FOOTPRINT Delft Architecture Theory Journal and OASE journal for architecture.

Of these journals, FOOTPRINT and OASE are peer-reviewed and have academic status (Scopus)..

Since 2016, we publish the series: Inaugural Speeches in the Built Environment: Global and Contextualised (http://books.bk.tudelft.nl/index.php/press/catalog/book/431).

In 2017, the new Writingplace journal for Architecture and Literature, a peer reviewed-open-access journal (funded by NWO/ EU-COST) was launched at the Department of Architecture. In 2018, the new peer-reviewed open access European Journal of Creative Practices in Cities and Landscape was launched in collaboration with University of Bologna (Horizon 2020).

Also, research staff is regularly invited for peer reviewing for, among others, the Journal of Architecture, Ambiances journal, Journal of Landscape Research, Planning Perspectives, Architecture and Culture, Bloomsbury Academic, CAPACIOUS Journal for Emerging Affect Inquiry, Journal of Posthuman Studies, Rowman & Littlefield International, RUUKKU Studies in Artistic Research, Routledge.

A very important performance indicator is as well the presence in the international archi-tectural debate though exhibitions, and participation in debates. In the past few years, researchers of the programme have for instance contributed to the highly prestigious Ar-chitecture Biennale in Venice, while collaborations with the Jaap Bakema Study Centre have also contributed to a stronger research culture regarding exhibitions.

Some of the research results of the programme transpire into design approaches and projects of practitioners that are directly involved in the programme. Part of the performance of the research programme can therefore be measured in the way that their work is rewarded in criticism, competitions and prizes.

TABLE 1.1 Selected output indicators

		RESEARCH QUALITY	RELEVANCE TO SOCIETY
Assessment dimensions	Activities, organisation, facilities/assets, output	**Activities** - Curated exhibitions; - Participation in academic conferences; - Organisation of and participation in colloquia; - Editorships of academic journals.	**Activities** - Editorship of professional journals; - Curated exhibitions; - Participation in international architectural events; - Participation in and organisation of debates; - Lectures at architecture institutes and other cultural venues.
		Organisation - Participation in academic networks; - Attracting PhD students; - Collaboration with research institutes such as Jaap Bakema Study Centre; - Hosting conferences.	**Organisation** - Collaboration with professional institutes; - Curating exhibitions; - Organising debates.
		Facilities/assets - Collections; - Digital archives and websites.	**Facilities/assets** - Collections; - Digital archives and websites.
		Output - Articles in peer-reviewed academic journals; - Academic books; - Academic book chapters; - PhD theses; - Edited or authored thematic books; - Editorships of themed academic journals; - Conference papers.	**Output** - Articles in professional journals; - Edited or authored thematic books; - Editorship of themed academic journals.
	Use	- Reach of calls for papers for conferences and edited journal issues; - Books in libaries (worldcat); - Media covereage of academic work in professional media.	- Media coverage of events, debates, exhibitions; - Publications of architec-tural work of practicing professors and staff in professional journals and websites; - Invited lectures.
	Marks of recognition	- Invitations to important conferences and seminars; - Election to academic or academic professional associations; - Selection by excellent researchers; - Invited keynote speeches; - Editorial boards; - Assessment committees; - Visiting positions.	- Prizes and awards; - Advisor/election to professional associations; - Invited keynote speeches; - Editorial boards; - Committees; - Advisory positions.

2 – **Research in numbers**

TABLE 2.1 Research output department 2016-2018

	2016	2017	2018
MAIN RESEARCH OUTPUT			
Refereed articles	17	19	33
Non-refereed articles	1	5	6
Books	8	1	6
Book chapters	27	33	44
PhD-theses	1	2	4
Conference papers	28	16	21
Professional publications	40	37	39
Publications aimed at the general public	7	6	4
Total Main Research Output	**129**	**119**	**157**
OTHER RESEARCH OUTPUT			
Media contritbutions and coverages	25	10	26
Abstracts	16	7	10
Editorial work: editorial activity	18	19	35
Editorial work: publication peer review	13	9	21
Bookediting	19	15	14
Exhibition	13	16	28
Memberships	34	21	25
Talk or presentation (conference)	48	44	74
Total Other Research Output	**186**	**141**	**233**
TOTAL	**315**	**260**	**390**

TABLE 2.2 Staff members department

STAFF		**2016**		**2017**		**2018**
	NR	FTE	NR	FTE	NR	FTE
Scientific Staff	35	9,94	32	9,81	34	9,84
Researchers (incl Postdocs)	13	5,12	21	7,32	25	10,71
PhD candidates	27		32		41	
Total research staff	**75**	**15,06**	**85**	**17,13**	**100**	**20,55**
Visiting Fellows	31	6,31	29	9,14	31	8,8
Total Staff	**106**	**21,37**	**114**	**26,27**	**131**	**29,35**

TABLE 2.3 Research income 2016-2018

	2016		2017		2018	
	K€	%	K€	%	K€	%
FUNDING						
Direct funding [1]	2.585	79%	2.450	73%	2.222	66%
Research grants [2]	109	3%	75	2%	50	1%
Contract research [3]	294	9%	372	11%	631	19%
Own contribution	-60	-2%	-133	-4%	-168	-5%
Other [4]	338	10%	584	17%	638	19%
Total Funding	**3.266**	**100%**	**3.348**	**100%**	**3.372**	**100%**
EXPENDITURE						
Personnel costs	-2.812	88%	-2.478	85%	-2.368	84%
Other costs	-399	12%	-421	15%	-451	16%
Total Expenditure	**-3.211**	**100%**	**-2.899**	**100%**	**-2.819**	**100%**
RESULT	**55**		**449**		**553**	

[1] Direct funding (basisfinanciering / lump-sum budget).
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and the Royal Academy).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations industry, government ministries, European organisations and charitable organisations.
[4] Funds that do not fit into the other categories.

TABLE 2.4 Length of PhD candidacies and success rate

ENROLMENT		**STARTING YEAR**					
		2010	**2011**	**2012**	**2013**	**2014**	**TOTAL**
GENDER	Male	2	0	0	1	4	**7**
	Female	2	2	2	0	0	**6**
	Total	**4**	**2**	**2**	**1**	**4**	**13**
GRADUATED							
≤ 4 years [1]	NR	2	0	0	0	0	**2**
	%	50%	0%	0%	0%	0%	**15%**
≤ 5 years [1]	NR	2	0	0	0	0	**2**
	%	50%	0%	0%	0%	0%	**15%**
≤ 6 years [1]	NR	3	0	0	0	0	
	%	75%	0%	0%	0%	0%	
≤ 7 years [1]	NR	3	0	0	0	0	
	%	75%	0%	0%	0%	0%	
Total Graduated	NR	**4**	**0**	**1**	**0**	**0**	
	%	**100%**	**0%**	**50%**	**0%**	**0%**	
Not yet finished	NR	0	0	1	1	3	**5**
	%	0%	0%	50%	100%	75%	**38%**
Discontinued	NR	0	2	0	0	1	**3**
	%	0%	100%	0%	0%	25%	**23%**

[1] Van de gestarte PhD's in dat jaar is gekeken naar de doorlooptijd en dit is cumulatief over de jaren heen getrokken. Een PhD die in "Graduated ≤ 4 years" is gepromoveerd, wordt dus ook weer bij "Graduated ≤ 5 years", bij "Graduated ≤ 6 years" en bij "Graduated ≤ 7 years" meegeteld. In de tabel "Total Graduated" staat het totaal aantal gepromoveerde PhD's.

3 – **Overview of the Architecture research**

Research groups

- Architecture and the City;
- Situated Architecture;
- Global Housing;
- Borders & Territories;
- Architecture, Culture and Modernity.

Transversal lines

- History: History of Architecture and Urbanism;
- Theory: Ecologies of Architecture;
- Methods: Architectural Pedagogy.

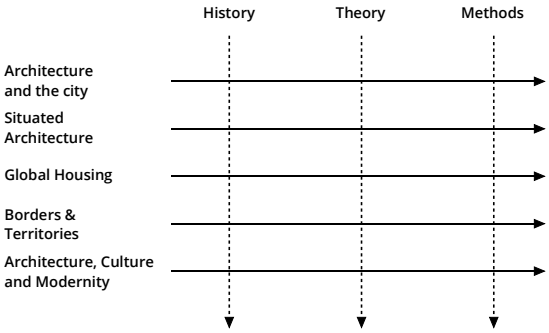

FIG. 3.1 New research structure department Architecture.

Borders & Territories

The Border & Territories (B&T) research group focuses on the critical relationship between architectural theory, socio-spatial analysis and architectural design. The B&T group studies architectural construct as a precursor of 'now' discourse, addressing 'other' possibilities of architecture by speculating on the relevance of the appropriation, implementation and application of methods and instruments that have been progressively externalized to the disciplinary core (cartography, literature, art, philosophy); and the constructs and objects that historically have not been considered as architectural 'material' as such within the discipline. The research group explores the concept of the border and the impact of cross-border exchange on architectural, urban and territorial entities; past, present and future. It studies the role of infrastructure, networks and migratory movements on the transforming territory. The current state of geopolitics is characterized by a series of superimposed, highly complex and differentiating conditions, balancing between the implementation of tangible and intangible borders that define carefully delimited territories of varying scales. Studying these conditions means getting insights into how borders are produced, controlled, coded and maintained within territorial entities, and how spatial sets of (cross-border) relationships thus also produce territories. The B&T research focusses on these four main areas of research:

- Border Conditions;
- Territory/Infrastructure;
- Architectural Adjacencies;
- Modi Operandi.

The research group cultivates the disciplinary edge conditions, meaning it emphasizes a trans-disciplinary research attitude and methodological approach that connects architecture to other related disciplines and fields of inquiry.

Contact person: Marc Schoonderbeek.

Architecture and the City

Central in the work of the research group Architecture and the City is the notion of public realm, as a lens to look at the (trans)formation of urban space and architectural form. The group utilizes multiple research approaches to investigating the architecture of the city and its long-term spatial development. The study regarding the changing definitions of public institutions along with the development and transformation of public infrastructures overtime is hereby a key issue. Building upon the tradition of typo-morphological studies, the group focuses on the mapping of spatial transformations of the Randstad on several scale levels (building, block, city and territory) and on the comparative analyses of types and models regarding case studies in Dutch as well as the European context.

Using the above-mentioned research approaches, the group is developing and carrying out research-by-design initiatives conducted with (PhD)students, professional firms, municipalities and within (inter) national collaborations. The main goal is to clarify and contribute to the debate concerning the role of the architectural intervention within ongoing urban transformations. Current research projects:

- Hybrid Building
- Role of Stations
- Next public Library
- Water Sight
- Randstad Holland
- Constructing Identity
- Stad van de toekomst' (City of the future)

Contact persons: Susanne Komossa, Roberto Cavallo.

Situated Architecture

We recognise that the experience of architecture is bound to "situations", which architecture both articulates and produces. The consideration of these situations includes material cultures, languages, representation, and a multitude of framings and mediations. The issue of a situated architecture demands inquiry into the complex nature of the conditions of its appearances and of its experience. This research group takes the notion of situated experience as a common ground between academia and practice; as a topic to explore both conceptually and through material and building practice. Within this field, the group defines three overlapping research perspectives:

Experiencing: Perception of Place

Exploring the complexities of the experience of place and architecture, giving privilege to phenomena—such as material, mass, light, and space—and the specific effects of cultures on architecture and the environment, its materialisations and expressions. The specific solutions, conventions, arrangements, and fantasies inscribed in places are all constituent elements of experience.

Narrating: Language and Representation

Investigating the relationship between the physical reality of place and the way it is imagined and expressed. We sue reflections on oral history, narrative, literary imagination and everyday spatial practices as lenses to reflect on how architecture is situated: not only in terms of its physical connection to place, but also socially and culturally.

Making: Material Culture

Ideas find themselves translated into atmospheric, spatial and material phenomena and expressions of material culture. Material culture refers to the ideas of culture(s) that are embedded in things, in artefacts: objects, interiors, places, buildings, cities; in their arrangements; in the ways they are made; in their appearances and the language of those appearances. Analyses of situated architecture are deeply indebted to how one interacts with the world through things.

Contact persons: Mark Pimlott, Klaske Havik, Daniel Rosbottom, Alberto Altés Arlandis.

Global Housing

The research group Global Housing aims at examining housing design from different perspectives: historical, theoretical and methodological. The group explores lines of inquiry that promote intersections of architectural studies with research fields focused on governance, technology, social sciences, and humanities. The Global Housing research group accommodates projects and scholarship that aim at contributing to create and disseminate knowledge on housing design as an essential component of a collective commitment to contribute solutions to the global challenges of urbanisation.

The Global Housing research group aims at consolidating housing design as a field of scientific research, developing empirical and experimental research designed to deliver outputs that can contribute to bridge the gap between science and practise. The group is particularly focused on research topics that address pressing societal challenges related with sustainable development in the global urban South. Exploring a diverse set of research outputs, from scholarly production, to exhibitions, to design workshops, to pilot projects, the group aims at developing further research methods that combine typological and ethnographic studies to investigate the relation between cross-cultural exchanges (e.g. typological transfers), housing governance, dwelling practices and protocols.

The Global Housing group establishes a strong link between architectural education and research. The members of the group have a strong participation in educational programs and are actively engaged in developing new educational tools and methods that address societal challenges related with the design and production of housing. Together with institutional partners from all over the world (and particularly educational organizations from the global urban South) the group pursues opportunities to develop synergies between design education and research.

Contact persons: Dick van Gameren, Nelson Mota, Frederique van Andel.

Architecture, Culture and Modernity

The main focus of this research group is the multiple ways architecture absorbed and reflected upon the conditions of modernity, including the rise of a mass society, new forms of (democratic) government systems, and concomitant issues of subject-formation, emancipation and citizens' empowerment.

The group collaborates closely with the Jaap Bakema Study Centre and Het Nieuwe Instituut in Rotterdam. This collaboration leads to an interest in questions of museology, in particular the way research and archives are connected and result in public presentations such as the phenomenon of the architecture exhibition.

Research interests:

- Long lines of developments of the larger modern era, with an emphasis on the twentieth century, and how they continue to impact the way we think, use and produce buildings and cities;
- Architecture discourse, its media and disciplinary institutions;
- How architecture embodies a multitude of traditions and epistemologies, through its development along various historical and geographical vectors;
- An understanding of architecture as embedded, cross- and transcultural;
- An interest in the ways, architecture operates within a multitude of societal forces;
- The study of historical case studies as precedents and paradigms of operative architectural knowledge.

The historical-theoretical dimensions of the research and the specific practice of discourse analysis brings a strong interest in archival and media studies and their methodologies, including the new field of digital humanities.

Contact persons: Dirk van den Heuvel, Jorge Mejía Hernández.

History: History of Architecture and Urbanism (formerly part of Design & History)

History as a reflective discipline shines its light on the past, present and future. The research group History of Architecture and Urbanism explores architectural and urban form and function from long-term development perspectives. It combines diverse methods of historical analysis (archival investigation, literature studies, interviews, field studies and mapping) and integrates big data to understand the role of the past in the formation of the present and the design of the future. Through research and teaching collaborations with practitioners and academics from other disciplines, we aim to use a historical perspective to both analyse the formation of the present and to identify and anticipate the fundamental issues of the near and distant future. We have thus focused on themes and methodologies that are dominant in the discourse of global 'grand challenges', such as Heritage, Digitalization, Climate Change, Equality Diversity and Inclusion, and Health. The group focuses on two major research themes:

Flows, nodes, and networks

In the past architecture and urban form have often been studied as fixities. We argue that nowadays the transformation of places and built form needs to acknowledge global systems, the need for a balanced understanding of all kinds of architecture and urban form. We study financial and commodity flows, the migration of people, and the exchange of expert knowledge as contributors to the production of the built environment and as architecture in itself. The North Sea is a key research focus, given its seminal role in international developments. Other themes include the global petroleumscape, port cities, financial centres, and the role of Handbooks in the exchange of ideas. Members of the Chair lead the LDE PortCityFutures research program.

People, places, and buildings

Buildings and cities are key elements in long-term societal change. Exploring diverse architectural representations notably from popular culture, including postcards, maps or toys, while also examining chairs and other objects that are not part of traditional sources, we expand the traditional approaches in architectural, urban and planning history. Topics also include questions of health, of heritage and sustainability or climate adaptation, and the issue of diversity and identity in the architectural profession. Members of the Chair are active in the LDE Center for Global Heritage and Development.

Contact person:
Carola Hein.

Theory: Ecologies of Architecture

The research group Ecologies of Architecture is primarily concerned with producing conceptual and process-based knowledge and insights on the relations of architecture and the (built and un-built) environment (milieu). It adopts a majorly neo-materialist perspective to architecture, understood both, as a philosophical, theoretical and discursive 'cluster', and as a core research methodology. From this perspective, we consider architecture as a cultural practice, and hence as a mechanism of culture, rather than merely its representation. The Ecologies of Architecture advances a transdisciplinary approach that rethinks subjectivity and ethics in terms of non-human forces within the human and explores the political ramifications of these processes for the discipline of architecture and beyond. In contrast to mainstream approaches, architecture is not seen as representative of culture, but as the very mechanism of culture.

The ethico-political ambition of the research group is to map the emergence of a new collective subject. The Ecologies of Architecture produces a cartography of urban, social, political and cultural developments that otherwise remain disassociated, fragmented and obscured. Crucially, its main hypothesis is that new values and modes of existence do not emerge out of an ideological nowhere and nowhen but as a result of entangled urban environments and emergent technicities.

The Ecologies of Architecture shelters two areas of investigation:

- Architecture and Libidinal Economy addresses the embodied, embedded, extended, enactive and affective approach to production, recording and consumption of affordances;
- Architecture and Political Economy critically analyses the manifold situatedness of a given (design) project, both in terms of physical attributes of the site at multiple scales and the complex conditions and factors operating through socio-political and economic forces.

Contact person:
Andrej Radman.

Methods: Architectural Pedagogy (in development)

The Chair of Methods & Analysis will foster the active participation of the Department of Architecture in the faculty ambitions to investigate innovation in education. It aims to take a stance for the particular character of architectural education, and to build upon the knowledge produced within the education of the department. If Delft is famous for its architectural education, it is time for the Department of Architecture to investigate if there is such a thing as the "Delft approach to architectural education". Which are the methodological and epistemological frames of reference of our pedagogical efforts? How does the diversity of positions within our department offer the invitation for students to develop their own position as responsible architectural thinkers and practitioners?

In order to make a plea- within the faculty as well as outside- for the importance of architectural thinking and making in education, the group will collect ongoing reflections and publications about the various studio's, and engage in discussion with the different chairs and studio's, to bring forward architectural pedagogy as a field of knowledge.

The following themes have been outlined:

- "Delft approach to architectural education" in collaboration with all chairs: studio reflections of teaching methods
- The critical moment of design invention: from analysis to design in the graduation studio creative imagination, design thinking
- The scientific ground of architectural pedagogy, architectural education as the production of knowledge

Contact persons:
Klaske Havik, Willemijn Wilms Floet.

Selected Output 2016-2018

Funded projects

One of our main goals in the past period was to substantially increase our external funding. Within the monthly meetings of the research group leaders, funding has been one of the fixed points on the agenda. Sharing successes and opportunities in these meetings has led to a high awareness of the need to actively participate in funding applications, and the exchange of experiences has helped to improve the quality of the proposals.
Four Marie-Curie post-doc projects have been obtained since 2016: (Armina Pilav “Evidencity” 2016-2018, Nancy Couling “Urbanization of the ocean.” 2017, Sandra Fatoric “How to Secure the Future of Cultural Heritage at Risk from Climate Change? Developing a Climate-Smart Adaptation Planning and its Prioritization Process in the Netherlands” (2019-2020) and Aleksandar Stanicic “Transurbicide” 2018-2019). A number of post-doc applications with different grant providers are currently in progress.
In the period 2016-2018, several staff members have obtained NWO Kiem grants (15-18 k€ each), which have allowed research staff to establish a project and make a step to larger funding applications. For instance, the 2016 KIEM grant for the Petroleumscape has led to the exhibition Oliedam: Rotterdam in the oil era 1862-today at Museum Rotterdam, based on research by Carola Hein, and the 2017 NWO KIEM grant for the Writingplace Journal for Architecture and Literature (Klaske Havik) resulted in a successful EU COST Action application in 2019. Other KIEM grants include: NWO KIEM Grant: Centralized to Decentralised: Understanding the Complexity of the Energy Transition in the Rotterdam/The Hague Area (2018), presented during a conference and exhibition on Energy and Decentralization. Another KIEM grant explored Performative Spaces in Dutch Public Libraries. Stepping Stones of Inclusive Innovation (Olindo Caso). In 2018, a NWO Matchmaking Grant was received for two symposia on 3D printing and scanning at Mauritshuis and TU Delft (Carola Hein, Uta Pottgiesser, Tino Mager).

Some major grants include:

Seramco: Secondary Raw Materials for Concrete pre-cast Products
European Regional Development Fund (±233.000, 2017-2020)
Programme Interreg | North-West Europe | European Regional Development Fund
Henri van Bennekom, Principal researcher

ArchiMediaL
Project for research into the automated recognition of buildings in historical images and the development of mixed-method strategies, Volkswagen Foundation.
Main Applicant: Carola Hein, Tino Mager, Seyran Khademi and Ronald Siebes as post-doctoral researchers
Participants: TU Delft (BK/EWI), VU Amsterdam, HCU Hamburg, University Essen-Duisburg;
450.000 Euro; http://archimedial.eu

Time Machine
Time Machine aims to develop the big data of the past, a huge distributed digital information system mapping the European social, cultural and geographical evolution across times. This large-scale digitisation and computing infrastructure will enable Europe to turn its long history, as well as its multilingualism and multiculturalism, into a living social and economic resource. Participant TU Delft (BK/EWI), Carola Hein, Tino Mager, Jan van Gemert, Alessandro Bozzon, Geert-Jan Houben, Jantien Stoter, Hugo Ledoux The Time Machine FET Flagship proposal and received a Horizon 2020 Fetflag GAP Grant (total amount: EUR 997.930).

The Urban Delta: A diachronic system approach to urban development, water, energy and food in the landscape of The Netherlands.
Heritage and landscape on the basis of a system approach in which not only the physical reality is important (the development of cities, water systems, infrastructure, and food and energy landscapes), but also the social reality (the systems of government and governance that determine the spatial structures and the relationships between city and country).

Budget 316.435 €
Participant TU Delft: Reinout Rutte

Port City Futures
Port City Futures explores these particularities of port city regions and proposes spatial planning and design measures for the use of this limited space so that the port and city (and region) can jointly evolve.The concept was presented at the Architecture Biennale in Venice in 2018 (portcityfutures.org). It has been discussed through a value deliberation process (https://mood.tbm.tudelft.nl/portcityfutures/welcome) and explored with international and local participants during a major conference 17-19 December 2018.
Grant awarded: 100.000€
Participants: Carola Hein, Tino Mager

Making space: Tools, methods and strategies for the design of affordable housing in emerging economies.
Funded by: Delft Global / TU Delft Global Research Fellowship, 4 Years 2016-2020
Grant awarded: 160.000€
Participants: Anteneh Tola, Dick van Gameren, Nelson Mota

Delft Education Fellowship
Funded by: TU Delft, 2017-2018
Main Applicant: Dick van Gameren
Duration: 2 Years Grant awarded: 50.000€

Dwelling in Addis Ababa: A Toolbox for Design Education on Affordable Housing.Funded by: Delft Global Initiative Program Development Seed Fund
Grant awarded: 30.000€
Duration: 6 months
Participants: Dick van Gameren, Nelson Mota

Addis Ababa Living Lab: Creating Resilient Dwelling Clusters for Urban Resettlement in Addis Ababa, Ethiopia [2ALL].
Funded by: NWO / WOTRO; Joint SDG research programme "Tackling Global Challenges through Use-Inspired Research"

Grant Awarded: €500,000
Duration: 4 Years
Principal Researcher: Prof. Dr. Marja Elsinga (Department MBE).
Members of the Department of Architecture (Global Housing group) involved: Dick van Gameren, Nelson Mota, Frederique van Andel, Anteneh Tola, Brook Haileselassie

Architecture and Urbanism, addressing the social space in the 21st century: segregation strategies and appropriation tactics
Funded by: State of São Paulo Research Foundation [FAPESP].
Grant Awarded: €200,000
Duration: 5 Years (2017-2021)
Responsible Researcher: Leandro Medrano (FAUUSP).
Member of the Department of Architecture involved: Nelson Mota

EU COST Writing Urban Places
European network grant (±600.000 euro over a period of 4 years 2019-2023), to establish an international, interdisciplinary network on New Narratives for the European City.
Klaske Havik, Main applicant and Action Chair)

Marie Curie ITN Tack
European grant (±267.000 euro in 2019-2023 for TU Delft as partner), to establish an international, PhD network on Tacit Knowledge with 10 universities, with ETH as leading partner. One PhD position at TU Delft starting March 2020.
Project partner TU Delft: Klaske Havik

Securing Democratic Society; State Policies, Technological Surveillance and Spatial (Cross-) Boundary Practices'. Gerda Henkel Stiftung
The Gerda Henkel grant is intended for financing 2 PhD-candidates for 2 years. Co-funded by: Gerda Henkel Stiftung, 2018-2022 Grant awarded: € 73.650,- plus € 24.000 = € 97.650
Project leader: Marc Schoonderbeek, Border&Territories research group. Participants: Marc Schoonderbeek (lead) John Hanna, Grazia Tona (PhD candidates)
Oscar Rommens,Guillaume Guerrier (external researcher)

Role of Stations in Future Metropolitan Areas
TU Delft/DIMI/AMS. 2017-2018 E 87.500 in total for the Department of Architecture. Project leaders: Roberto Cavallo & Manuela Triggianese

Richard Rogers Fellowship
from GSD Harvard University for Dirk van den Heuvel

Stad van de Toekomst
Consortium TU Delft/DIMI/BNA/Dutch Ministry I&W. 2017-2018 E 57.500 in total for the Department of Architecture.
Project leader: Roberto Cavallo

Campus Development Delft/Eindhoven
Collaboration with Fac. of Architecture, TU Eindhoven. 2017, E. 25.000 of FMVG TU Delft for the Department of Architecture.
Project leader: Esther Gramsbergen

Highway & City
Consortium TU Delft/DIMI/BNA/Dutch Ministry I&W E 20.000 in total for the Department of Architecture. Project leader: Roberto Cavallo

Amsterdam 2050 Urban makeover
Consortium TU Delft/AMS INSTITUTE 2016-2018
E 72.500 in total for the Department of Architecture.
Project leaders: Kees Kaan, Manuela Triggianese

Books

Avermaete, T., and Gosseye, J. (eds) Shopping Towns Europe: Commercial Collectivity and the Architecture of the Shopping Centre, 1945-1975. (New York: Bloomsbury Academic, 2017) p. 110-121

Havik, K., Mejia Hernandez, J, Oliveira, S. (et al, eds) Writingplace. Investigations in Architecture and Literature. (Rotterdam: NAi010 Publishers, 2016)

Hein, C. (ed.) The Routledge Handbook of Planning History (New York: Routledge 2018), Winner of the 2018 IPHS Special Book Prize

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Heuvel, D. van den: Jaap Bakema and the Open Society (2018), with an international lecture tour including Venice, Melbourne, Sydney, New York, St.Louis, Berlin, Prague, Zagreb, Tel Aviv, Paris, Barcelona, Valencia, Liège, Amsterdam

Leonardo Zuccaro MArchi: The Heart of the City: Legacy and Complexity of a Modern Design Idea (Abingdon/New York: Routledge - Taylor & Francis Group 2018)

Mager, Tino (Editor) ; Trötschel-Daniels, Bianka (Editor). / BetonSalon : Neue Positionen zur Architektur der späten Moderne . Berlin : Neofelis, 2017. 281 p.

Mager, Tino. / Schillernde Unschärfe : Der Begriff der Authentizität im architektonischen Erbe. Walter de Gruyter GmbH, 2016. 272p.

Pimlott, Mark, The Public Interior as Idea and Project, Heijningen: Jap Sam Books.2016

Radman, A. and H. Sohn, eds., Critical and Clinical Cartographies: Architecture, Robotics, Medicine, Philosophy (Edinburgh: Edinburgh University Press, 2017). <ISBN 978-1-4744-2111-9>

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Rutte, R. B. Bouwens, J. Dankers, Y. van Mil, K. Sluyterman & J. Verheul, Driven by Steel. From Hoogovens to Tata Steel 1918-2018, Thoth, Bussum, 2018.

Triggianese, M., Cavallo, R., Baron, N. & Kuijper, J., (eds.) (2018), Stations as Nodes: Exploring the role of stations in future metropolitan areas from a French and Dutch perspective. Delft: TU Delft Open

Van Andel, F., D. van Gameren, D., A. de Vrede, Yearbook of the Department of Architecture 2016: Contributions from Education, Research and Practice (Delft: Delft University of Technology, 2016)

van Bergeijk, Herman. / Als bloemen bloeien achter stranden : Droom en werkelijkheid in de glazen stad. Atlas van het Westland: 10.000 jaar ruimtelijke planning. editor / M. IJsselstijn ; Y. van Mil. THOTH, 2016. pp. 161

van Bergeijk, Herman. / Jan Duiker, bouwkundig ingenieur (1890-1935) : Van warm naar koud. Nijmegen : Uitgeverij Vantilt, 2016. 320 p.

Van Gameren, D.E., and R. Varma, Living Ideals, designs for housing by Charles Correa, (Goa: Charles Correa Foundation, 2018).

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Heuvel, D. van den, 'Architecture and democracy: Contestations in and of the open society' , Jaap Bakema and the Open Society. van den Heuvel, D. (ed.). Amsterdam: Archis, p. 240-257

Koning, D de 'The City as a Project–The Farm as a Hobby', in: Utopia and the Project for the City and Territory.

Lacanna, Giuseppe ; Wagenaar, Cor ; Avermaete, Tom ; Swami, Viren. / Evaluating the Psychosocial Impact of Indoor Public Spaces in Complex Healthcare Settings. In: HERD: Health Environments Research and Design Journal. 2018.

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Mota, Nelson, "Dwelling in the Middle Landscape: Rethinking the Architecture of Rural Communities at CIAM 10" in Re-Humanizing Architecture: New Forms of Community, 1950-1970, Ákos Moravánszky and Judith Hopfengärtner, eds (Zürich: Birkhäuser, 2017), 311-324.

Pimlott, M. 'Interior, ideology and alternatives for the public interior', in: P. Atmodiwirjo, Y.A. Yatmo(eds) The stories of interior: Multiple Perspectives on Interiority, Proceedings [In]Arch International Conference 2018, Universitas Indonesia, 15-16

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A Stanicic, A 'The memory in the bodily and architectural making: Reflections from embodied cognitive science', in: Affective Architectures: More-than-Representational Approaches to Heritage.

Tesfaye Tola, A., "Coen Beeker's 'Urban Fields' for Addis Ababa," in Folkers, A., and Perzyna, I. (eds.), The Beeker Method: Planning and Working on the Redevelopment of the African City, Leiden, African Studies Centre Leiden, 2017, pp. 109–22.

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van Bergeijk, Herman. / The free bird and its cages : Dutch architectural journals in the first decade after the Second World War. Modernism and the PROFESSIONAL Architecture Journal: Reporting, Editing and Reconstructing in Postwar Europe. editor / Torsten Schmiedeknecht ; Andrew Peckham. Routledge - Taylor & Francis Group, 2018. pp. 56-75

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Bandeirinha J.A., L.M. Correia and N. Mota, eds. "Ideas and Practices for the European City", Joelho. Journal of Architectural Culture, 8 (December 2017), Coimbra: EDARQ.

Bulletin KNOB: Koninklijke Nederlandse Oudheidkundige Bond (Journal) Marie-Therese van Thoor (Editor), Reinout Rutte (Editor)

Engel, H., Gramsbergen, E., Pane', I., Diesfeldt, O., Hoeks, H., Rutte, R. (eds.) (2017). OverHolland 18/19. Architectural studies for Dutch Cities. Nijmegen, NL (Vantilt Publishers)

FOOTPRINT # 18: Constellation of Awakening: Benjamin and Architecture (Delft: Architecture Theory Chair in partnership with Stichting Footprint and Jap Sam Books, 2016). Healy, P. and A. Radman, eds.

FOOTPRINT # 21: Trans-Bodies / Queering Spaces, (Autumn / Winter 2017). Gorny, R., and D. van den Heuvel, eds.

FOOTPRINT # 22: Exploring Architectural Form: A Configurative Triad Kousoulas, S. and J. Mejía Hernández, eds., (Spring/ Summer 2018).

FOOTPRINT #19 'Spaces of Conflict', (M Schoonderbeek ed.)

FOOTPRINT #23 'The Architecture of Logistics', (N Sanaan Bensi ed.)

Journal of Creative Practices in Cities and Landscapes, Journal (co-editor : Carola Hein), Issue 0

OASE #101 Microkosmos: Een zoektocht naar de stad in haar interieurs Grafe, C. (ed.), Mandias, S. (ed.), Rosbottom, D. (ed.), Grootveld, M. & Schreurs, E., (Rotterdam: Nai010 publishers, 2018)

OASE #97 Action and Reaction in Architecture. Avermaete, T., Van Gerrewey, C. & Patteeuw, V. (eds.). (Rotterdam: Nai010 publishers, 2016)

OASE #98 Narrating Urban Landscapes Havik, K., Notteboom B, and de Wit, S. (eds) (Rotterdam: Nai010 2017)

Planning Perspectives, Journal of the International Planning History Society. (IPHS Section Editor: Carola Hein)

Simiolus: Netherlands quarterly for the history of art (Journal) Everhard Korthals Altes (Editor)

van Bergeijk, Herman (Editor). / Eigenbouwer : Tijdschrift voor de goede smaak. In: Eigenbouwer : tijdschrift voor de goede smaak. 2017 ; No. 8.

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Writingplace Journal for Architecture and Literature #1 Literary Methods in Architectural Education. K. Havik, M. Proosten, D. Perrotoni (eds), (Rotterdam: Nai010, 2018)

Writingplace Journal for Architecture and Literature #2 Inscription: Tracing Place: History and Memory in Architectural and Literary Practice . K. Havik, S. Oliveira, J. Voorthuis and N. Weenink (eds), (Rotterdam: Nai010, 2018)

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Cavallo, R., Komossa, S., Gadet, J. (2016) Triumph of Parks: how socio-economic dynamics change urban green. Journal Urban Design and Planning, art. nr. 1400033 (pp 1-16).

Couling, Nancy: Carola Hein (2018) “Blankness: The Architectural Void of North Sea Energy Logistics,” Footprint 12.2. Autumn/ Winter, p. 87–104,

Gorny, R., “Reclaiming what Architecture Does: Toward an Ethology and Transformative Ethics of Material Arrangements”, Architecture Theory Review 22, no.2 (2018), 188–209.

Havik, K. “Writing Urban Atmospheres”, in Jonathan Charley (ed), Research Companion to Architecture, Literature and the City, (London: Routledge, 2018) 270-282

Havik, K., “How Places Speak: A Plea for Poetic Receptivity in Architectural Research” in: Angeliki Sioli and Yoonchun Jung, Reading Architecture: Literary Imagination and Architectural Experience, (London: Routledge, 2018) 61-71

Hein, Carola (2016) “Port Cities and Urban Waterfronts: How Localized Planning Ignores Water as Connector,” Wires Water, 3:3: 419-438

Hein, Carola (2017) “The Urban Core in Japan (1930s-1950s): From Plans for the Colonies to the Mainland” Histories of Postwar Architecture, n. 1

Hein, Carola (2018) “Oil Spaces: The Global Petroleumscape in the Rotterdam/The Hague area” The Journal of Urban History.

Hein, Carola and Elise van Dooren on “Teaching History for Design at TU Delft: Exploring types of student learning and perceived relevance of history for the architecture profession.” In: International Journal of Technology and Design Education, 1-17,

Korthals Altes, Everhard. / International rivalry at the auction of Willem Lormier’s paintings in 1763: James Lowther, 1st Earl of Lonsdale, and August III, Elector of Saxony and King of Poland. In: Simiolus: Netherlands quarterly for the history of art. 2016 ; Vol. 38, No. 4. pp. 273-288.

Korthals Altes, Everhard. / Looking for patterns in collecting : Schalcken in the eighteenth century. Wallraff-Richartz-Jahrbuch. Vol. 77 2016. pp. 177-186

Kousoulas, S., “Non-Correlational Athens” in Architectural and Urban Reflections after Deleuze and Guattari, eds. C. Boundas and V. Tentokali, (London: Rowman & Littlefield, 2017), 139–152.

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Mota, N., and D.E. van Gameren, “Affordable housing and sustainable development: a tale of two systems”, in World Architecture Festival 2016, supplement of The Architectural Review, no. 1430, April 2016.

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Radman, A., “Ecologies of Architecture” in Posthuman Glossary, eds. R. Braidotti and M. Hlavajova (London: Bloomsbury Academic, 2018), 117–120.

Rooij, R., Klaassen, R., Cavallo, R. & Arts, J. A., (2019). ‘Architecture and built environment design education: disciplinary and pedagogical developments’. In: International Journal of Technology and Design Education. p. 1-12.

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Schwake, Gabriel. / Post-traumatic urbanism : Repressing Manshiya and Wadi Salib. In: Cities: the international journal of urban policy and planning. 2018 ; Vol. 75. pp. 50-58.

Sedighi, S.M.A. “Megastructure Reloaded: A New Technocratic Approach to Housing Development in Ekbatan, Tehran.” ARENA Journal of Architectural Research 3, no.1 (2018): 2-36.

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Sun, Yanchen, Carola Hein, Kun Song (2017 online/2019), “Planning of Public Housing in Modern Tianjin (1928-1945)” Planning Perspectives, 34:3. June, p. 438-462 .

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Dissertations

Jurgenhake, Birgit, De gevel - een intermediair element tussen buiten en binnen: Over het tonen en vertonen van het twintigste -eeuwse woongebouw in Nederland (TU Delft: Phd Dissertation, 2016).

Teerds, Hans, At Home in the World: Architecture, the Public and the Writings of Hannah Arendt (TU Delft: Phd Dissertation 2017).

Doron, Gil Mualem, The “Dead Zone’ and the Architecture of Transgression (TU Delft: Phd Dissertation, 2018).

Sanaan Bensi, Negar, An Inhabitable Infrastructure: Rethinking the Architecture of the Bazaar (TU Delft: Phd Dissertation, 2018).

Mejía Hernández, Jorge, Transactions; or Architecture as a System of Research Programs (TU Delft: Phd Dissertation 2018).

Brigitte Hansen, Architectural thinking in practice: A qualitative study of architectural practice seen from the view point of a reflective practitioner (TU Delft: Phd Dissertation 2018).

Exhibitions

City as Architecture – Architecture as City, Imminent Commons.
Exposition at the Seoul Biennale of Architecture and Urbanism 2017, Seoul (South Korea), Roberto Cavallo with Maurice Harteveld, Steven Steenbruggen and Valentina Ciccotosto 2017.

Building on Ideas: Charles Correa’s Built & Un-built Designs for Housing
Exhibition curated by Dick van Gameren and Rohan Varma, held at TU Delft - Faculty of Architecture (The Netherlands, June 2017), followed by the traveling exhibition “Living Ideals: Designs for Housing by Charles Correa” in Mumbai (February 2018), Kolkata (June 2018), Pangim (September 2018), and Ahmedabad (November 2018).

The Global Petroleumscape
Exhibition for Museum Rotterdam, curated by Carola Hein and Seyed Mohamad Ali Sedighi, shown at BK Expo with additional elements and curators: Paolo de Martino, Elmira Jafari, and Erfan Farahmand, also held at University of Groningen, University of Leiden, and TU Dresden (2018).

Global Housing: Affordable Dwellings for Growing Cities
Exhibition curated by Frederique van Andel and Dick van Gameren, held at BK Expo, Faculty of Architecture, TU Delft, (21 March – 6 April 2016) and Gallery of the National Theatre Addis Ababa, Ethiopia, (15 –28 November 2017).

Un-War Space, A Pilav (Marie Curie)
BK-booth exhibition at Venice Biennale 2018.

Tools of the Architect: Drawing, Modeling, Writing
Willemijn Wilms Floet, Tom Avermaete, Klaske Havik, Jorge Mejia Hernandez, BK-booth exhibition at Venice Biennale 2018.

Moonwalk Mapping
G Guerrier, O Rommens & M Schoonderbeek, in the ‘Skizzieren, Zeichnen, Skripten, Modellieren: Artefakte des Entwerfens und ihre Wissenspraktiken’, Architekturmuseum TU Berlin, November-December 2017.

Habitat, Expanding Architecture
Dirk van den Heuvel (Rotterdam: HNI, 2018)

Architectural Collective Enunciation: A Question of Forming Relays
Exhibition (02-23/04/2018) Architecture Theory Chair, TU Delft.

Achttiende-eeuws Nederland in beeld : Prenten uit De Tegenwoordige Staat en Het Verheerlijkt Nederland.
Korthals Altes, Everhard (History of Architecture and Urban Planning).

Cities of the North Sea: Antwerp, Amsterdam, London.
Korthals Altes, Everhard / (History of Architecture and Urban Planning).

From Architectural Ethnography to Planning; Kon Wajiro and Nishiyama Uzo’s participatory research of everyday space in Japan from the 1910s to 1970s
Exhibition TU Delft and Yokohama at (3.2018).

Rise of a campus
Exposition at Aula building TU Delft from 01-12-2017 till 30-06-2018, a collaboration with TU Delft Library, (projectleaders Jules Schoonman and Abel Streefland), Delft (NL), Esther Gramsbergen, Otto Diesfeldt and Iskandar Pané.

Conferences/ Symposiums / Colloquia

EAAE Annual Conference 2016: For example Delft.
A Case Study discussed in the Context of Institutional Profile(s) and the Future of Architectural Education. Roberto Cavallo in collaboration with Susanne Komossa and Maurice Harteveld.

The Irritant Principle of Renewal: Celebrating 100 Years of Aldo and Hennie van Eyck
TU Delft / Het Nieuwe Instituut Rotterdam 2018, Dirk van den Heuvel

The Tools of the Architect. EAHN Conference,
TU Delft and HNI, EAHN 2017 Conference "The Tools of the Architect" - Delft and Rotterdam, Netherlands, Main organiser Tom Avermaete, 22 Nov 2017 - 24 Nov 2017

Affordable Housing Design: Histories of Cross-Cultural Practices
Session chaired by Nelson Mota and Dick van Gameren, at the Society of Architectural Historians 2018 Annual International Conference, 18–22 April 2018, Saint Paul, Minnesota, USA.

Second Life: Modern Housing and the Aesthetics of Growth and Change
Session chaired by Dirk van den Heuvel and Nelson Mota at the 14th International Docomomo Conference, 6-9 September 2016, Lisbon, Portugal.

Housing and the Grassroots. Rethinking Production and Agency in the Architecture of Dwelling
Session chaired by Tom Avermaete and Nelson Mota, at the 4th International Meeting EAHN, 2-4 June 2016, Dublin, Ireland.

Externalizing rationalities: Infrastructure between Datum and Assemblage
Borders & Territories panel at 'SCAFFOLDS; Open Encounters with Society, Art and Architecture', International Symposium, 22-23 November 2018, Brussels.

The Post-Digital: Contradictions in Drawing / Complexities in mapping
Colloquium organised by 'Borders & Territories', TU Delft, September 2016

Mapping the Gesture in Architecture, CRTGRPHS 3
Seminar and round-table discussion with Frans Sturkenboom (Eindhoven University of Technology) and Sjoerd van Tuinen (Erasmus University Rotterdam), TU Delft (07/06/2018).

Mapping Sonic Space, CRTGRPHS 2
Seminar and round-table discussion with Hillel Schwartz (independent scholar), Marcel Cobussen (Leiden University) and Raviv Ganchrow (Royal Conservatoire The Hague); moderated by Taufan Ter Weel, TU Delft (07/12/2017).

Southopolis: Urban development game
Workshop organized by Nelson Mota and Ana Rosa Chagas Cavalcanti for Dutch Culture: "Visitors Programme Heritage – Liveable Historical Cities", 11 October 2017, Het Nieuwe Instituut, Rotterdam, The Netherlands.

Port City Futures
Conference organized by Carola Hein and Tino Mager for the LDE Centre Metropolis and Mainport in Rotterdam/Delft 17-19 December 2018

Viscous Space
Conference TU Delft, organized by Nancy Couling and Carola Hein, 20.-22.6.2018

ICOMOS/TU Delft Workshop on Water and Heritage for the Future
Workshop organized by Carola Hein on behalf of the Center for Global Heritage and Development held at TU Delft and Fort Fechten, 25-26.11/16

17th International Planning History Society (IPHS) conference at TU Delft
Convener: Carola Hein, 17-21 2016

The Global Petroleumscape
Workshop at TU Delft, 5.2017 Convener Carola Hein

4 – **Links with faculty-wide and TU Delft initiatives**

One of the recommendations of the 2016 report was Further strengthening of collaboration (defining research topics) across departments. The new research structure provides links to faculty wide programmes in different ways.

The programme on Architectural Pedagogy will represent the Department of Architecture in the faculty ambitions to investigate innovation in education. The research group Ecologies of Architecture will challenge the predominant reductionist conceptions of ecology. The transversal approach, as advanced by the Theory Chair, provides a way to overcome techno-determinism without regressing to relativism, and vice versa.

The Chair of History of Architecture and Urban Planning participated in the past period in the cross-departmental research programme Design and History and has continued this collaboration. The Chair worked with the Department AE&T and colleagues in other TU Delft faculties (3ME, EWI) through NWO and 4TU Lighthouse grants, exploring 3D scanning and 3D printing for paintings on curved surfaces at the building scale. Together with ICOMOS NL we have spearheaded research on adaptive strategies for water heritage that will be published in two volumes, one with Springer and one as a special issue of the European Journal of Creative Practices and Landscapes (CPCL).

Within the thematic research groups, collaboration with other departments is encouraged, particularly in terms of funding applications. While we have a long history of collaboration with Urbanism, recently more collaborations with other departments have been initiated. For instance, the research group Global Housing is now actively collaborating with the Department of MBE, both within a NWO-funded research project and within the cross-departmental programme 1 Million Homes.

In addition the department has ongoing collaboration with the AMS Institute in Amsterdam and with two DRIs, TU Delft Health Initiative via the History group (contact person: Cor Wagenaar) and DIMI, the Delft Deltas, Infrastructures & Mobility Initiative (contact persons: Roberto Cavallo and Manuela Triggianese)

5 – **Major research collaborations**

Although many of our research staff already collaborate with partners in academia and practice both in the Netherlands and internationally, our ambition has been, following the recommendation of the assessment committee in 2016, to extend and strengthen the international research collaboration, as well as to use our networks to obtain external funding, and vice versa, to find external funding to solidify and extend our international networks. During the process of formulating the new research groups, two main questions posed to all (potential) research groups were about the formulation of a funding strategy and about the perspectives on international collaboration.

On the level of the university, we are actively participating in the DIMI/AMS Projects Role of Stations in Future Metropolitan Areas and and Stad van de Toekomst (City of the Future), in which we collaborate with the faculty of CiTG, the ministry of Infrastructure and Water Management, the BNA (Royal Institute of Dutch Architects), the Deltametropolis Association and the most important Dutch municipalities. In addition, with the AMSTERDAM 2050 urban makeover strategic project, strongly connected to education, the Department of Architecture teamed up with the municipality of Amsterdam and AMS Institute, a collaboration between Delft University of Technology, Wageningen University & MIT Boston. This project included a Post-Doc and a research assistant position. Our intention is to strengthen this collaboration. We are also setting up the collaboration with our colleagues of the faculty of Industrial Design, particularly in our investigations in Design education (Architectural Pedagogy), as they have valuable expertise in methods of design thinking in education.

On a national level, we have solidified our collaboration with the Jaap Bakema Study Centre and Het Nieuwe Instituut in Rotterdam, which holds the national archive of architecture and urbanism, particularly through our new thematic research group Architecture, Culture and Modernity. This group initiated a special PhD-programme Architecture and Democracy, together with the Jaap Bakema Study Centre and Het Nieuwe Instituut.

Besides being involved in many research projects beyond the Faculty, in correspondence with our topics, we are also engaged in maintaining a healthy relationship with institutions that can promote our research, such as the TU Library, with whom we have made several exhibitions. Charlotte van Wijk will join the TU Library team temporarily to curate an exhibition that will open in March 2020 in the Delft Tetar van Elven Museum.

Further, we have established closer links to the LDE (Leiden-Delft-Erasmus) research initiatives. The group of History is currently leading the LDE programme on Port City Futures which will offer PhD positions in Delft, Leiden and Rotterdam. Also, members of the History group are connected to the LDE Center for Global Heritage and Development (CGHD) and lead the Heritage and Environment section.

On an international level, staff members are active in the Architectural Research Network ARENA, participating in their conferences and board meetings. Thereby, we have been able to obtain substantial funding in the past period. Some of these grants are precisely about establishing research networks, such as the recently obtained COST Action Writing Urban Places and the Marie Curie ITN PhD Training network with ten European universities.

6 – **Relation to Education**

The Department of Architecture has a large task in architectural education. Each year, over 400 Master students enter the Msc Architecture programme. This means that most of the research staff also plays a role in education, and that in many cases, research and education mutually influence each other. Graduation studios serve as laboratories for research and design, while the work of researchers is tested and developed through education.
Staff members regularly publish about their pedagogical approaches and studio results, while excellent graduation project receive national and international prizes such as the Archiprix award. Staff members are active in the European Association for Architectural Education (EAAE), participating in their conferences and boards.

Students have to learn about and practices their academic skills. A recent pilot survey led by the History Chair explored how students relate to teaching, and the impact of history on design more generally. Students overwhelmingly agree with us on the relevance of history for design and for their education in general. This survey and its analysis has since been pub-lished as a research paper by Carola Hein and Elise van Dooren on “Teaching History for Design at TU Delft: Exploring types of student learning and perceived relevance of history for the architecture profession.”

In the coming period, as part of the new research structure, we aim develop a collective strategy regarding our research related to education.

7 – **PhD research**

One of the ambitions of the Department is to ensure a high level of incoming PhD's and Post-docs, and to offer a solid base for their research trajectory. This means, we are working on improving the procedures of PhD applications, and we aim to offer a more solid structure for the guidance of research by embedding them in the research groups, offering more catered Graduate School courses and offering peer review colloquia with external guests on the level of the Department.

PhD Application Policy

The Architecture Department accepts PhD application are relevant to the discipline of architecture—understood here to include interior architecture, urbanism and planning, and landscapes design, and that have a clear relation to ongoing research at the Department.

A template is provided for all PhD application, so that applications are comparable, and will all address issues such as the research problematique, the structure and methodology, and the frame of reference.

Applications submitted on the relevant form are discussed in the Research Committee of the Department. They will be evaluated on their relevance to the research topics within the department and on the researchers ability to be methodologically sound, show knowledge of appropriate historical, methodological and theoretical perspectives. Also the level of English writing is taken into account.

Applications to and acceptance of PhD students can take different forms and will follow specific steps depending on how closely they are aligned with established research programs and the departmental parts of Crossover and LDE research programs that members of the Department of Architecture participate in. For instance, research groups can propose a call for PhD applications, to seek for PhD candidates working in their line of research. The Architecture Department's Research Committee will assess or help assess these applications (during meetings or by email). We have recently specified the procedures for incoming PhD applications.

PhD guidance

The Department of Architecture offers multiple of layers of discussion and guidance of research. The primary supervision responsibilities are carried by the main supervisor team (promotor and daily supervisor). At the secondary level, the research groups offer peer-to peer discussions, and allow the research to be related to other ongoing projects. The third level consists of peer-review colloquia, which are organized multiple times a year. Each PhD candidate is required to participate in at least two peer-review colloquia, namely one after the first year of research (outline presentation) and one after approximately 2.5 years (chapter presentation). Another level of guidance takes place at the Graduate school, for which the Department aims to develop a number of course more specifically geared toward researchers in the field of architecture.

Graduate school courses

In line with the enhancement of PhD guidance, the Department has identified the need for PhD candidates in architecture to receive of more tailored PhD courses for the Graduate school. The "discursive" chairs of the Department, Theory, History and Methods have commited to the development of foundational PhD courses for research in architecture.

Ideally, the department would offer:

Year 1

- ABE900 Research design (compulsory, together with other departments)
- ABE020 Skills course for Architectural research: Monthly meetings for 1st year PhD candidates, organized by H/T/M
- ABE021 PhD course on Architectural Research Methods (in development, will be offered spring 2020)

Year 2/3

- ABE008 Advanced Theory course
- Advanced Research Methods Course (in development)
- ABE016 Advanced Architectural History Course (History of Architecture and Urban Planning), such as: Topics in global flows and dynamic landscapes: Port Cities between global networks and local transformations
- Thematically focused seminars by the research groups
- ABE012 Architecture and the Built Environment in Different Cultures.

8 – **SWOT analysis**

Strenghts

One of the greatest strengths of the department is the diversity, energy and enthusiasm of its research staff. This has endowed us with a strong innovative capacity and the ability to explore beyond the established boundaries of research and the structure of the chair groups. In addition, there are a great number of foreign students at the master's level, most of whom chose to study at Delft because of the international reputation of Dutch architecture. The research programme resonates with this diversity, energy and reputation. The centrality of the "Architectural Project" within the research programme ensures the productive linkage between fundamental and applied research, theory and architectural practice. The output of our research is very well known and well received in the professional field; our staff's publications are well read and known by Dutch and international architects and architectural researchers; and our research staff's debates, exhibitions and lectures are widely attended and receive a good deal of media coverage. The research programme offers both focus and flexibility through its clearly formulated programme and the diversity of the topics and approaches of its research groups. The department has an excellent reputation and a unique international position in design research, understood as a field of inquiry into a wide range of issues related to architectural design practice. Researchers of our programme are invited to give lectures, take up guest professorships, and participate in conferences and international events all over the world. The department's international orientation has pro-moted intellectual exchange. Members of the research staff are active in both formal and informal international networks.

Weaknesses

A significant weakness is the difficulty in acquiring external funding. The programme at the moment is mainly dependent on direct government funding. This poses a threat to the viability of research, particularly in the light of current budget constraints.

In the period 2016-2018, we have made a big effort to increase our success in reserach funding, with some rate of success. More staff members are actively engaged in funding applications, while collaborations with other departments inside the faculty as well as with external partners also helped to gain more funding as project partners.

In the logic of funding applications, the humanities, the applied sciences and the social & behavioural sciences are generally treated as separate areas. Although architecture shares characteristics with all of these areas, there is no perfect fit with any of them. This position "in between" categories, although challenging and productive, also has its drawback in the scientific rating of our research output. In the field of architecture, high-rated scientific journals are scarce, and even though our staff publish in peer-reviewed journals with high reputations, the scientific rating of these is simply different from that of the natural sciences.

We have continued our efforts in scientific publishing, while cherishing the other forms of output that we believe are crucial to play a role in the international architectural debate: exhibitions, books and symposia, which actively reach out to the wider professional public.

Opportunities

There are also opportunities within the extensive master's programme that our department offers. We have many excellent master's students who could contribute more substantially to the research discussions and research output of the department. Many master's studios already have strong links to the topics and approaches of different research groups, while in the formulation

of educational assignments, the linkage to our collective research themes of the department could be stimulated.

We have made steps to collect the research output related to education, and have formulated the ambition to establish a stronger research line on architectural pedagogies, that on the one hand brings together already ongoing reflections on our education, and on the other hand further explored architectural pedagogy as a field of research itself. Here, we think we can learn from our colleagues at Industrial Design in Delft who have a strong pedigree in such reflections, predominantly in Design Thinking.

Threats

The main challenge in the coming years will be to create and maintain cohesion, without losing the energy generated by the personal efforts of individual researchers. In other words, we must guarantee a certain level of autonomy while encouraging greater collabo-ration and more exchange of ideas; this is the central task of the research programme. Further, the difficulty in obtaining funding to attract new researchers and to recruit new PhD and research staff from our own master's students is becoming a threat. The department is actively applying for research grants to accommodate such candidates.

The recalibration of the research structure that took place after the 2016 assessment had the ambition to give new energy to the research group and to allow some promising research staff to take more responsibility in research coordination and funding application. With these goals in mind, the new structure focused on creating more group dynamics and exchange among researchers, and on improving the research culture of our department. In the new structure we hope to create interaction between the more general considerations of methods, history and theory, and the more specific concerns of each thematic group. This interaction sug-gests a kind of cross fertilization or collaboration. On the one hand, it offers researchers and staff a "home" within a certain group, and have the stability provided by the long term idea of investigating a particular theme with particular approaches. On the other, the inter-group dynamics would provide each researcher with input from other groups and from issues that the department is putting forward.

9 – **Research projects Architecture**

Constructing the Commons

Duration
09-2016 > 07-2018

TU Delft researchers
Prof.dr. Tom Avermaete
Dr. Hans Teerds
Dr. Willemijn Wilms Floet
Dr. Jorge Mejía Hernández
Dr. Klaske Havik
Oscar Andrade Castro

Project partners
Atelier Bow-Wow - Momoyo Kaijima and Yoshiharu Tsukamoto
[Visiting Professors]

Contact person
Dr. Jorge Mejía Hernández
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アトリエ・ワン
Atelier Bow-Wow

'Commons' exhibition and conference, Bogota and Delft

'Constructing the Commons' reflects upon the contemporary practices of architecture and urban design by probing into the figure and project of the commons. The term 'commons' today is widely and extensively discussed within economic, social, and political theory, as well as within the creative industries. Historically it refers to natural resources that we, the people, have in common. The project aims to reflect upon the multiple challenges that the commons pose today to the fields of architecture and urbanism.

The project included a series of workshops, research seminars and educational projects, organized in cooperation with visiting professors of Atelier Bow-Wow. The conference 'Constructing the Commons' on March 3rd and 4th 2016 brought together renowned academics and designers. Two exhibitions were held, one in Delft alongside the conference, and one in Bogotá, Colombia, presenting the work of the graduation studio on the topic.

Further information
http://constructingthecommons.com/event/the-second-event/

Project for the urban redevelopment of the Menen neighbourhood, Addis Ababa (figure: Arianna Fornasiero and Paolo Turconi, 2017

Addis Ababa Living Lab

Creating Resilient Dwelling Clusters for Urban Resettlement in Addis Ababa, Ethiopia

Acronym
2ALL

Funder | Programme [grant number]
Netherlands Organisation for Scientific Research (NWO) | *WOTRO Science for Global Development* [grant W 07.3O318.011]

Overall budget
€ 500.000

Grant amount
Total: € 250.000
TU Delft: € 250.000

Role TU Delft
Lead partner

Duration
03-2019 > 03-2023

TU Delft researchers
Prof.dr.ir. Marja Elsinga
Prof.ir. Dick van Gameren
Dr. Henk Jonkers
Dr. Nelson Mota
Brook Teklehaimanot
Anteneh Tesfaye Tola
Ir. Frederique van Andel

Project partners
Addis Ababa University: Ethiopian Institute of Architecture Building Construction and City Development - EiABC [Dr. Elias Yitbarek Alemayehu and Yonas Alemayehu Soressa]
RAAS Architects, Addis Ababa [Rahel Shawl Zelleke]
FDRE Federal Housing Corporation - FHC [Zekarias Sebsbie]
FDRE Ministry of Urban Development and Housing - MoUDH [Tsegaye Moshe]
Addis Ababa City: Housing Development and Administration Office - AAC-HDAO [Senait Damtew]
Mission for Community Development Program - MCDP, [Mulu Haile]
UN HABITAT, [Ir. Rogier van den Berg]
Delft University of Technology: Faculty of Civil Engineering and Geosciences, TUD-CiTG, [Dr.ir. Edo Abraham and Dr. Henk Jonkers]
Erasmus University/ IHS, Rotterdam [Dr. Maartje van Eerd]

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Yeka Abado condominium site. View of newly developed housing blocks, constructed on greenfields distant 20 Km from Addis Ababa city centre. November 2016 (photo: Nelson Mota)

Since 2002, Addis Ababa's urban resettlement programme has primarily focused on short-term efficiency (speed and affordability), which resulted in housing policies and design-decisions that have produced problematic living conditions. Development induced resettlement demands a holistic approach based on an understanding of patterns of inhabitation and processes of community engagement. This is challenging, because of the shortage of socio-spatial analyses, and lack of actionable information that can be adopted by local actors. The main goal of the project "Addis Ababa Living Lab" is to improve the livelihood of Addis Ababa's urban dwellers using transdisciplinary approaches of analysis, planning and design. Accurate understanding of social, economic and technological needs and enhanced community participation is crucial.

To achieve this goal, a contextually new co-creation model will be used – engaging a local university (EiABC), government agencies (i.e. Federal Housing Corporation), an NGO, local and international design and planning practitioners, and a local dwellers' community. The research will use tools and methods such as geomatics and visual ethnography in site surveys, life-cycle-assessment (LCA) to quantify buildings' sustainability performance, and Societal Cost Benefit Assessment studies (SCBA).

Old and new housing settlements built on the banks of the Kechene river (Arada). November 2016 (photo: Nelson Mota)

This project will produce a policy paper, an actionable framework and build a pilot project on a test site as experiment and feedback loop. These research outputs will be used to impact decisions, for education and upscaling. The project positively contributes to several SDG's (sustainable cities, good health & well-being, education, clean water & sanitation, decent work & economic growth) and generates knowledge and tools to prevent negative feedbacks.

Further information
https://www.nwo.nl/onderzoek-en-resultaten/onderzoeksprojecten/i/89/33089.html

PortCityFutures

Funder | Programme [grant number]
LDE Metropolis and Mainport

Overall budget
€ 100.000

Role TU Delft
Project partner

Duration
01-2017 > 12-2018

TU Delft researchers
Prof.dr.ing. Carola Hein
Dr. Tino Mager

Project partners
Erasmus University, Rotterdam
Leiden University

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Source: PortCityFutures conference 17-19 December 2018; portcityfutures.org, Drawing by Flatland

Port City Futures started as an initiative of the LDE Centre for Metropolis and Mainport. The group focused on the evolving spatial use and design of port city regions over time, in particular addressing when port and city activities occur in the same places and sometimes conflict. The Port City Futures concept was presented at the Architecture Biennale in Venice in 2018 (portcityfutures.org). It has been discussed through a value deliberation process (https://mood.tbm.tudelft.nl/portcityfutures/welcome) and explored with international and local participants during a major conference 17-19 December 2018.

Port City Futures employs interdisciplinary methods and long-term perspectives to connect political, economic, social, and cultural dimensions of spatial use. It explores how the flows of goods and people generated by port activities intersect with the dynamics of the natural territory, hydraulic engineering, spatial planning, urban design, architecture, and heritage. It examines the spatial impact of competing interests among port-related and urban spatial development needs and timelines, proposes possible scenarios, and examines the impacts of these futures.

The concept has been selected in 2019 as foundation for development as a 4-year research program.

Further information
http://www.portcityfutures.nl/

Case study #2, Paris (credits:John Hanna)

Securing Democratic Society

State Policies, Technological Surveillance and Spatial (Cross-)Boundary Practices

Acronym
B&T-SDS-project

Funder | Programme [grant number]
Gerda Henkel Stiftung | *Security, Society and the States*

Overall budget
€ 110.500

Grant amount
Total: € 73.560 + € 24.000
TU Delft: € 12.940

Role TU Delft
Project initiator

Duration
05-2017 > 05-2022

TU Delft researchers
dr. Marc Schoonderbeek [lead]
John Hanna [PhD-candidate]
Grazia Tona [PhD-candidate]
Oscar Rommens [research]
Guillaume Guerrier [external researcher]

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GERDA HENKEL STIFTUNG

Taksim Square protests, exemplary of democratic ‘desires’ confronting security ‘concerns’

Within the context of the European Union, boundaries can also be regarded as indicators of its state of constant, dynamic transition. Its administrative borders are regularly redrawn through the assessment of (potentially) new member countries and, in the more recent reversal of that tendency, through the potential departure from the EU (Brexit). In addition, as new geo-political global realities are continuously emerging, migratory movements are equally affecting the spatial organization of the European continent in significant ways. The increased mobility of its culture, labor and leisure is causing an array of profound exchanges of cultural values and ideas, both within the Union and across its borders, while on the other hand the recent refugee crisis has also shown that migratory movements and the other extreme examples of ‘cross-border exchange’ can result in a sudden return to the importance of the State as protective entity.

The spatial implications of these developments are unmistaken, and they are unmistakably relevant, but to understand them completely, a strictly spatial perspective is urgently needed in order to fully understand how borders operate and secure. This research project will show how politically decided boundaries are spatially implemented; how new technologies support these; how this affects the democratic nature of public space; and how spatial

boundaries become part of social practices of signification. Urban planning and architecture, the very disciplines that plan, design and build social spaces, lie at the heart of these challenges and transformations of cities and territories. The knowledge and expertise in these fields should result in the re-examining of inherent innovation and creativity embedded in urban communities confronted daily with (cross-)boundary activities. The elements embedded in the urban policies and strategies that influence the production of urban form and that shape the built environment across and beyond borders are crucial for the establishing and, in fact, the securing of democratic society.

The specific nature of contemporary urban spaces and, especially, the way they are used and experienced, has been highly influenced by another, rather paradoxical, development within contemporary society as well. On the one hand, capitalistic democracy focuses on the importance of the individual as the object of consumption, an object that needs to be constantly addressed on an individual basis: individual needs, individual taste, individual habits, etc. On the other hand, the emergence of mass culture has introduced a sense of collectiveness that has become an inevitable part of everyday urban life. Nowadays, the experience of the collective is no longer restricted to commemorations or cultural festivities in 'group' context or the need to protect or defend the group's territory. Rather, mass culture has introduced large-scale gathering in urban spaces on a regular basis where the experiences of collectivism and the emergent global culture go hand in hand. New and emergent technologies have only increased the 'smoothness' with which mass culture can work as well as the impression that invisible surveillance technologies are starting to give society the essential characteristics of a totalitarian state.

The emergence of 'security', the 'boundary' and the 'other' as significant objects of study seem to be the logical outcome of these processes: boundaries not only spatially frame a collective or group, but simultaneously exclude the alien, the outsider in an ever-more insecure society. The urban transformations that have taken place since the aforementioned historical events, combined with the developed consequential political strategies and administrative decisions, the social tensions they still produce and the implementation of new technologies of surveillance and control in public space, have led to the emergence of a wide range of very specific spatial boundary conditions within contemporary spatial contexts, all in need of careful study from a spatial perspective (and with a specifically spatial methodology as well as set of instruments).

This research project will bring together theoretical insights and methods of spatial analysis in its investigation of contemporary boundary spaces, and will clarify, map and analyze the relationship between state politics of security (through surveillance and control), new technologies (employed to implement security measures), the way citizens perceive and respond to security measures. Using recent insights in border studies, and relating the emerging boundary conditions to conceptual and theoretical scientific debates, the research focuses on different scales, thus enabling to verify the extent with which the securing of democratic spaces have nowadays been implemented and how they have influenced democratic society. The research work consists of three case studies that address these different scales, namely from the urban locality of public space, via the investigation of a related network of public spaces, to the regional size of border construction.

Case Studies
-SECURING DEMOCRATIC PUBLIC SPACE; The 'New Normal' of Everyday Life.

The Policy-Practice-Perception of Spatial Boundaries at Schumanplein / Brussels

-SECURING DEMOCRATIC URBAN SPACES; Urbanism during the 'War on Terror'.

The Policy-Practice-Perception of Spatial Boundaries in Paris

-SECURING DEMOCRATIC TERRITORIAL SPACES; The Re-Emergence of the Border on the 'Balkan-Route'

The Policy-Practice-Perception of Spatial Boundaries on the Hungary/Serbia border

Further information
www.gerda-henkel-stiftung.de/en/specialprogram-security

Writingplace

Journal for Architecture and Literature

Funder | Programme [grant number]
NWO | *Kiem* [314-98-085]*

Grant amount
€ 15.000

Role TU Delft
Lead partner

Duration
03-2017 > 03-2018

TU Delft researchers
Dr.ir. Klaske Havik
Dr.ir. Jorge Mejía Hernández

Project partners
Universidade de Lisboa, Portugal [Dr. Susana Oliveira | co-editor]
RWTHA, Germany [Ir. Mark Proosten | co-editor]
Mike Schäfer, The Netherlands [co-editor]
RWTH Aachen, Germany [Prof. Wim van den Bergh | academic board]
Ghent University, Belgium [Prof. dr. Bart Keunen | academic board]
Bartlett University - UCL London, UK
[Prof. dr.Jane Rendell - academic board]
McGill University, Montreal, Canada [Prof. dr. Alberto Pérez-Gómez | academic board]
Nai010 Publishers, Rotterdam [publisher]

Contact person
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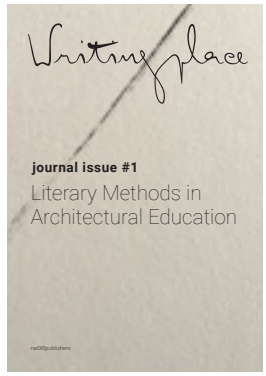
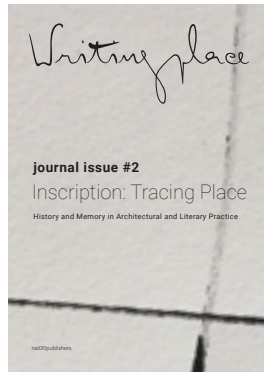
[Developed into EU COST Action CA18126 Writing Urban Places 2019-2023, granted € 600.000]





The *Writingplace journal for Architecture and Literature* is the first peer-reviewed, open-access journal of architecture and literature, focused on the exchange of knowledge on the relationship between architecture and literature. Through thematic issues, it aims to address and promote alternative ways of looking at architecture, urban places and landscapes through literary methods. Next to academic articles the journal is open to accounts of experiments in education and works of design or spatial analysis in which literary tools have been explored. The journal follows earlier projects of the Writingplace team including the international *Writingplace conference on literary methods in architectural research and design* in 2013 and the book *Writingplace: Investigations in Architecture and Literature* in 2016. In 2019, the Writingplace team received an EU COST Action grant for the international network *Writing Urban Places*, which is expected to result (among others) in a number of issues of the *Writingplace journal*.

Further information
https://journals.open.tudelft.nl/index.php/writingplace/index

‘City of the Future’, Biennale Session, Venice Biennale 2018

Stad van de Toekomst / City of the Future

Ten Design Strategies for Five Locations, Visualizations for a Square Kilometre of City

Funder | Programme [grant number]
Ministry of Infrastructure and Water Management
Ministry of the Interior and Kingdom Relations
Municipality of Amsterdam
Municipality of Rotterdam
Municipality of The Hague
Municipality of Utrecht
Municipality of Eindhoven
TU Delft Deltas Infrastructures & Mobility Initiative (DIMI)

Overall budget
€ 537.793

Grant amount
Total: € 537.793
TU Delft: € 128.293

Role TU Delft
TU Delft Deltas, Infrastructures & Mobility Initiative (DIMI), leading partner
Faculty Architecture and the Built Environment, project partner
Faculty Civil Engineering and Geosciences, project partner

Duration
11-2017 > 05-2019

TU Delft researchers
Dr.ir. Roberto Cavallo [dept Architecture, Faculty Architecture and the Built Environment]
Dr.Ir. Maurice Harteveld [dept Urbansim, Faculty Architecture and the Built Environment]
Dr.ir. Tom Daamen [dept MBE, Faculty Architecture and the Built Environment]
Dr.ir. Fransje Hooimeijer [dept Urbansim, Faculty Architecture and the Built Environment]
Prof.dr.ir. Marcel Hertogh [dept Materials, Mechanics, Management & Design, Faculty Civil Engineering and Geosciences]

Project partners
DIMI [lead]
Ministry of Infrastructure and Water Management
Ministry of the Interior and Kingdom Relations
Municipality of Amsterdam
Municipality of Rotterdam
Municipality of The Hague
Municipality of Utrecht
Municipality of Eindhoven
Branche Vereniging Nederlandse Architecten (BNA)
Vereniging Deltametropool
TU Delft Faculty Civil Engineering and Geosciences

Contact person
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Stad van de Toekomst (City of the Future) is a large national design research study. The central question of the study is: how to design and to develop in an integrated way an inner-city transformation area into an attractive and future proof urban environment? This question is motivated by urgent social as well as local tasks in the urban areas, varying from housing demand, social inclusiveness, new economy, climate adaptation, and the like, taking into account the transitions in energy, mobility, circularity and digitization. Based on future scenarios, the aim and intended results of this study are to obtain better insights into central and local questions in context of multiple social issues and system transitions in order to inform future prospects for integral area development. Such insights can have significance for the development of locations, and contribute to the policy of local and central governments concerning the potential spatial impact of multiple issues and transitions. The study offers also concepts, principles and guidelines for practice and education and gives several clues for further research.

Massive urbanization puts pressure on public space and demands new programmes – for instance, alternative gathering places such as interior spaces and a variety of forms of collective spaces. This diversity of programme cannot be planned in advance. The rapid urbanization of the Netherlands is putting pressure on urban, periurban and rural connectivity. People are still migrating from the countryside to the city, but also, increasingly often, from city to city, in search of better place with more agglomeration advantages. This leads to more and more movements within the densely built metropolis, which requires different forms of mobility.

The five biggest cities of the Netherlands have to contend with a growing number of inhabitants. They all have to deal with compaction and expansion. In each of these five cities *Stad van de Toekomst* appointed a 1 × 1 kilometre transformation area to be analyzed, researched and designed by two interdisciplinary teams of architects, urbanists, city planners, visionaries, engineers and sociologists – for the five cities there are in total ten multidisciplinary teams of

practitioners fully involved with the project. This size of the 1 kilometre ‘window’ is considered necessary because many different functions and spatial issues come together and are visible at once. These windows have in common the challenge of dealing with the existing city and, at the same time, with an urban densification assignment. They serve as test locations for new insights that can also be used in other places where further urbanization takes place. The Faculty of Architecture and the Built contributed in research and with cross-departmental education. In this framework, an international workshop followed by a Biennale Session at the 2018 Venice Biennale has been taking place in September 2018.

In this very realistic design brief, *Stad van de Toekomst* brings together designers, stakeholders, municipalities and academia in order to find answers on the central question for the near future where various essential transitions will most probably take place. The design teams did this in a speculative manner, from current as well as known developments and techniques, and on the basis of explicit assumptions. In different plenary meetings all stakeholders and experts were invited to present and criticize the findings of the design teams.

In the interdisciplinary Master’s design studio ‘City of the Future’, a collaboration between the Master’s degree programmes in architecture, urbanism and landscape architecture of the Faculty of Architecture and the Built Environment, the students worked with the same design brief as the professional teams of the national design research study worked with. The students focused on the consequences of urbanization for the major foundations of the city of the future – urban infrastructure and urban space – and designed a set of experimental design visions. Part of the design studio was an active exchange with practice. Students were given the opportunity to participate in meetings with the professional design teams. These teams at their turn had a direct link with municipalities, stakeholders and clients. Therefore, the interdisciplinary approach from both practice, government and academia met and shared their expertise.

Results of the interdisciplinary Master’s design studio ‘City of the Future’: Amsterdam, Den Haag, Eindhoven, Rotterdam, Utrecht

Den Haag Analysis

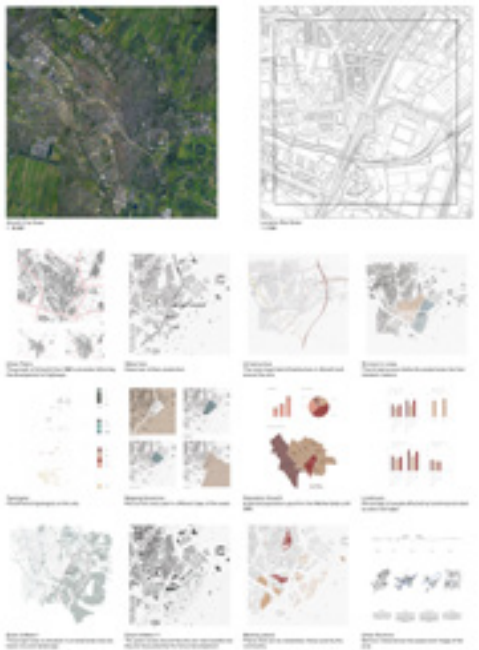
Eindhoven Analysis

Den Haag Design

Eindhoven Design

Rotterdam Analysis

Utrecht Analysis



Rotterdam Design

Utrecht Design

Midterm Presentation Interdisciplinary MSc2 Studio
'City of the Future'

A notable feature of the student's design proposals is that they address societal, environmental and spatial sustainability in an integral and context-specific way, just as professional teams would do. The new generation seldom thinks in terms of generic solutions. Despite their international composition and insight into worldwide changes, they are acutely aware of the need to deal with the future of the city in a local or even circular approach. The students are human-oriented, think in terms of clusters and diversity and they emphasize the complex connections and relationships among them. They are conscious of further urbanization and certainly do not eschew high-rise construction, but they are sensitive to the human scale and provide critical commentary on large scale area development. They opted for a good living environment with less car ownership, where sharing is a self-evident alternative.

Selected publications

—Cavallo, R., Kuijper, J., van Ardenne, M., & Heuvelmans, J. (Eds.) (2018). *City of the Future / Stad van de Toekomst*. TU Delft Open.

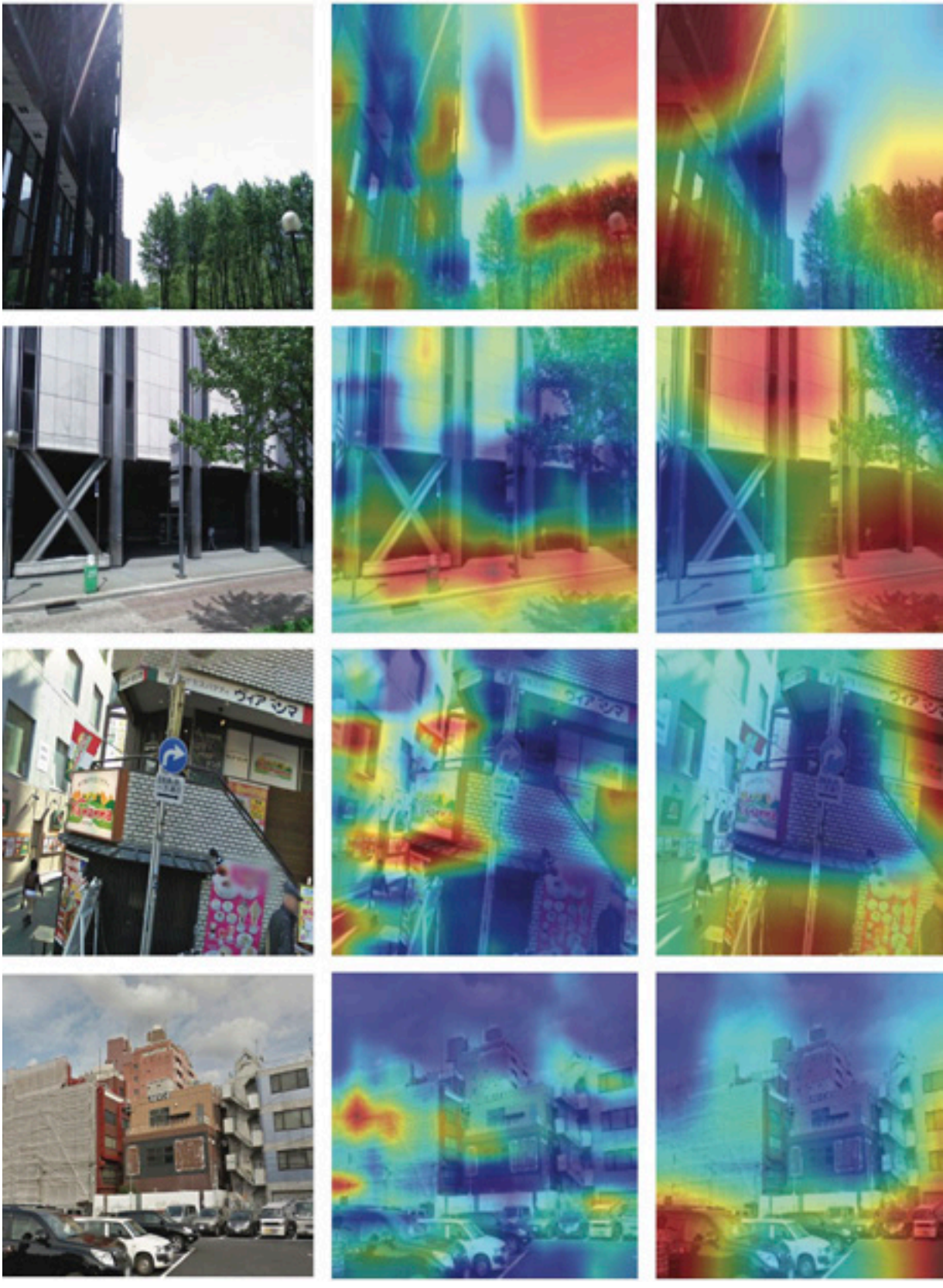
—Berkers, M., De Boer, H., Buitelaar, E., Cavallo, R., Daamen, T., Gerretsen, P., Harteveld, M., Hinterleitner, J., Hooimeijer, F., Van der Linden, H., & Van der Wouden, R. (Eds.) (2019) *De stad van de toekomst: Tien ontwerpvisies voor vijf locaties, verbeelding voor een vierkante kilometer stad.* Amsterdam: BNA Onderzoek.

—Cavallo, R. & Lucente, R. (2019). STAD VAN DE TOEKOMST, EXPERIMENTS OF FUTURE FOR THE EUROPEAN CITY. *Metamorfosi,* (06), 48–59.

Further information

https://www.bna.nl/nieuws/de-stad-van-de-toekomst-stad-maken-in-tijden-van-grote-transities

https://deltametropool.nl/publicaties/de-stad-van-de-toekomst/



Sight-Seeing in the Eyes of Deep Neural Networks

ArchiMediaL

Enriching and linking historical architectural and urban image collections

Funder | Programme [grant number]
Volkswagen Foundation

Overall budget
€ 450.000

Role TU Delft
Lead partner (A+BE/EWI)

Duration
01-2017 > 01-2020

TU Delft researchers
Prof.dr.ing. Carola Hein [A+BE]
Dr. Tino Mager [A+BE]
Dr. Jan van Gemert [EWI]
Dr. Ronald Siebes [EWI]
Dr. Seyran Khademi [EWI]

Project partners
VU University Amsterdam
HafenCity University Hamburg
University of Duisburg-Essen

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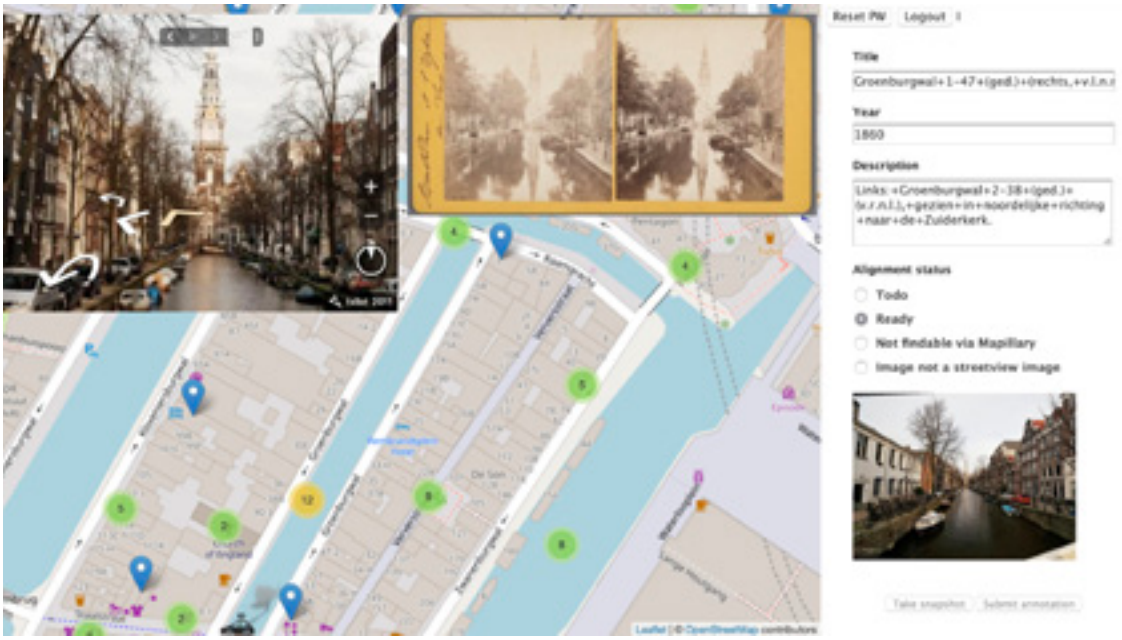
TOP: Historical photograph of Brouwersgracht 160 in Amsterdam
BOTTOM: The same building today, identified from online street view images

In close cooperation between architectural historians and computer scientists, ArchiMediaL researches the automatic recognition of architectural and urban forms in diverse visual media that are available digitally or on the web.

Recent advances in machine learning have made it possible to process large amounts of data and to train neural networks to recognize spatial forms. As part of our research, we are investigating how computers perceive urban scenarios and which spatial features enable them to distinguish between different cities and buildings.



Screenshot from the online tool for crowdsourcing geolocalizations

The aim is to facilitate the automatic linking of image content and to prepare these data for the comparative investigation of contemporary and historic built form. We train neural networks to identify buildings in hundreds of thousands of historical images and to find their exact location. ArchiMediaL also uses crowd-sourcing techniques to generate comprehensive data sets needed for automatic image recognition. In this way, experts and interested laypersons help to assess the reliability of the algorithms and can participate in cutting-edge research. ArchiMediaL uses research in computing to address novel questions for the fields of architectural and urban history. Going beyond existing repositories it aims to and to correct potential biases that are inherent in historic data collections, which are often geared towards colonial buildings, high architecture or Western artefacts.

The project thus extends the scope of hermeneutic analysis by a quantitative reference system in which subject-specific canons and boundaries are questioned. For the dialogue between architectural history and urban form, this means careful consideration of qualitative and quantitative information and the negotiation of new methodological approaches for future studies.

Further information
Archimedial.eu

The Urban Delta

A diachronic system approach to urban development, water, energy and food in the landscape of The Netherlands

Detail Polder Map Hoekwater 1901

Funder | Programme [grant number]
Cultural Heritage Agency of the Netherlands/Rijksdienst voor het Cultureel Erfgoed (RCE) | *Visie Erfgoed en Ruimte*

Overall budget
€ 316.435

Grant amount
Total: € 175.982
TU Delft: € 140.453

Role TU Delft
Project partner

Duration
03-2018 > 12-2019

TU Delft researchers
Dr. Reinout Rutte
Thomas van den Brink MA
Otto Diesfeldt MArch
Yvonne van Mil MArch
Iskandar Pané MArch
Arnoud de Waaijer MArch

Project partners
Cultural Heritage Agency of the Netherlands

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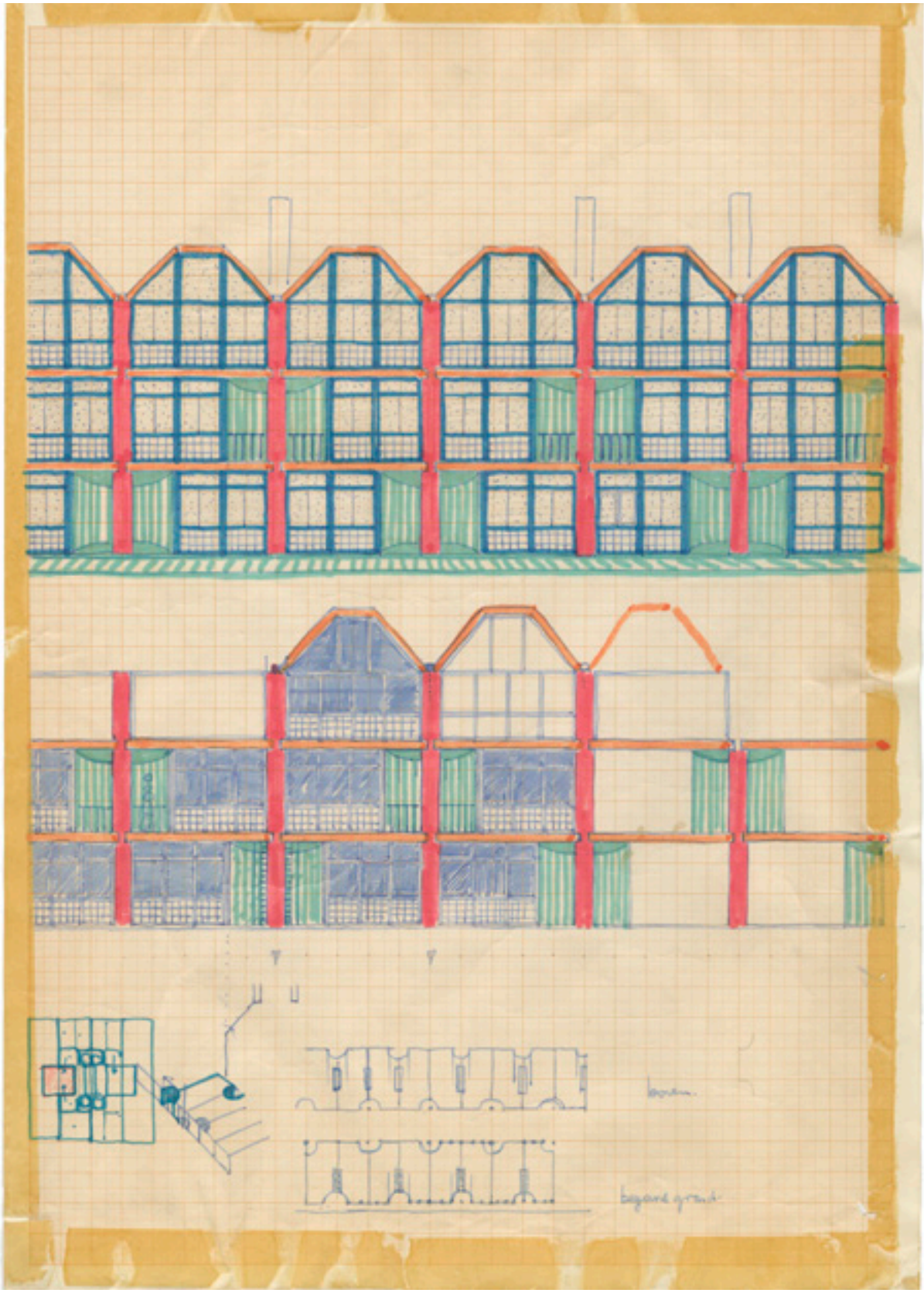
The general trend is for spatial planning issues to be approached in an increasingly integrated manner. The interweaving of city and country and the relationship between aspects such as urban development, traffic, water management, agriculture, the environment, energy and (water) safety are becoming more prominent. This means that the analyses on which spatial plans are based must also be set up in a broader context, whereby the functioning of complex structures and systems is approached in a coherent manner. In the project The urban delta we apply a notion of heritage and landscape in which we think not only at the object and structure level, but on the basis of a system approach in which not only the physical reality is important, the development of cities, water systems, infrastructure, and food and energy landscapes, but also the social reality, the systems of government and governance that determine the spatial structures and the relationships between city and country. Throughout history, cities have often looked at their own problems through the region and tried in various ways to use and control the region.In the first place, the project will generate and order a large amount of data using GIS systems. On the basis of data, analyses, maps and stories can be made that can serve as examples and inspiration for the various areas.
It is a step-by-step project: the data layer and a number of analyses will be carried out by the RCE, but the deepening to the regional and local scale level can take place within provinces, water boards or municipalities. The data, examples of analyses and toolkits for the regional and local scale will be made available to the public.

Further information
www.landschapinnederland.nl



Aldo van Eyck and Theo Bosch, project for social housing and workshops, Zwolle, 1970. Collection Het Nieuwe Instituut, Rotterdam

Jaap Bakema Study Centre

Collaboration with Het Nieuwe Instituut, Rotterdam

Acronym
JBSC

Funder | Programme [grant number]
Het Nieuwe Instituut (HNI)

Overall budget
Ca. € 100.000,- per annum

Grant amount
Structural collaboration with additional funding per sub-project.
TU Delft: per sub-project (e.g. book, conference), overall for 2016-2018 ca. € 200.00,- incl fte

Role TU Delft
Lead partner

Duration
Established as of November 2013; current cycle 2017-2020

TU Delft researchers
Dr.ir. Dirk van den Heuvel
[with group Architecture, Culture and Modernity:]
Dr. Jorge Mejia
Dr. Cathelijne Nuijsink
Dr. Leonardo Zuccaro Marchi
Fatma Tanis
Dorina Pllumbi
Golnar Abbasi
Jana Culek
Federica Marulo

Project partners
Het Nieuwe Instituut (HNI) [Dr. Hetty Berens, Suzanne Mulder, Ellen Smit, Eline de Graaf, Soscha Monteiro de Jesus and various archive and communication support staff]

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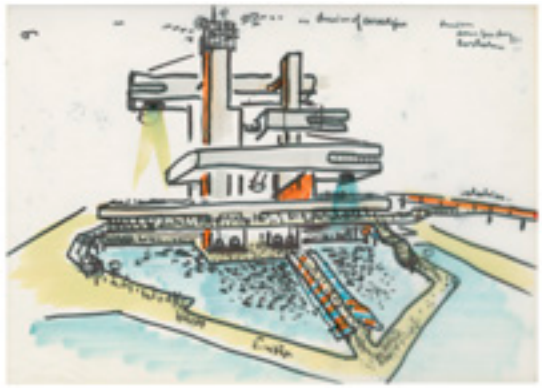
Het Nieuwe Instituut | architecture design digital culture



Jaap Bakema, sketch for the Dutch national pavilion at the Expo '70 in Osaka, Japan, 1970. Collection Het Nieuwe Instituut, Rotterdam

The Jaap Bakema Study Centre started life in 2013 as collaboration between Het Nieuwe Instituut and TU Delft's faculty of Architecture and the Built Environment. The goal was to instigate academic research, together with third parties, in the fields of architecture and urban planning. Partners per sub-project include: Gulbenkian Museum (Lisbon), The Berlage, Archive institutes (Smithson family archive, Aldo and Hannie van Eyck Foundation, BroekBakema, etc).

The centre explicitly aims to open up the materials in the State Archive. The collections of the National Archive for Dutch Architecture and Planning form the basis for formulating a research programme which is situated at the intersection of advanced historical/theoretical studies and urgent social issues. The activities are distributed among several long-term projects.

The Jaap Bakema Study Centre has an academic advisory board consisting of Tom Avermaete (ETH Zürich), Hetty Berens (HNI), Maristella Casciato (Getty Institute), Carola Hein (TU Delft) and Laurent Stalder (ETH Zürich).

Habitat: Expanding Architecture, exhibition curated by Dirk van den Heuvel at Het Nieuwe Instituut, Rotterdam, 2018. Photo by Johannes Schwartz

Each year, the Jaap Bakema Study Centre organizes an international conference on topics related to its research. Previous editions dealt with themes such as the open society, the relationship between research and exhibition practices, architectural drawing in the digital age, the architect's tools and the legacy of Aldo and Hannie van Eyck.

As of 2018, the research group Architecture, Culture and Modernity has been established at TU Delft by Dirk van den Heuvel and Jorge Mejia Hernandez. Special emphasis is reserved for the academic value of the archives at Het Nieuwe Instituut. A first call for PhD proposals and PhD colloquium was set up related to the theme 'Architecture and Democracy'.

The Jaap Bakema Study Centre also facilitates visiting researchers who help to disclose the archive of Het Nieuwe Instituut. Previous guests include: M. Christine Boyer (Princeton University), Georges Teyssot (Université de Laval), Gianluca Ferriero (Politecnico di Milano), Rebeca Merino del Río (Universidad de Valladolid), and Fabiano Borba Vianna (Universidade de São Paulo), among others. In 2017, the Jaap Bakema Study Centre welcomed Maarten Gielen and Lionel Devlieger of the Brussels-based office Rotor as visiting professors.

Special highlights

-Bakema book publication Open Society, and international lecture tour

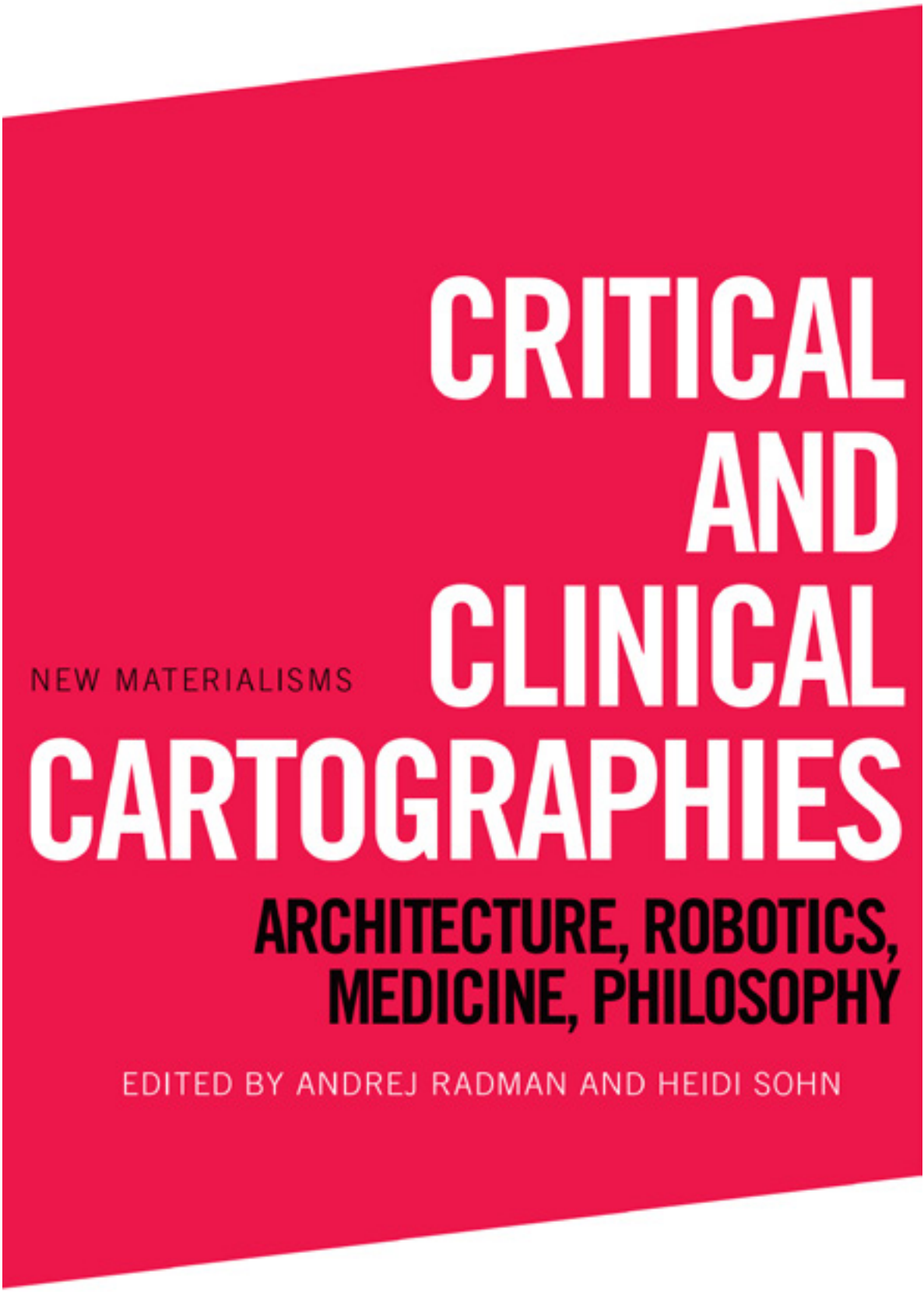
-Dirk van den Heuvel was awarded a Richard Rogers Fellowship from GSD Harvard University

-Aldo and Hannie van Eyck conference with keynotes by Herman Hertzberger, Stanislaus von Moos and Francis Strauven

-Exhibition: 'Habitat: Expanding Architecture', with a special lecture series (Alessandra Ponte, Georg Vrachliotis, Hadas Steiner, Leonardo Zuccharo Marchi, Erik Rietveld / RAAAF, Frits Palmboom)

Further information

jaap-bakema-study-centre.hetnieuweinstituut.nl


NEW MATERIALISMS
CRITICAL AND CLINICAL CARTOGRAPHIES
ARCHITECTURE, ROBOTICS, MEDICINE, PHILOSOPHY
EDITED BY ANDREJ RADMAN AND HEIDI SOHN

Critical and Clinical Cartographies

Architecture, Robotics, Medicine, Philosophy

Acronym
3C

Role TU Delft
Lead partner

Duration
11-2014 > 02-2017

TU Delft researchers
Dr.ir. Andrej Radman [editor]
Dr.ir. Heidi Sohn [editor]
Dr.ir. Stavros Kousoulas
Em.prof.ir. Kas Oosterhuis
Em.prof.ir. Arie Graafland
Prof.dr. Jenny Dankleman [Bio-mechanical Engineering]

Project partners
Utrecht University, The Netherlands [Rosi Braidotti]
ENSA Paris-Malaquais, France [Christian Girard]
Cornell University, USA [Keith Evan Green and Rachel Prentice]
Edinburgh University Press, UK [Carol Macdonald]
Academy of Fine Arts Münster, Germany [Katharina D. Martin]
University College London, UK [Peg Rawes]
University of Sidney, Australia [Chris L. Smith]
Erasmus University, The Netherlands [Sjoerd van Tuinen]
Ghent University, Belgium [Charles T. Wolfe]

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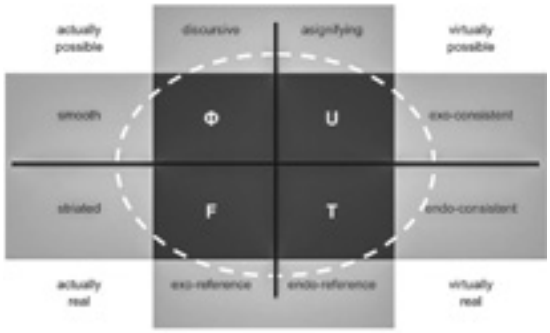

Axes of discursivity/ reference and de-territorialisation/ consistency, based on Felix Guattari, *Schizoanalytic Cartographies*, trans. Andrew Goffey (London: Bloomsbury, [1989] 2013)

Major questions addressed in the 3C project:

1. What is the impact of the Digital Turn on the contemporary medical and architectural education and/or practice?
2. How does the Posthuman Turn influence the possible convergence of medical and architectural education and/or practice?
3. How has the biopolitical concept of care mutated under the proliferation of digital technology?
4. How could medical research contribute to architectural design and how could design, in turn, contribute to the improvement of health care?

"This collection answers, through an impressive range of perspectives, the call of Nietzsche's 'great health' – the health that 'one does not merely have but also acquires continually,' an impersonal health that traverses the whole of life. Displaying the unique ability to embody and map out those pulsing vitalities at the always more-than- and other-than-human intersections of architecture, robotics, medicine and philosophy, these chapters ultimately carry forward Deleuze's 'critical and clinical' answer to Nietzsche's call. Enjoy this symptomatology!"

Review by Gregory J. Seigworth, Millersville University, co-editor of *The Affect Theory Reader*

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Part I: Architecture

1 Urban Correlationism: A Matter of Access / Stavros Kousoulas
2 Housing Biopolitics and Care / Peg Rawes
3 Amorphous Continua / Chris L. Smith

Part II: Robotics

4 Robots Don't Care: Why Bots Won't Reboot Architecture / Christian Girard
5 The Convivial ART of Vortical Thinking / Keith Evan Green
6 Emotive Embodiments / Kas Oosterhuis

Part III: Medicine

7 Ecologies of Corporeal Space / Katharina D. Martin
8 Swimming in the Joint / Rachel Prentice
9 Key-Hole Surgery: Minimally Invasive Technology / Jenny Dankelman

Part IV: Philosophy

10 Elasticity and Plasticity: Anthropo-Design and the Crisis of Repetition / Sjoerd van Tuinen
11 Automata, Man-machines and Embodiment: Deflating or Inflating Life? / Charles T. Wolfe
12 Generative Futures: On Affirmative Ethics / Rosi Braidotti

3C arises from a transdisciplinary conference (2014) organised by the TU Delft Architecture Department's Theory Chair and Hyperbody, in cooperation with the Bio Mechatronics and Bio Robotics Section of the Department of Bio Mechanical Engineering, TU Delft. The book project (2017), published by Edinburgh University Press, rethinks medical and design pedagogies in the context of both the Affective and Digital Turns that are occurring under the umbrella of New Materialism. The collection creates the ideal terrain for architecture and medical technologies of care to meet with robotics, alongside the emerging 'materialist landscape'.

Further information
https://edinburghuniversitypress.com/book-critical-and-clinical-cartographies.html


erHolland
FOOTPRINT
THE ARCHITECTURE OF HOUSING AFTER THE NEOLIBERAL TURN
Delft
Architectural
Studies
on Housing
Microcosm
Searching
for the City
in Its
Interiors
OASE #101
OASE #70
Journal for Architecture / Tijdschrift voor architectuur

DASH, FOOTPRINT, OASE, OverHolland

Duration
Ongoing

DASH / TU Delft contributors 2016-2018
Frederique van Andel
Prof. Dick van Gameren
Dr. Nelson Mota
Harald Mooij
Pierijn van der Putt

FOOTPRINT / TU Delft contributors 2016-2018
Dr. Andrej Radman
Dr. Nelson Mota
Dr. Stavros Kousoulas
Dr. Dirk van den Heuvel
Dr. Jorge Mejía Hernández
Dr. Marc Schoonderbeek
Robert Gorny
Negar Sanaan Bensi

OASE / TU Delft contributors 2016-2018
Prof.dr. Tom Avermaete
Dr. Hans Teerds
Dr. Klaske Havik
Prof. Daniel Rosbottom
Sereh Mandias
Elsbeth Ronner

OverHolland / TU Delft contributors 2016-2018
Dr. Esther Gramsbergen
Ir. Henk Engel
Ir. Otto Diesfeldt
Ir. Iskander Pane
Dr. Reinout Rutte

The Department regards it as its responsibility to actively invest in providing a platform for academic exchange and publication through four thematic journals, which are supported by and (partly) produced within the department:

DASH Delft Architectural Studies on Housing is a thematic book series that is wholly devoted to residential design. Inquiry into historical and contemporary projects and conditions is the central focus of DASH. New types of housing but also existing models and changing trends are thoroughly charted and examined. The target is the future: with thought-provoking analyses, DASH aims to give new impetus to innovative housing design.

Footprint is an academic journal dedicated to the study of architecture and the urban environment as a means of comprehending culture and society, and as a tool for relating them to shifting ideological doctrines and philosophical ideas. The journal promotes the creation and development – or revision - of conceptual frameworks and methods of inquiry. It is engaged in creating

a body of critical and reflexive texts with a breadth and depth of thought which would enrich the architecture discipline and produce new knowledge, conceptual methodologies and original understandings.

OASE is a Dutch-Belgian peer reviewed architecture journal, that brings together academic discourse and the sensibilities of design practice. OASE advocates critical reflection in which the architectural project occupies a central position, yet is understood to be embedded in a wider cultural field. Intersections and affinities with other disciplines are explored in order to gain a more profound understanding of the practice and theory of architecture and rearticulate its disciplinary limits.

OverHolland – Architectural studies for Dutch cities focuses on possible links between urban analysis and architectural design. The research conducted over recent decades has yielded a range of conflicting views and insights on the subject, raising all kinds of questions that will be highlighted and examined in-depth in OverHolland.

Further information
http://dash-journal.com
https://journals.open.tudelft.nl/index.php/footprint/
https://www.oasejournal.nl/en/Issues
https://journals.open.tudelft.nl/index.php/overholland

Architectural Engineering + Technology

Research

Overall coordinator
— Dr.ir. Sabine Jansen

Coordinators
— Prof.dr.ir. Andy van den Dobbelsteen
— Dr. Barbara Lubelli

Section leaders
— Dr.ir. Wido Quist, Heritage & Architecture
— Prof.dr.ing. Tillmann Klein, Architectural Technology
— Dr.ir. Martin Tenpierik, Environmental & Computational Design

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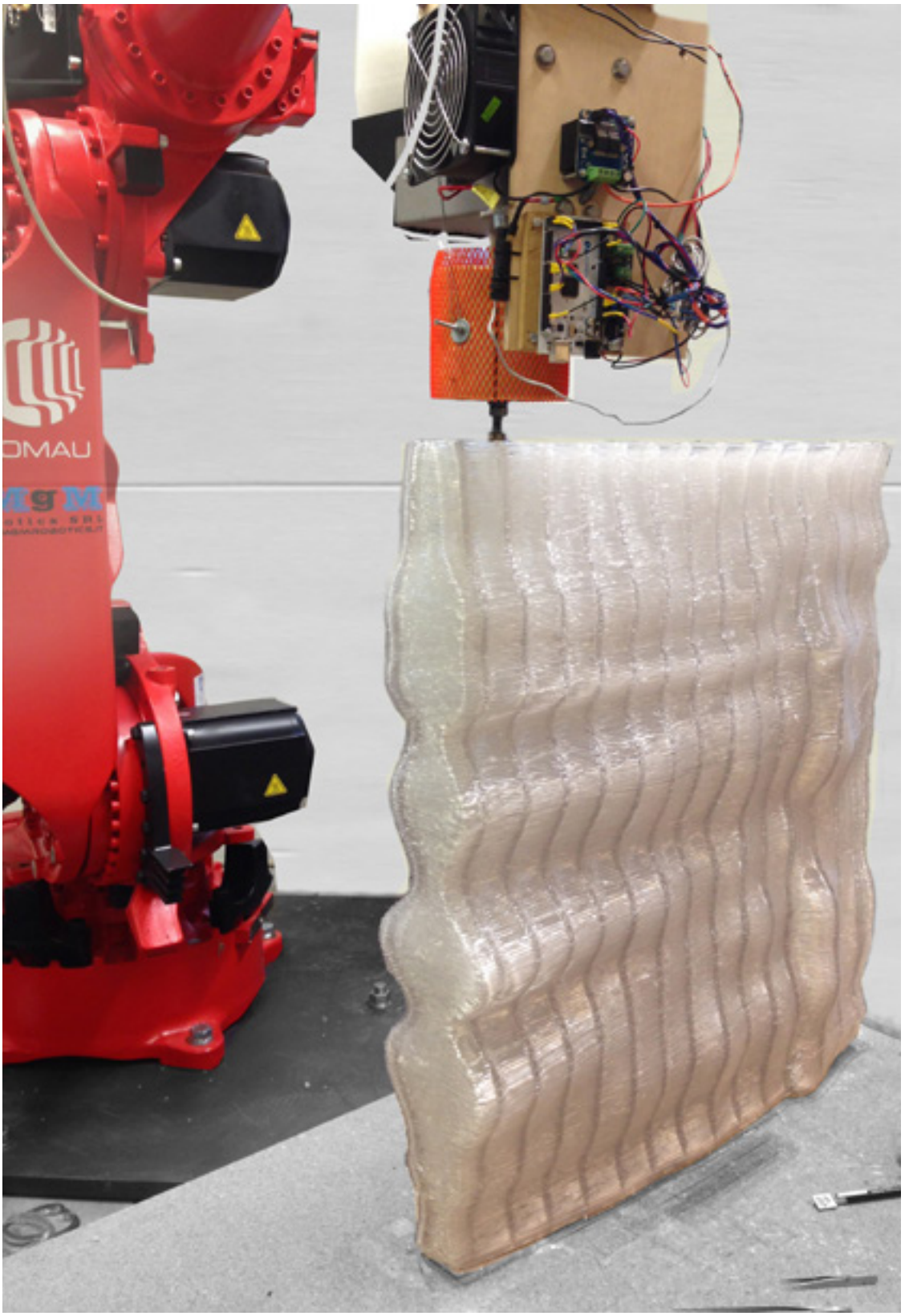

Additive manufacturing at AE+T

1 – **Organisation, vision and strategy**

Introduction

The faculty research programmes over the period 2010-2015 were reviewed by an external committee of peers in 2016, following the assessment protocol of the Association of Universities in the Netherlands (VSNU). Three aspects are assessed: research quality, relevance to society and viability, on a four-point scale ranging from 1 (world leading/excellent) to 4 (unsatisfactory). For a full explanation of the indicators and scores see the Standard Evaluation Protocol 2015 – 2021 on the VSNU website).
In the 2016 Research Review, the Architectural Engineering + Technology department (AE+T) took part in three research programmes, the Green Building Innovation (GBI) programme, the Computation + Performance (C+P) programme and the Design & History programme (D&H).

This mid-term evaluation describes how the Department of Architectural Engineering + Technology have continued their research in the period 2016-2018. The document describes the follow-up on the recommendations by the assessment committee in 2016, and how the department is planning to continue working on research in the following years. In addition, it highlights the most important activities and output covering the period 2016 to 2018.
Over the past three years, more attention has been given to societal issues dealing with energy transition solutions, people's comfort, adaptive re-use, sustainability and circularity. This has also resulted in close collaboration in research projects between researchers from the original C&P (Computation and Performance) programme, the original GBI (Green Building Innovation) programme and the original D&H (Design and History) programme, in line with the merger of the programmes.
In this midterm document the renewed mission and strategy of the department and its sections is presented, and the achievements in projects, valorisation, impact of the review period are shown.

Strategic and operational improvements after the 2016 review

After the 2016 review, the research programmes of Computation & Performance (C&P), Green Building Innovation (GBI) and (a part of) Design & History (D&H) were merged into one overall research programme on department level, in order to create an improved organisational structure for research, and facilitate closer collaboration. Recently, at faculty level, six cross-over themes were defined and within the department, several themes were highlighted in which researchers from different sections collaborate. This change has significantly improved the structure of the research and has aligned the role of the research programme coordinator with the department research coordinator (now one and the same person).

The unfortunate lack of laboratory space was mentioned by the assessment committee in 2016. Over the past years, much effort has been put into the development of lab facilities. These facilities are described in the faculty chapter of this report. AE+T initiated and established The Product Development Lab, Heritage & Technology Lab, the Laboratory for Additive Manufacturing in Architecture (LAMA) and the Robotic Building Lab. These last two are now located in a place within the faculty building called the Sandbox. The SenseLab and Glass Lab are positioned outside, of which the latter will also be accommodated within the faculty in the coming year. They all are very important for our research. LAMA has grown from a few 3D printers in 2016 to a full running lab with more than 10 3D printers and a fully-fledged robotic arm. The labs are still steadily growing. One issue, though, is the lack of structural funding to maintain these facilities. New acquisitions and maintenance at the moment needs to be funded by externally acquired funds. The next step regarding laboratories is the challenge to group and promote them and as one integrated AE+T laboratory with different specialisms.

In 2016, the research assessment committee mentioned a lack of coherence between the contributions of different chairs to the former Design & History research programme. By ending the research programme and introducing a faculty-wide cross-over theme of ‘heritage’, this problem has been addressed. The section Heritage & Architecture (as well as the chair of History of Architecture and Urban Planning within the department of Architecture and other contributors to the Design & History research programme) can now focus on coherence of the research within the section and contribute to the cross-over theme ‘heritage’, as well as set up other alliances within the department of Architectural Engineering + Technology without having to fit this into the research programme Design & History.

Current organisational structure of the department

As mentioned in the previous paragraph, the previously existing three research programmes have merged into one overall research programme at departmental level.

The department itself is now organised into three sections, in which different chairs are grouped: Architectural Technology, Environmental & Computational Design and Heritage & Architecture. This resulted in a more efficient daily management on both section level and department level. Every section has approximately 30-50 people of staff serving Bachelor, Master and PhD education and conducting research. In every section, full professors, associate professors and assistant professors, as well as post-doc researchers, PhD students, junior researchers and teachers, are working together on a wide range of topics.

The department managed to appoint 5 new full professors. In 2018 these were: Tillmann Klein (Building Product Innovation), Ana Pereira Roders (Heritage & Values) and Uta Pottgiesser (Heritage & Technology). In 2019, professor Mauro Overend (Structural Design & Mechanics), and professor James O’Callaghan (Architectural Glass) were appointed. This ensures the continuity and repositioning of research and education in their respective academic fields. Below a scheme of the sections and full professors is shown.

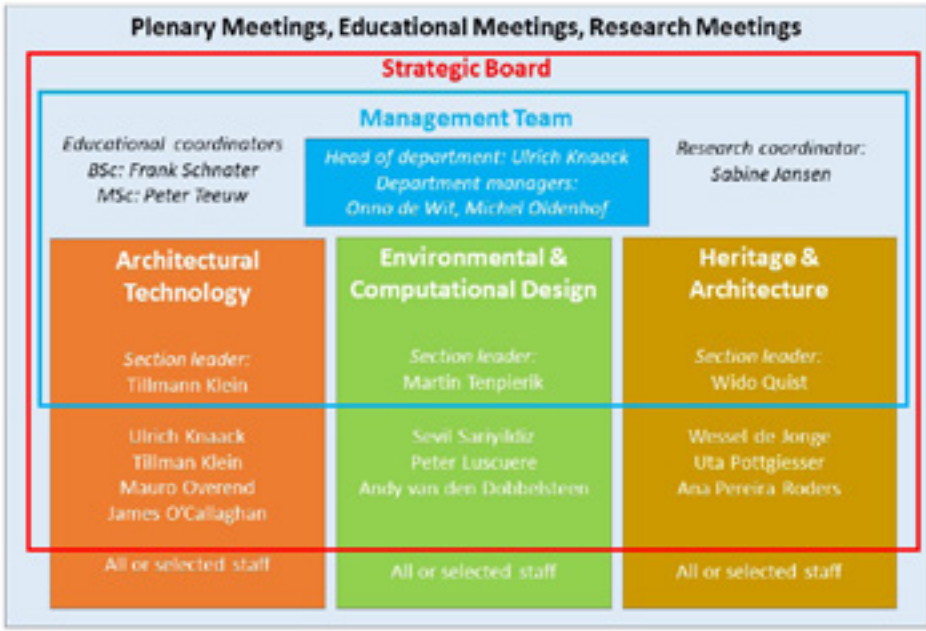

FIG. 1.1 Organisational structure of the department

Vision and mission

For architectural disciplines, the coming decades will be more important than ever. By the year 2050, in accordance with the Paris Agreements, the entire built environment needs to have become carbon neutral, requiring innovative and sustainable design and construction methods and, more importantly, a pragmatic approach to the existing built environment, addressing qualities and values. Striving for net zero-energy buildings should also consider and improve, the comfort and health of users, as well as address the values attributed to the existing buildings.
In addition, partly because of the climate goals, but more so due to the depletion of valuable resources, supply chains have to become more durable and circular, requiring innovation in building products and materials, new ways of manufacturing, assembling and disassembling. Furthermore, society and the built environment alike are more complexly organised in networks of different scales. Computational technologies and methods will enable smart buildings and cities to deal with this complexity. Digitisalition will also lead to a paradigm shift in design and building processes.

Hence, the traditional ways of designing and engineering come to a close; these should be replaced by new élan, providing hope, opportunities and improved living conditions. AE+T is taking that responsibility seriously and provides the means and insights to tackle the following societal challenges:

- The transition towards a sustainable built environment, for new and existing buildings, addressing climate adaptation and mitigation;
- The transition towards a circular economy;
- The need for a healthier and more comfortable built environment;
- Best performing buildings and cities by means of informatics methods and techniques.

Hence, we envision the Department of AE+T to be world-leading in innovation for a sustainable and healthy built environment. Following our vision, our mission is to contribute ingeniously, with knowledge, experiment and design, to a sustainable, high performing and aesthetic built environment, with positive value for people and the environment.

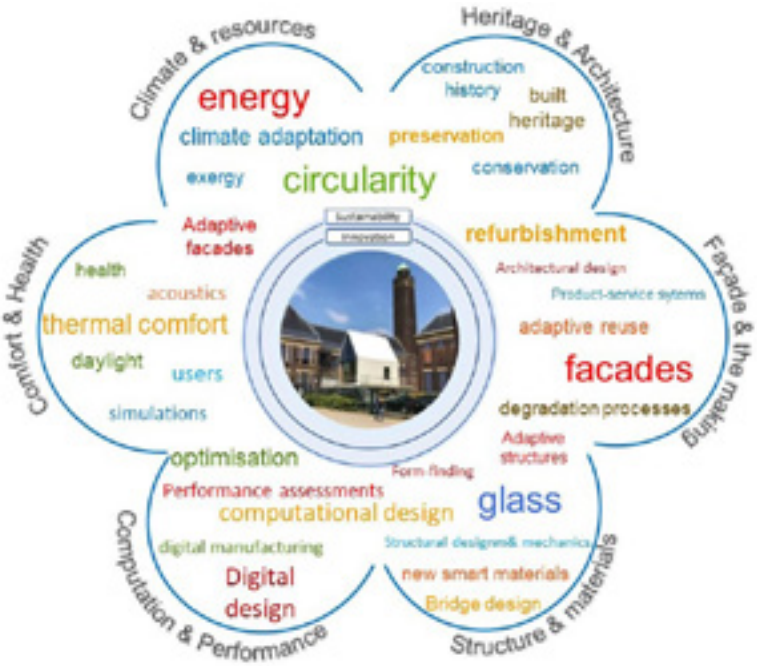

FIG. 1.2 Overview of the AE+T research, AE+T flower

Research area/themes

Aligned with our vision and mission, our current research focus on six themes:

- Climate & resources;
- Comfort & health;
- Computation & Performance;
- Structure & Materials;
- Façade & the making;
- Heritage & Architecture.

Strategy

Our strategy to achieve this mission is:

To create a safe, inclusive and inspiring working environment that enhances creativity and collaboration within the department:

- Creating and sharing the department vision with all researchers, i.e. by having monthly research meetings;
- Stimulating collaboration between researchers and strengthening expertise and synergies between the specialists in cross-disciplinary projects;
- Further improving the existing Lab infrastructure;
- Further improving the diversity and gender balance within the department.

To create strategic collaborations with other departments, faculties, universities and international partners:

- Increasing the visibility of the department`s research and stronger branding of the department and its fields of expertise;
- Leading involvement in the university themes: Urban Energy Platform and Circular Built Environment;
- Active participation and leadership in relevant networks at national and international level;
- Collaboration with world-leading universities in Europe; these include UCL, BauHow5 and the European Façade Network.

To further increase the valorisation and impact of our research output:

- Publication, not only in scientific journals but also in professional journals and conferences, reaching out to industry and practice, and popular media, in order to bring science to the general public;
- A continuous connection to and involvement with societal challenges;
- Strengthening collaboration with the building industry;
- Participation in international projects and networks for knowledge sharing.

To continue to find the funding opportunities that enable high quality research and valorisation.

- Continue acquisition of national and European funding, becoming more professional in this, with increased cooperation with the Valorisation Centre TU Delft;
- We strive for a healthy mix of larger, long term European projects and smaller projects in collaboration with industry and local municipalities and provinces. This brings scientific innovation to practice and societal challenges to science;
- Active sharing of interesting calls; collaboration with university platforms (e.g. Urban Energy Platform). Also, currently more collaboration between chairs in the section when preparing a proposal is taking place.

To create synergies between research and education: Research-based education.

- Use of research in education, i.e. apply knowledge and experience coming forth from ongoing research projects;
- Collaboration in education: each master student is supervised by at least two mentors from different sections: this way students work on innovative, scientific topics, there is ‘cross-pollination’ between research themes, and automatic sharing of knowledge between student and researchers;
- Master students support research output; all master thesis topics are proposed based on running research and PhD projects.

Publication strategy

- Within the current research environment and evaluation, publishing in scientific journals is of primary importance. All academic staff is encouraged to publish in scientific journals and PhD thesis are more and more paper-based;
- The policy of the TU Delft is to shift to open access publications only. Through a national agreement with many of the larger publishers, researchers at Dutch Universities can publish their journal papers open access, free of charge to access;
- Researchers at AE+T should consider fees for journal that are not included in this list when applying for new research funds as some funding institutions cover these expenses;
- When being involved in book publications, AE+T researchers are encouraged to explore open access possibilities and negotiate this with the publisher;
- Furthermore, books, book series or conference proceedings should be considered to be published in collaboration with TU Delft Open which provides an open access platform for such publications.

Remaining challenges

Our research field currently has exceedingly high societal relevance and our ambitions to contribute are equally high. In addition, our research themes are very much interconnected, as can be seen in AE+T flower figure.
However, more effort can be put into enhancing the internal coherence of the sections and to envision the mid-term strategies related to people's personal development (HR) and content to be addressed (including to stop or reduce) in research and education. In order to increase the coherence in the department, the vision and strategy can be more actively communicated in the department, so that people feel more part of the department's vision. Also, an important issue might still be as to whether all groups and themes are visible to the outside world clearly enough to be able to attract attention from companies and governmental bodies. Currently, the website is undergoing improvements to address this.

In addition to the above, several challenges that are related to more organisational matters, are also important to pay attention to. Currently, according to the current management paradigm, the department has too many permanent staff in relation to the fixed income. Therefore, permanent positions will be reduced in the coming years. At the same time, the faculty does not want to appoint tenured researchers anymore, other than PhDs and postdocs (temporary) or academic tenure-track staff (assistant professors). Temporary staff can only be appointed onto fixed term projects. This makes it difficult to build up earlier career staff in the knowledge base. Appointing PhDs is difficult since this requires a 4-year or at least a 3-year project, with sufficient funding.

Furthermore, in January 2017 a survey has shown that the employees of AE+T experience very high workloads. Especially employees dealing with research, teaching and management are typically juggling too many balls at once. The rat race of constantly needing to apply for research funds, which are becoming ever more competitive, is part of this problem. Solving the problem mentioned in the previous paragraph may alleviate the current work load challenges.

TABLE 1.1 Selected output indicators

		RESEARCH QUALITY	RELEVANCE TO SOCIETY
Assessment dimensions	Activities, organisation, facilities/assets, output	**Activities** - Research projects - Internationally funded research projects (Getty Foundation, JPI) - Nationally funded research projects (NWO, RVO, 3TU) - Organisation of academic conferences, seminars, colloquia - Experimental (building) projects	**Activities** - Research projects - National research projects (ministries, museums, private institutions) - Advisor/election to professional associations - Membership of national and international professional committees - Experimental (building) projects
		Organisation - Organisation of international conferences - Participation in national and international centres and consortia - Collaboration with national and international research institutes - Membership of national and international scientific committees and networks	**Organisation** - Organisation of international conferences - Participation in co-funded centres - Collaboration with professional institutes - Membership of knowledge networks of professionals and end-users - Role in practice and policymaking - Participation in consortia and networks
		Facilities/assets - Collections (chairs, decorative stone, wood, building materials) - Digital archives and websites - (Mobile) Labs	**Facilities/assets** - Collections (chairs, decorative stone, wood, building materials) - Digital archives and websites - Web-based tools - (Mobile) Labs
		Output - Refereed journal articles - Academic books/book chapters - PhD theses - Conference papers - Editorship of peer-reviewed journals - Editorship of books - Curatorship of exhibitions - Keynotes at int. conferences - Book series	**Output** - Professional journal articles - Professional books/book chapters - Media presence - Applied research reports - Editorship of professional publications - Professional book series - Curatorship of public exhibitions - Invited lectures at architecture institutes and other cultural venues - Patents - Exhibitions - Book series
	Use	- Participation in European (JPI) and national (NWO, RVO, 3TU) consortia - Citations - Downloads	- Media coverage of academic work, events, debates, exhibitions - Publications of architectural work of practicing professors and staff in professional journals - Research projects and application of research outputs in professional practice
	Marks of recognition	- Prizes and awards - Member of research review panels - Invitations as keynote speakers to important conferences and seminars - Election to academic or academic professional associations - Editorship of academic journals - Honorary positions - Acquisition of research grants based on peer review JPI, NWO, RVO, 3TU - Guest / visiting professor function	- Prizes and awards - Advisor/election to professional associations and practice - Practice chairs financed/co-financed by external partners - Long-term cooperation with government and industry - Invited public lectures and debates - Guest / visiting professor function

2 – **Research in numbers**

TABLE 2.1 Research output department 2016-2018

	2016	2017	2018
MAIN RESEARCH OUTPUT		**AE+T AS IT WAS 2016-2018**	
Refereed articles	40	54	62
Non-refereed articles	0	2	5
Books	4	0	0
Book chapters	11	13	15
PhD-theses	8	11	7
Conference papers	63	57	56
Professional publications	39	31	33
Publications aimed at the general public	4	0	0
Total Main Research Output	**169**	**168**	**178**
OTHER RESEARCH OUTPUT			
Media contritbutions and coverages	17	32	68
Abstracts	3	9	7
Editorial work: editorial activity	12	8	5
Editorial work: publication peer review	3	1	5
Bookediting	2	8	14
Exhibition	3	3	6
Memberships	10	10	17
Talk or presentation (conference)	21	15	17
Total Other Research Output	**71**	**86**	**139**
TOTAL	**240**	**254**	**317**

TABLE 2.2 Staff members department

STAFF		**2016**		**2017**		**2018**
	NR	FTE	NR	FTE	NR	FTE
Scientific Staff	41	11,74	39	11,45	37	11,36
Researchers (incl Postdocs)	29	12,14	27	13,27	25	9,15
PhD candidates	59		61		51	
Total research staff	129	23,88	127	24,72	113	20,51
Visiting Fellows	**18**	**4,15**	**21**	**6,87**	**31**	**5,67**
Total Staff	**147**	**28,03**	**148**	**31,59**	**144**	**26,18**

TABLE 2.3 Research income 2016-2018

	2016		2017		2018	
	K€	%	K€	%	K€	%
FUNDING						
Direct funding [1]	2.361	48%	2.334	57%	2.070	54%
Research grants [2]	545	11%	726	18%	395	10%
Contract research [3]	2.147	44%	1.295	31%	1.527	40%
Own contribution	-275	-6%	-538	-13%	-333	-9%
Other [4]	112	2%	302	7%	176	5%
Total Funding	**4.890**	**100%**	**4.119**	**100%**	**3.835**	**100%**
EXPENDITURE						
Personnel costs	-3.998	80%	-3.660	84%	-3.393	87%
Other costs	-974	20%	-681	16%	-516	13%
Total Expenditure	**-4.972**	**100%**	**-4.341**	**100%**	**-3.909**	**100%**
RESULT	**-82**		**-223**		**-74**	

[1] Direct funding (basisfinanciering / lump-sum budget).
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and the Royal Academy).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations industry, government ministries, European organisations and charitable organisations.
[4] Funds that do not fit into the other categories.

TABLE 2.4 Length of PhD candidacies and success rate

ENROLMENT		**STARTING YEAR**					
		2010	2011	2012	2013	2014	TOTAL
GENDER	Male	9	7	6	4	6	**32**
	Female	2	1	0	2	2	**7**
	Total	**11**	**8**	**6**	**6**	**8**	**39**
GRADUATED							
≤ 4 years [1]	NR	0	1	0	0	1	**2**
	%	0%	13%	0%	0%	13%	**5%**
≤ 5 years [1]	NR	1	2	1	1	2	**7**
	%	9%	25%	17%	17%	25%	**18%**
≤ 6 years [1]	NR	3	3	2	3	2	**13**
	%	27%	38%	33%	50%	25%	**35%**
≤ 7 years [1]	NR	7	4	3	3	2	**19**
	%	64%	50%	50%	50%	25%	**48%**
Total Graduated	NR	**8**	**5**	**3**	**3**	**2**	**21**
	%	**73%**	**63%**	**50%**	**50%**	**25%**	**52%**
Not yet finished	NR	0	3	2	2	5	**12**
	%	0%	38%	33%	33%	63%	**31%**
Discontinued	NR	3	0	1	1	1	**6**
	%	27%	0%	17%	17%	13%	**15%**

[1] In the case of the started PhD's in a given year the lead time was considered and cumulatively drawn over the years. A PhD who graduated in "≤ 4 years", is therefore again included in "≤ 5 years", in "≤ 6 years" and in "≤ 7 years". The table "Total Graduated" shows the total number of PhDs candidates that successfully completed there studies.

3 – **Overview of the AE+T research**

The department of Architectural Engineering and Technology has three sections:

- Environmental & Computational Design;
- Heritage & Architecture;
- Architectural Technology.

This chapter provides an overview of their organisation, chairs and people, vision, main research topics and track record.

Environmental & Computational Design

Section leader: Martin Tenpierik

Organisation, chairs and people

In the year 2016, E&CD was formed by a merger of the two sections of Climate Design and Computation. Around the time of this merger the section contained six chairs: Climate Design & Sustainability, Building Physics, Building Services, Indoor Environment, Design Informatics and Hyperbody. Due to retirement of Kas Oosterhuis, the chair Hyperbody ceased to exist. At the end of 2018, the chair of Indoor Environment moved to MBE.

Furthermore, the chairs of Building Physics and Building Services, which were already collaborating closely, were merged informally into one chair. This merger will be formalised when Peter Luscuere will retire (2022) and a new combined chair from the two chairs will be formed. Furthermore, early 2020 a new industry-funded chair Building Services Innovation with a new professor will be created, with the aim to create stronger ties between academia and industry.

This means that the section soon consists of four chairs:

- Climate Design & Sustainability (CD&S) – prof. dr.ir. Andy van den Dobbelsteen;
- Building Physics & Services (BP&S) – prof.ir. Peter Luscuere;
- Design Informatics (DI) – prof.dr.ir. Sevil Sariyildiz;
- Building Services Innovation (BSI) – professor to be hired soon.

These chairs cover the core competences that are needed for education and research within the field of Environmental & Computational Design (ECD).

Vision

How can architects and building engineers prepare the built environment for climate change, energy transition, human well-being, circular resource and digitalisation? In our vision architects and engineers should strive for a built environment based on positive footprints and positive environments. The idea of positive footprints stems from the idea that “being less bad is no good”. Our vision is to move towards a society that creates positive footprints to build sustainable, liveable and healthy cities and buildings; or in other words, tries to increase positive values, and it tries to do so for all important resources in the built environment: energy, water, air, materials, space and top soil. Simply translated to each of these resources, positive footprints can be achieved by ‘energy positive buildings’ (energy), ‘cleaner discharge than intake’ (water and air), ‘waste as resource and endless recycling’ (materials) multiple use of spaces and ‘positive contribution to top soil production’ (top soil; including food and biomass).

These five resources refer to the ‘technical’ ingredients needed to maintain our technological society and to improve our way of living. Besides these ‘technical’ ingredients, we can place four human needs: quietness, daylight, thermal delight and clean (indoor) air. In a similar way as we defined positive footprints for the resources, we can define positive environments for the human needs. Positive environments are environments in which health of people but also biodiversity are stimulated and therefore are improving; it is more than simply a status quo situation of healthy, comfortable or liveable environments.

FIG. 3.1 Holistic view

All these resources and needs need to be seen in a coherent and holistic view. Decisions related to one resource or human need may have an effect on other resources or needs. Thus, on all levels positive footprints and positive environments should be created. Due to this increased and holistic complexity, traditional methods of analysis and design are no longer sufficient. Computational design, optimisation and analysis techniques in combination with techniques of rapid prototyping enable a paradigm shift in the design of highly performative buildings. Developing such new design and analysis techniques is part of the challenge we try to tackle.

Main research topics

This vision leads to the mission statement of the section. This mission of the section Environmental & Computational Design (E&CD) is to play a key role in scientific research, academic education and in knowledge dissemination concerning the design of comfortable, healthy and climate-proof built environments within the framework of positive footprints, as well as the development and application of (computational) design. This leads to the following research priorities:

- Positive footprints, for energy, water, air, materials, biomass and space
- Climate adaptation and mitigation in the built environment
- Positive (health-stimulating and dynamic) environments (indooroutdoor) and their interactions: thermal, acoustical, visual and air quality
- Performance based design (based i.a. on computational methodologies and the use of new technologies)

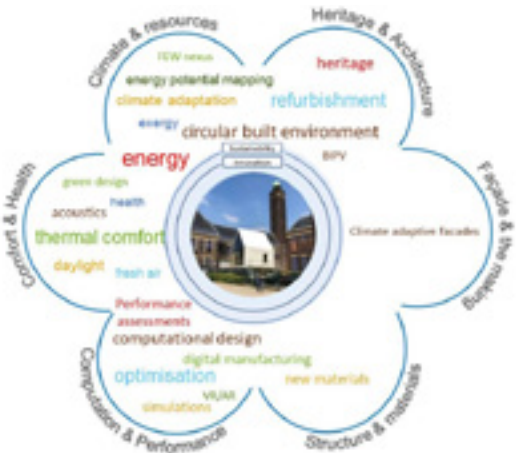

FIG. 3.2 Specific topics addressed within the section

Track record

In the period 2016-2018 many research projects were funded by European and Netherlands national funding partners. All projects were highly related to societal challenges and obviously to the vision of the section. Several large projects were related to energy transition strategies and research (in some cases also including food and water), from local scale to regional scale: City-zen (EU FP7, TU Delft: 1,200 k€), aiming to develop and demonstrate zero-energy cities with a key role for citizens and other stakeholders; PLANHEAT (EU H2020, TU Delft: 291 k€), investigating energy potentials and heating and cooling scenarios for cities; CELSIUS (EU FP7, TU Delft: 260 k€), focussing on smart heat networks, and Smart Urban Isle (EU JPI, TU Delft: 250 k€), investigating neighbourhoods as 'energy isles' by locally balancing the energy system. In these projects, both building measures and energy systems are investigated. Following these projects, several more technical development projects were granted: KoWaNet (TKI UE, TU Delft: 150 k€) investigates the design of local, bi-directional ultra-low temperature heat grids, in relation to building heating and cooling demands and local resources; AC/DC (EU, TU Delft: 240 k€), exploring the use of DC grids in buildings; Movable Nexus (VerDus SUGI, TU Delft: 240 k€), exploring the food-energy-water nexus for sustainable cities.

Several other projects focused on developing innovative solutions on product scale, many of which including aspects of additive manufacturing and computational design: Double Face (NWO RtD, TU Delft: 250 k€), developing a lightweight, translucent, adjustable Trombe wall based on phase change materials, aerogel, additive manufacturing and computational optimisation; ADAM (NWO OTP, TU Delft: 570 k€), developing a sound absorbers based on the principle of quarter wavelength tubes, computational design and additive manufacturing; Spong3D (4TUBouw, TU Delft: 40 k€), developing a mono-material façade component for climate control using additive manufacturing; sound absorbing glass (4TUBouw, TU Delft: 38 k€), developing glass based sound absorbers with micro-perforations; Terra-ink (4TUBouw, TU Delft: 45 k€), developing 3D printed clay elements; Extruder bots (4TUBouw, TU Delft: 30 k€), developing autonomous robots for 3D printing; Solar Urban (TKI, TU Delft: 225 k€), developing building-integrated PV products; IMd project (industry, TU Delft: 26 k€), the development of a robotically 3D-printed pavilion.

With the focus on health and well-being, the following projects are connected: Impekt (TKI UE, TU Delft: 117 k€), investigating the energy saving potential when providing office workers with local comfort control (local heaters and ventilation units); PhD research into improved metrics for daylight glare prediction (FCT funded).

In relation to resources and materials in a circular economy, many different projects were granted within the EIT Raw Materials calls: e.g., SusCritMat (EIT RM, TU Delft: 155 k€), IRTC (EIT RM, TU Delft: 41 k€) and Remanpath (EIT RM, TU Delft: 49 k€) are delivering positive results.

Lastly, various smaller projects on sustainable and circular buildings have been supporting the transition of science to practice. To mention only a few of these: for Strandeiland, a new island in Amsterdam, several locally renewable and innovative energy systems were developed, one of which is being further developed; for ABN AMRO research was carried out for the development of a circular pavilion, now called Circl; for the Lidl supermarket chain a study was executed to develop a roadmap towards total circularity; and Go Design, which is a gaming platform for environmental design. Most recently, a carbon roadmap was developed for TU Delft campus itself, paving the way for becoming fully climate neutral, and a sustainability report was written for the renovation project of the Dutch parliamentary buildings (Tweede Kamer – Parliament 2nd house and Binnenhof – Parliamentary palace).

Apart from the long list of projects, the section has also been active in writing publications, ancillary activities, committees and some awards have been won. The full list of publications can be found in the overview chapter, but important awards that deserve to be mentioned are: the Solar Decathlon Europe 2019 competition, in which the Delft team (MOR) won a world record of 9 awards with their Modular Office Renovation (1st place: Communication & Social Awareness, Innovation & Viability, Energy Efficiency; 2nd place: Circularity & Sustainability, Neighbourhood Integration &

Impact, Engineering & Construction, House Functioning; 3rd place: Comfort Conditions; overall position: 2nd). Andy van den Dobbelsteen became Knight in the Order of the Dutch Lion (2018), ended 3rd in the ABN AMRO Sustainable 50 ranking, and received the KIVI Academic Society Award. Peter Luscuere was awarded the REHVA Professional Award (2017) and the TVVL B.J. Max Award (2017).

Furthermore, research prototypes have been invited to many different and sometimes very prestigious exhibitions. Just to name a few:

The Double Face 2.0 research prototype was exhibited on La Biennale Architettura di Venezia (May 26 - Nov. 25, 2018, Palazzo Mora, Venezia) and on the TU Delft Research Exhibition (June 6-8, 2017, TU Delft). And the Spong3D prototype on the World Architecture Festival (Nov. 28-30, 2018, RAI, Amsterdam), the TU Delft Research Exhibition (June 6-8, 2017, TU Delft), on the Bouwbeurs, (February 6-10, 2017, Jaarbeurs, Utrecht) and on Mind the Step, Dutch Design Week (October 20-28, 2016, Eindhoven).

During the past few years the section has also (further) developed and built three main laboratories: the SenseLab for research into Indoor Environmental Quality; LAMA: Laboratory for Additive Manufacturing in Architecture, which is part of the Sandbox, and The Light Van: a mobile laboratory for research into the perception of daylight.

Heritage & Architecture

Section leader: dr. ir. Wido Quist
Research coordinator: dr. Barbara Lubelli

Organisation, chairs and people

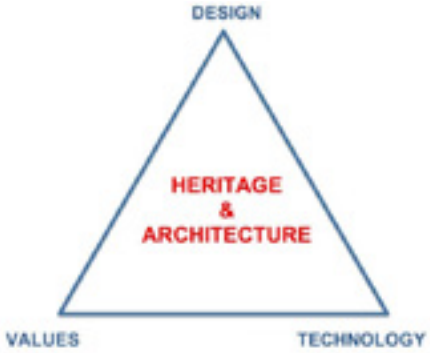

FIG. 3.3 H+A triangle

The Heritage & Architecture section includes three chairs:

- Heritage & Design (H&D) – Prof.ir. Wessel de Jonge
- Heritage & Values (H&V) – Prof.dr. A. Pereira Roders
- Heritage & Technology (H&T) – Prof. dr.-ing. U. Pottgiesser

In the period 2016 -2018 new professors have been appointed for the chairs of H&V and H&T. The Heritage & architecture section is part of the AE+T department and participates in the cross over research program ‘Heritage’.

Research Area

The section Heritage & Architecture focusses on the transformation of built heritage (e.g. conservation, refurbishment, adaptive re-use). Heritage is a key resource to make ‘cities and human settlements more inclusive, safe, resilient and sustainable’ [https://unstats.un.org/sdgs/report/2016/goal-11/]. The Netherlands has a long tradition of adaptive reuse, meaning to preserve historical buildings and simultaneously develop new uses for them. International designers and researchers are increasingly interested in the transformation of built heritage, specifically in innovative approaches that integrate conservation and development. The section H&A aims at strengthening its role in the international debate and practice in this field.

Climate change and the consequent urgent need of energy transitions, migratory flows and demographic changes, social and economic trends are all rapidly transforming cities and posing new challenges to our built heritage. The complexity of the originating challenges requires a comprehensive approach in order to reach effective and sustainable solutions. We believe that only an integral and multidisciplinary approach facilitates tackling the complexity that characterizes the research questions currently being posed.

The section Heritage & Architecture (H&A) concretizes this integral and multidisciplinary approach by gathering and integrating those disciplines which are crucial for effectively dealing with the preservation and transformation of built heritage. The section H&A is developing (in research) and testing (in education) an integral design process, in which the first step is a diagnostic survey on the values (e.g. historic, cultural, social, ecological, & economic) and condition of built heritage. Such a baseline aims to guide designers on the sustainability of their design solutions, and to better control their resource efficiency, innovation effectiveness and impact. Applying innovative technologies and solutions, including design, engineering and materials, should enhance the sustainability of the preservation and transformation of built heritage.

Built heritage has multiple scale levels – ranging from the scale of the landscape and the city, the building and the materials - and this is reflected in the interventions. They can address preservation and adaptive reuse of listed buildings as well as new architecture in historic areas and/or cultural landscapes. The expertise of the section allows for a multiscale approach, able to tackle research questions at the varied scales, as well as, the relation between them.

The section H&A connects to other sections in the AE+T department, by collaboration on research

themes and projects, as well as throughout the faculty, by participation in the research program Design & History (the current cross-over theme Heritage), and cross-university at the Leiden-Delft-Erasmus Centre for Global Heritage and Development.

The section H&A actively promotes the integration of research, practice and education. Most projects secure a strong relation between students, staff and professionals from the heritage field (both practice and policy makers) at national and international levels. The aim is to enable shared learning – exchanging knowledge and experiences – between present and future generations, between practice, research and education, in order to improve scientific and societal impact.

Main research topics

In the period 2016-2018, the research of the section H&A focused on the following research themes:

Heritage values, sustainability and digitalisation

Historical landscapes, ranging from rural and industrial areas to city centres, have evolved as a result of constant spatial and social change. We focus on the investigation of the role of cultural heritage in sustainable urban development, considering the opportunities and challenges raised by the digital century and modern technologies. New integrated assessment frameworks to better monitor and strengthen heritage conservation worldwide are developed and assessed. Novel research methods, integrating quantitative (e.g. big data) and qualitative methods crossing disciplinary boundaries and scales, are explored.

Preservation and adaptive re-use 20th century Cultural Heritage

The 20th century was characterized by rapid demographic, economic, social and technological changes resulting into many new typologies of built heritage, large scale application of new technologies and new materials. Despite the novelty of the 20th century heritage and the fact that the majority of our built environment dates from this period, this heritage is often at risk because of the late recognition of its values and the experimental use of materials and technologies. 20th century built heritage is still underrepresented on heritage registers, from local inventories to the World Heritage. Our aim is to tackle this issue by applying a multidisciplinary and multi-scalar approach to the preservation and sustainable design for adaptive re-use of the 20th century architectural heritage.

Climate change and Cultural Heritage

Global climate change poses new hazards to the built cultural heritage. To tackle these threats, a multidisciplinary assessment of climate vulnerabilities, which takes into account cultural heritage significance and values as well as new possibilities provided by technical innovation, is required. Only in this way can sustainable climate adaptation measures be developed. At H&A we focus on the development and assessment of smart materials and new technical solutions for heritage buildings, seeking a balance between preservation and durability and sustainability of the interventions. Moreover, by the improvement of diagnostic and decision-making processes support tools we aim at increasing our impact in the heritage practice and policy making.

The themes are shown in relation to the department themes in the figure below:

FIG. 3.4 Specific topics addressed within the section

Track record

Projects

Fundamental and applied research at the section H&A is financed by diverse sources including the national government, provinces and municipalities, industries and SMEs, as well as national and international funding agencies and institutes.

A leading example of collaboration between different parties on heritage themes, is MonumentenKennis (290 k€), a long-term cooperation between the chair of Heritage & Technology, the Cultural Heritage Agency of the Netherlands (RCE) and the Netherlands Organization for Applied Scientific Research (TNO) and supported by the Ministry of OCW, set up as programmatic cooperation for the preservation and sustainable renovation of built cultural heritage (www.monumentenkennis.nl). In the field of conservation techniques and new sustainable materials for built cultural heritage, several projects have been granted in the evaluation period. An example is the SELFCRYST project (325 k€) financed by RVO (Netherlands Enterprise Agency) within the program" Self-healing materials". In this project, led by H&A, new self-healing mortars to be applied in heritage buildings have been developed, in collaboration with different universities, industry and practice. Other examples are the EMERISDA (340 k€, www.emerisda.eu) and CHANGES (654 k€, http://www.changes-project.eu/) projects, both financed within the European JPI-CH program.

Another major theme in H&A-research is sustainable preservation and adaptive re-use of the built environment. A major project in this field is KaDEr (k€ 634, see project sheet), funded by the Province of Gelderland and carried out in collaboration with several researchers in other sections within and outside the AE+T department. Besides, H&A actively participated in the research project Beyond the Current, on energy-efficient renovation of multi-storey housing stock, together with the department of Management in the Built Environment and the chair of Architectural Engineering; in this framework of cooperation H&A focused on those architectural and social aspects necessarily involved in the renovation process.

Sustainable conservation of built heritage requires a consistent management plan that considers different aspects, including values, technology and design. Examples of projects focusing on this theme are the Rietveld Schroder Huis project (125 k€, see project sheet), and the TU Delft Aula project (146 k€), both funded by Getty Foundation, within the program "Keeping it Modern"; in these projects conservation management plans, which balance sensitivity to the architect's design intent with the building's complex conservation needs, are designed for two icons of Modernist architecture.

Integration between practice, education and research is the distinctive character of HA-research. The link between academic research and practice is for example established in projects financed by provinces, municipalities and private parties, such as Monumentenwacht, to support, by scientific knowledge, the conservation and adaptive re-use of built heritage. Dissemination of knowledge and education is the aim of the project financed by the Rondeltappe foundation (k€ 170), which resulted in the open access publication of a series of books in the field of built heritage (see list publication).

Laboratory

Recently, the Heritage & Technology laboratory (see section on facilities) has been set-up as a part of the AE+T laboratories to support fundamental and applied research on techniques and materials for conservation and adaptive re-use of built cultural heritage. The laboratory is also used in education activities.

Committees, publications, exhibition, awards

The H&A-section has been active in writing publications, participating in ancillary activities and committees and organizing expositions.

Several papers, published in international peer reviewed journal and books (see list of publications), have contributed to increase the impact of H&A-researchers at national and international level.

Many H&A-researchers are leading and/ or participating in (inter)national groups and committees. For example, Ana Pereira Roders is governing board member of the International Centre on Space Technology for Natural and Cultural Heritage, under the Auspices of the

United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2018-2020), U. Pottgiesser is chairing the DOCOMOMO International Specialist committee on Technology (ISC/T) (2016-to date); Barbara Lubelli is convenor of the RILEM TC 271-ASC (2016- to date); Wido Quist and Rob van Hees are respectively chairman of Docomomo-NL and of WTA-NL-VL (see collaborations) Marie-Therese van Thoor has been member of the “Committee for Architectural Review and Monuments Amsterdam” in the period 2015-2018. Some H&A members are editor-in-chief or associated editors of international journals in the field of cultural heritage (e.g. Journal of Cultural Heritage Management and Sustainable Development, Bulletin KNOB, Studies in Conservation), are regularly invited speakers and part of scientific committees at international conferences (e.g. ICCH, SWBSS2017, Modihma 2018) and members of juries (e.g. Ana Pereira Roder, Regiostars Awards, Category: Cultural Heritage 2018).

In the period 2016-2018 HA members have organized and contributed to several exhibitions, such as “Kyoto Design Lab”, (Faculty of Architecture, TU Delft 30 October – 1 December, 2016), “Amsterdam Housing Heritage” (van Eesterenmuseum, Amsterdam, 9 July-25 September, 2016), “Piet Tauber” (Faculty of Architecture, TU Delft, 30 May – 20 June, 2016), “The future of structuralism”(Faculty of Architecture, TU Delft 27 November 2018).

An important award that deserve to be mentioned is the Award for Excellence from the South African Institute for Architects conferred to Nicholas Clarke for the book “Eclectic ZA Wilhelmiens. A shared Dutch built heritage in South Africa”.

Architectural Technology

Organisation, chairs and people

Before summer 2018, the section AT consisted of five chairs: Architectural Engineering (AE), Design of Construction (DoC), Building Product Innovation (BPI), Structural Design (SD), and Structural Mechanics (SM). That arrangement has since changed, following the merger of the chairs of Structural Design and Structural Mechanics into the Chair of Structural Design & Mechanics (SD&M), under the direction of recently appointed Prof.dr. Mauro Overend. Furthermore, James O'Callaghan has been appointed as part-time professor (0.3 fte) in the newly created chair of Architectural Glass.

Therefore, the current state of the section consists of the following five chairs with their respective Professors:

- Architectural Engineering (AE) – Prof.ir. Thijs Asselbergs;
- Design of Construction (DoC) – Prof.dr.-ing. Ulrich Knaack;
- Building Product Innovation (BPI) – Prof.dr.-ing. Tillmann Klein;
- Structural Design & Mechanics (SDM) – Prof.dr. Mauro Overend;
- Architectural Glass (AG) – Prof. James O'Callaghan.

Research Area

Driven by the need to think differently about resources, energy, power generation, the choice of materials, and user involvement, we see the built environment in a new perspective. Hence, the section focuses on the search for innovative and inspiring solid architectural solutions for social and environmental issues through all scales.

The section focuses on 'The Making' of buildings. One can describe it as the 'hardware' side of architecture ranging from building products, to building construction, façades, structures and architectural Engineering. But nonetheless, we understand that innovation in our field is strongly linked to other disciplines such as climate design, architectural composition, management and civil engineering. Thus, interdisciplinary work is embedded in the genes of the section.

The focus on 'The Making' materialises on a grounded approach to both teaching and researching, that seeks to answer to current and urgent issues, while fostering applied innovation. Thinking, Designing, Prototyping, Evaluating and Adaptating is how we teach and research. Testbed is the real building world. Examples are the Crystal Houses Façade in Amsterdam, Leasing Façade mock-ups, Product Development (PD) Test Lab, and also the project of the AMC Amsterdam Medical Centre. Through that living lab oriented approach we explore relevant and actual topics. We understand the market needs, develop and execute highly relevant research. We keep contact to national and international networks. Our students are well equipped and know the state of art and are known to carry innovative ideas into the practice.

Main research topics

The thematic focus of the section ('The Making') manifests itself across different scales, aspects, and components of the building; defining the specific areas of expertise and topics of interest for each one of the chairs.

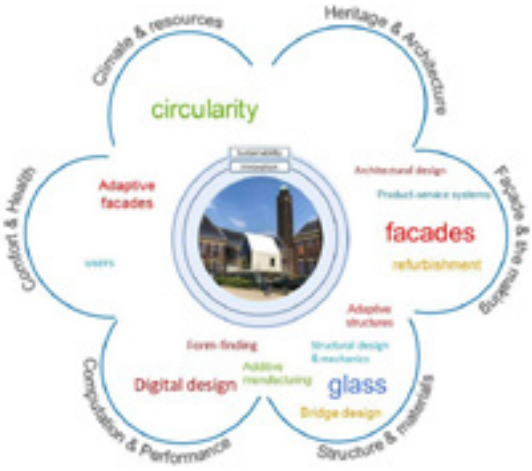

FIG. 3.5 Specific topics addressed within the section

Track record

In the period 2016-2018 many research projects were funded by national and international funding bodies and institutions. These projects are the backbone of the accumulated expertise of the section, reflecting its main areas of interest.

Regarding circularity issues, the section has carried out several research projects, and has a leading role in the Circular Built Environment Hub, a Faculty-wide initiative implemented at the Faculty of Architecture and the Built Environment, to promote interdisciplinary views and boost synergies for research in topics around the circular economy. An example is the Product Development Test Lab (PD Lab - 4TU Bouw Lighthouse grant + funding from industrial partners, 100k€), a test facility for building product innovation, which was itself conceived as a research project to explore the potential of dry connections and reusable materials in a digitally optimised design. Other relevant examples are the different stages of the Façade Leasing Project, initially supported by EIT Climate-KIC through its Pathfinder Grant (2015: 50k€), and sequentially supported by EIT Climate-KIC Demonstrator grants (2016-2017: 56k€ and 2018: 154k€) and the industrial partners of the assembled consortium. The project aims to develop and evaluate a circular business model based on the use of multifunctional façades as performance-delivering tools. Under this scheme, the client is no longer the owner of the building envelope and its integrated building services, but instead leases them from a service provider through a long-term performance contract.

Research on façade design and construction has been represented by several types of projects on adaptive façades and refurbishment. Examples of the former are the Spong3D façade project carried out with members from the section of Climate Design and Informatics and researchers from TU Eindhoven (2016 - 4TU Bouw Lighthouse grant: 35k€), an adaptive 3D printed facade system that integrates multiple functions to optimize thermal performances according to the different environmental conditions throughout the year. Another relevant research experience was the involvement of researchers from the section in the COST Action 1403: Adaptive Facades Network (2015-2018 COST Action Grant), which aim was to harmonise, share and disseminate technological knowledge on adaptive facades at a European level, leading to the development of novel concepts, technologies and new effective evaluation tools and design methods for adaptive facades.

Examples of research on refurbishment topics are the ‘Beyond the Current’ Project, carried out by researchers from TU Delft in cooperation with Utrecht University of Applied Science (2016-2018 – NWO/ STW Research through Design programme: 247k€), which generated design solutions for increasing the energy efficiency of four-storey apartment blocks; and different stages of the 2nd Skin Project, supported by the earlier mentioned EIT Climate-KIC projects Pathfinder and Demonstrator. The main outcome of the project was an easy to install light-weight façade system, designed and tested by researchers from the section and implemented by start-up BIK Bouw. The pilot stage ended with 12 zero-energy renovated housing units, and is now being scaled up to over approximately 183 units.

Glass related research has been carried out by high-profile research projects carried out by the Glass and Transparency Research Group. The most noteworthy examples are the Crystal Houses, in Amsterdam; and the Re3 Glass Project (2017-2018 - 4TU Bouw Lighthouse grant: 50k€). The former consisted of the research and development of a glass brick façade designed by the architecture firm MVRDV. The project has won several design awards and the engineering team was awarded the Outstanding Innovation Award at the FACADE2016 competition. The latter explores the development of a new generation of Recyclable, Reducible and Reusable cast glass components for structural and architectural applications. It was nominated for the New Material Award 2018.

Architectural Façades & Products Research group

During the past decades facade construction has undergone extensive development, due to several causes, starting with the never-ending search for innovative architectural expression, accompanied by a clear trend to more sustainable solutions in terms of energy savings, collecting and decentralized storage. Moreover, more respect is paid to user friendliness, climatic performance

and circularity. Construction and manufacturing methods are becoming increasingly sophisticated; resulting in system based design methods and products. For this reason, the former Façade Research Group, founded in 2005, has recently extended its scope with an additional focus on building product development.

The AF&P research group (2018) is hosted by the chairs Design of Construction and Building Product Innovation. The group has currently 12 PhD researchers and conducts numerous national and international research projects on multifunctional façade construction, refurbishment, additive manufacturing and product service systems.

FIG. 3.6 Specific topics addressed within the section

The group is linked to academic networks like the European façade network (efn), the COST Action TU1403: Adaptive façade network, Circular Built Environment and several individual co-operations with other knowledge institutions. Next to the academic environment, industry is a strong partner in development and research-projects. The AF&P Research Group also edits and publishes the Journal of Facade Design and Engineering (JFDE), indexed in Scopus and the Directory of Open Access Journals (DOAJ), which presents new research results and new proven practice of the field of facade design and engineering.

Glass and transparency Research group

It is only in recent decades that the structural potential of glass has started to be revealed. Combining transparency with a high compressive strength, glass enables us to make diaphanous load-bearing compressive members, from beams and columns to free-standing facades and entire glass structures. Although glass' fabrication boundaries have been continuously expanding, so far, glass structures are still confined to the shapes and dimensions that can be realized by the virtually flat elements fabricated by the float industry. Moreover, despite the fact that glass is fully recyclable, the majority of glass objects are neither reused nor recycled, mainly due to contamination from coatings and adhesives.

The Glass & Transparency Research Group is a joint venture between the Chairs of Structural Design and Mechanics and the chair of Architectural Glass. Its activities focus on the research and development of novel glass solutions for buildings, bridges and other structures. The overarching goal is to develop safe, and at the same time, sustainable glass structures. This means that next to the investigations into the structural performance of glass structures, the possibilities of recycling and re-use of glass components are thoroughly addressed.

The group has gained relevant recognition in the field throughout several high-profile research projects, such as the Crystal Houses and the Re3 Glass projects. Furthermore, within an international academic network on glass structures, the research group is involved in international initiatives such as the Glass Structures & Engineering journal and the international Challenging Glass Conference.

4 – **Participation in faculty-wide and TU Delft research initiatives**

AE+T participates in a number of University and Faculty research programmes and initiatives. This is in line with our strategy to collaborate on our research areas in order to further increase research quality and valorisation.

The collaborations are divided into:

- Inter-departmental themes, i.e faculty themes;
- Inter-faculty collaborations, i.e. University wide collaborations;
- National and international collaboration.

Not all collaborations can be mentioned but the most important ones are presented below:

Faculty themes/crossovers

The AE+T department contributes to the following faculty-wide themes.

Circularity

Circularity in the department has been developed over the past 2 years and is part of the wider faculty and university activity on circular economy transition. The aim of the cross over circularity activity in the faculty is to develop knowledge that contributes towards a circular built environment, enabling the circular design of buildings, cities and infrastructure. The establishment of a faculty wide Circular Built Environment hub (CBE) was initiated in AE&T. The CBE takes a living lab approach, conducting live scale projects and experiments in co-operation with not only researchers but also educators, for profit / not for profit organisations, governmental organisations and civil society.

In the CBE hub we include colleagues from all 4 BK departments, taking a transdisciplinary and systemic approach, considering the different scale levels from region to city, component to materials at the core. Social, technological and economic / value aspects are of major importance.

Across the university the CBE links with faculties Industrial Design Engineering, Technology Policy and Management, 3ME and Civil Engineering. The joint programme with Leiden-Delft in Industrial Ecology is important as well as the connection to the Leiden-Delft-Erasmus Centre for Sustainability. Beyond the Netherlands the CBE hub connects with the BauHow5 network and the Ellen MacArthur Foundation for a Circular Economy where AE&T is the lead for the ‘Pioneer University’ status. Our link with the Bartlett in UCL London is of note. In terms of international action the CBE hub has a seat on various EU Commission working groups on circular actions.

The CBE hub has assessed research income across the faculty for circular activity. The faculty

currently has approx. 6.5m Euro of circular funding in projects with budgets totalling 48m Euro. In the department we see circular projects totalling 2.1m Euro of circular funding in projects with budgets totalling 19.1m Euro. This has all been led and developed in the department over recent years.

One million homes

The one million homes (1M homes) initiative aims at developing a clear vision on the housing challenge. To construct the 1million homes, in an effective and sustainable way, innovation and systemic changes are required. This innovation can only be realised through experimentation and out-of-the box thinking. To successfully address those issues, the synergy of disciplines is essential.

The AE+T department participates at this cross-over faculty initiative, offering expertise in different scales and areas, which can provide answers to the issues the design and construction of the one million homes faces. Such questions are related to the following themes:

- Design and Cultural value: How should the design of the new homes affect the cities heritage?
- Technology: What technological advancements in the construction industry are necessary in order to increase the production capacity, while ensuring good quality?
- Bioclimatic design: What are the design principles for a comfortable and healthy indoor and outdoor climate in the buildings
- Energy transition: How should the new and existing buildings contribute to carbon-neutral built environment by 2050?
- Circularity and Flows: How to save material and resources during the construction and operation of the 1mil homes, and how can they be designed for circularity?

Hence, in the 1M homes crossover is a challenge that brings many themes together with the need to integrate them.

Climate Change

Climate change is a recently defined faculty cross-over. It involves both climate mitigation and adaptation and energy and resource transition challenges.

In all fields, the department has been active already for a long time. This means we are an important contributor to this crossover, which still has to take shape in terms of internal organisation.

Digitalisation

Digitalisation is becoming more and more important in the built environment, with increasing need of new methods, techniques and tools for the design, predictive assessment, construction, control, monitoring, and steering of our built environment and of its users' daily interaction.

The department has its roots in computational methods, techniques and tools for the built environment since 25 years, and contributes to the faculty activity via the already developed experiences. We are currently internationally known in the field of computational design (including e.g. spatial computing; computational design optimization; computational performance assessment and performance data analysis), robotics (including e.g. reconfigurable buildings and robotic construction), digital manufacturing (subtractive and additive) and the interaction of design tools with design processes (including e.g. gaming and VR).

Additionally, the faculty activity "Digitalisation" is currently hosted in the department – to develop a general outline for the theme for the faculty. It leads an action collaboratively transversal to all departments, to boost digitalisation in research and education. The strategy targets the opportunities of both wider applications and new developments of digital methods, techniques and tools, and their interactions with traditional approaches for data collection, design, control, evaluation etc., of smart buildings and cities and the needs of environmental improvements.

Heritage

The section H&A participates in the cross-faculty theme Heritage, in which experts from different fields, ranging from materials science to design, history and theory, collaborate on subjects related

to heritage. Documentation and preservation of building materials, development of sustainable solutions for preservation and transformation of built heritage and landscapes, design of new buildings in existing surroundings as well as related dissemination activities are key elements of Heritage research, design and education.

From 2016 to 2018, H&A members have individually and collectively produced extensive output around the theme of heritage. They have collaborated on projects, grant applications, events and publications. A major example of a collaborative project is KaDer (634K€), a research project financed by the Province of Gelderland, led by the chair of H&D, in which members from different departments contributed with their diverse expertise to the research (see project sheet).

Recently, the appointment of professors Ana Pereira Roders (H&V) and Uta Pottgiesser (H&T) has further strengthened the collaboration. The NWA-funded events at the Mauritshuis “Digital Technologies for Documentation, Conservation and Dissemination and the upcoming 3-day “International LDE-Conference on Heritage and the Sustainable Development Goals” in November 2019 are examples of collaborative dissemination events which will increase the international exposure and bring together academics and practitioners.

University research contributions

Urban Energy Platform

The Urban Energy Platform of the TU Delft is a faculty wide platform where collaboration between researchers from all faculties working on urban energy challenges is boosted. This is essential, as the large-scale energy transition of the urban energy system faces multiple challenges. The platform organises lunch lectures and other events all around the topic, and serve as a connector between different research initiatives from all faculties. The platform is one of the four pillar of the Delft Energy Initiative.

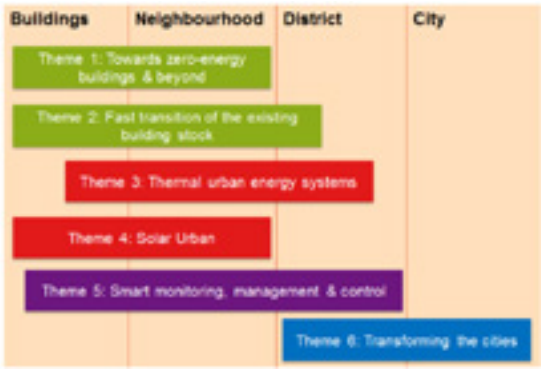

FIG. 4.1 Themes of the urban energy platform

The platform is organised in 6 themes:

1. Towards zero-energy buildings & beyond;
2. Fast transition of the existing building stock;
3. Thermal urban energy systems;
4. Solar Urban;
5. Smart monitoring, management & control;
6. Transforming the cities.

Two theme leaders are from the department of AE+T: Sabine Jansen for theme 1, and Andy van den Dobbelsteen for theme 6. Also in the other themes the department is highly involved.

See also: https://www.tudelft.nl/tu-delft-urban-energy/

The Green Village

The Green Village is TU Delfts ‘Living lab for sustainable innovation’. It is located where the former architecture faculty building used to be, and now houses many innovative pilot projects in their last phase to be market ready. Also, from our department several pilot projects have been built on the green village. Two solar decathlon competition project van be found there: Pret a-loger (from 2015) and MOR (2019), being 3rd and 2nd prize winners.

The collaboration with the Green Village enhances our connection to society and creates the opportunity to test innovative sustainable proposals towards market ready solutions. One project, CONVERGE is awarded, bringing a variety of companies together with 2 faculties of TUD: 3mE and Architecture trying to climatise a glass building as passively as possible.

5 – **Main national and international research collaborations**

The AE+T research programme has many partners in civil society, government, the profession and industry across the Netherlands. We also have many international links in all EU member states, other European countries and in Latin America and Asia, especially China. We list here only the most significant partners.

Amsterdam Institute for Advanced Metropolitan Solutions (AMS)

AE+T has a central role in the joint TU Delft, Massachusetts Institute of Technology (MIT) and Wageningen University and Research (WUR): the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). The Institute was initiated by the Municipality of Amsterdam and is located in the city of Amsterdam. Andy van den Dobbelsteen is Principal Investigator of the AMS institute and thereby closely connected to its work and objectives.

The following projects were carried out in collaboration with AMS: Buiksloterham Integrated Energy System (BIES), City-zen and Moveable Nexus (M-NEX).

Contact: Andy van den Dobbelsteen.
Website: https://www.ams-institute.org

KNOB

The KNOB, the Royal Netherlands Society of Built Heritage, is the oldest national heritage organisation in the Netherlands (since 1899). The KNOB stimulates the exchange of scientific and policy knowledge in the field of spatial heritage. In order to achieve this goal, the KNOB publishes the Bulletin KNOB, a respected scholarly journal that appears four times a year and is recognized in the Netherlands and abroad as an important source of knowledge in the field of spatial heritage. The journal is double-blind peer reviewed and indexed by Scopus and the Emerging Sources Citation Index.

Contact: Marie-Thérèse van Thoor.
Website: https://knob.nl

Glass

The glass and transparency group collaborates closely with other academic partners at TU Delft and internationally: At TU Delft, the group has strong links with colleagues in Materials Science and Civil Engineering, including shared laboratory resources; Internationally, the group collaborates with other centres of excellence (e.g. Cambridge, TU Ghent, TU Dresden, TU Darmstadt and DTU Copenhagen) for research activities such as the Challenging Glass conference series and the successful scientific journal “Glass Structures and Engineering” published by Springer.

The group also has strong links across the glass knowledge and supply chains in industry ranging from local SMEs (e.g. Van Noordenne group, IFS-SGT etc.) to multi-national glass producers (e.g. AGC, NSG Pilkington, Corning etc.) to Architects (Carpenter Lowings, MVRDV etc.) and engineering designers (Arup, Eckersley O’Callaghan, ABT etc.) to end-users (e.g. Apple, Permasteelisa, etc.).

IEA contributions

The International Energy Agency support several research programmes, which are mainly undertaken through a series of research projects, so-called ‘Annexes’. In these annexes international researchers can work together on research topics.

In 2016-2018 the department has been involved in two of these annexes:

— Annex 64 on ‘low exergy communities’ collaborated on the development of community energy systems based on exergy principles. The section Climate Design was involved as work package leader of Subtask A: demand and contributed to final guidebook, i.a. to chapter 3: ‘Exergy thinking and Exergy analysis framework’, presenting simplified approaches on how to include exergy thinking in the development of sustainable energy systems for the built environment. The project was finalised in 2018.
— Annex 75: Cost-effective Building Renovation at District Level Combining Energy Efficiency & Renewables.

Annex 75 sets of to investigate cost-effective strategies for reducing greenhouse gas emissions and energy use in buildings in cities, at district level, combining both energy efficiency measures and renewable energy measures. The objective is to provide guidance to policy makers, companies working in the field of the energy transition, as well as building owners for cost-effectively transforming the city’s energy use in the existing building stock towards low emission and low energy solutions. Staff members of the AE+T department are co-leading the development of the subtask D: Policy Instruments, Stakeholder Dialogue, and Dissemination.

COST actions

A COST Action is a network dedicated to scientific collaboration, complementing national research funds. To enable and enhance this collaboration, funding is available for a range of networking tools (such as meetings, conferences, workshops, short-term scientific missions, training schools, publications and dissemination activities). The department is involved in one COST Action: TU1403 ‘Adaptive Facades Network’ (2014-2018). The main objective of this action is to harmonise, share and disseminate technological knowledge on adaptive facades at a European level. This shall lead to increased knowledge sharing between European research centres and between these centres and industry, the development of novel concepts, technologies and new combinations of existing technologies for adaptive facades, as well as the development of new knowledge such as effective evaluation tools / design methods for adaptive facades. These objectives fit the expertise the AE+T department, whose members have actively participated in the Action’s working groups, regarding content development, meetings and training schools organisation, and authoring of publication.

European façade network (EFN)

The EFN seeks to advance and promote façade design and engineering at a European level and beyond. This is achieved through inclusive collaborative working between its members and alumni, resulting in skills and knowledge transfer/ sharing in educational programmes, workshops, conferences and other dissemination activities. The Architectural Facades & Products research group of the AE+T department has been a founding member of the network. It currently includes 10 international universities, which conduct education activities on the field of façade design. This cooperation was also the base of the annual conference cooperation “the future envelope” between Bolsa,, San Sebastian and Delft as well as the base for a Cost action “the adaptive façade network”.

UCL Bartlett

As part of the developments between TU Delft and University College London on closer working, David Peck and Ben Croxford (UCL) have been developing joint activity. This is part of the specific drive of the collaboration between the faculties of Architecture and Built Environment BK (TUD) and The Bartlett (UCL). The focus is around Circular Built Environment, and is a further development of the BauHow5 network of Architecture faculties. Both Ben and David are ‘Honorary Appointments’ in each other’s faculties.

BauHow5

Within framework of the Bauhow 5 collaboration, we have participated in a number of activities.

FIG. 5.1 BauHow5 meeting on circularity

An important one was the symposium “Approached to Circularity” in Jun 2018, which was organised by the TUDelft’s Circular Built Environment hub, in collaboration with the BauHow 5 partner universities. Approximately 100 people attended the event, where the experience of the different countries regarding the transition to circular economy in the built environment.

Rilem

TC 271-ASC A RILEM technical committee is a group of international experts working together in a particular field in order to assemble and evaluate research data, harmonise testing methods, suggest new topics for research and to promote their conclusions by publishing recommendations, technical reports or state-of-the-art reports for test methods or construction practice. The RILEM TC 271 ASC includes 30 members from 18 countries and aims at developing an improved test procedure for the assessment of the durability of buildings materials to salt decay.

Contact: Barbara Lubelli.
Website: www.rilem.net/groupe/271-asc-accelerated-laboratory-test-for-the-assessment-of-the-durability-of-materials-with-respect-to-salt-crystallization-355

4TU Centre of Excellence for the Built Environment

AE+T plays an important role in the 4TU Centre of Excellence for the Built Environment. 4TU.Bouw is a cooperation of the building departments of the universities of technologies in the Netherlands (Delft, Eindhoven, Twente, Wageningen). 4TU. Bouw supports the main objectives of the 4TU. Federation, namely:

1 More close collaboration between Dutch universities to increase competitiveness in international research and education.
2 Concentrating research and education to improve efficiency and scientific excellence.

This collaboration has led to the acquisition of a large number of research projects within the Lighthouse framework by researchers from AE+T.

Contact: Ulrich Knaack.
Website: https://www.4tu.nl/bouw/en

Valorisation and Impact

In addition to the departmental research and educational activities, valorisation is one of the full core activities of the university and key to that is the impact which results. In TU Delft valorisation is the creation of social and economic value which is derived from academic knowledge. This is often termed as the 'impact' of research. This means the integration of new knowledge generated, the resulting improvements in innovation capacity, strengthening the competitiveness and growth of companies, delivering innovations into the market. Increasingly, valorisation impact is concerned with environmental and social actions which are realised through projects.

As shown in the track record paragraph of each section, many of our projects have a close link with society and have actually resulted in innovations which have been put onto the market.

Many projects are carried out in collaboration with local governments, i.a. City-zen, Smart Urban Isle, in relation to the energy transition challenges, KaDEr in relation to heritage.

An example on product innovation is the "2nd SKIN: Zero-Energy Renovation" EIT-Climate Demonstration and Scaler Projects, where AE+T is participating. Within this project the renovation of 12 zero-energy apartments and 180 zero-energy-ready apartments was realised in Vlaardingen, the Netherlands. Another example of local governmental engagement is H2020 Pop-Machina which partners with municipality Venlo, along with 6 other city municipalities around Europe.

Valorisation is not only important on the project level, also there are the insights given to society and the active participation of our academic staff in societal issues, such as committee or jury member, where there is a significant aspect of valorisation. For example Andy van den Dobbelsteen became Knight in the Order of the Dutch Lion (2018), ended 3rd in the ABN AMRO Sustainable 50 ranking, and received the KIVI Academic Society Award. Peter Luscuere was awarded the REHVA Professional Award (2017) and the TVVL B.J. Max Award (2017).

Lastly also our publications create impact. Of note is the Journal of Façade Design and Engineering (JFDE), initiated and edited by the section of Architectural Technology. The JFDE presents new research results and new proven practice in the field of facade design and engineering. The journal is managed by the Architectural Facades & Products Research Group at AE+T. Within the period 2016-2018, the journal has published three volumes and a total of 24 scientific, peer-reviewed articles. The JFDE is since 2017 indexed in the Scopus database and has been ranked Q1 in the field of Architecture by the Scimago Journal & Country rank, with a SJR factor of 0.325 and an impact factor of 0.91, considering the average number of citations for the articles of the past two years.

FIG. 5.2 2nd Skin - Façade Refurbishment for Multifamily Social Housing. Picture: Marcel Bilow

6 – **PhD**

Applications

All applications are be made through the Graduate School and after that reviewed by a reviewing committee of the department.

www.bk.tudelft.nl/en/research/graduate-school-a-be/

TABLE 6.1 PhD projects finalised period 2016-2018 (first promotor situated in AE+T)

NAME	TITLE PHD	DEFENCE
Dr. Alejandro Prieto	COOLFACADE: Architectural Integration of Solar Cooling Technologies in the Building Envelope	21/11/2018
Dr. Nico Tillie	Energetic Communities: Planning support for sustainable energy transition in small- and medium-sized communities	28/09/2018
Dr. Babak Raji	Sustainable High-rises: Design Strategies for Energy-efficient and Comfortable Tall Office Buildings in Various Climates	06/09/2018
Dr. Jochen Krimm	Acoustically effective Façades	06/07/2018
Dr. Mauricio Beltran	Smart Energy Dissipation: Damped Outriggers for Tall Buildings under Strong Earthquakes	18/06/2018
Dr. Qingpeng Li	Form Follows Force: A theoretical framework for Structural Morphology, and Form-Finding research on shell structures	12/03/2018
Dr. Leyre Echevarria Icaza	Urban and regional heat island adaptation measures in the Netherlands	08/12/2017
Dr. Merve Bedir	Occupant behavior and energy consumption in dwellings: An analysis of behavioral models and actual energy consumption in the Dutch housing stock	04/12/2017
Dr. Lidewij Tummers	Learning from co-housing initiatives: Between Passivhaus engineers and active inhabitants	25/10/2017
Dr. Christian Wiegel	Thermal comfort in sun spaces: To what extend can energy collectors and seasonal energy storages provide thermal comfort in sun spaces?	12/10/2017
Dr. Giovanni Borsoi	Nanostructured lime-based materials for the conservation of calcareous substrates	27/09/2017
Dr. Alireza Mahdizadeh Hakak	Enhancing Spatial Creativity: Enhancing creativity of architects by applying unconventional virtual environments (UVEs)	04/07/2017
Dr. Thomas Henriksen	Advancing the manufacture of complex geometry GFRC for today's building envelopes	23/06/2017
Dr. Tony Maragakis	Sustainable Academia: Translating the Vision of a Fully Sustainable University into a Measurable Reality	04/04/2017
Dr. Remco Looman	Climate-responsive design: A framework for an energy concept design-decision support tool for architects using principles of climate-responsive design	27/01/2017
Dr. David Peck	Prometheus Missing: Critical Materials and Product Design	18/11/2016
Dr. Achilleas Psyllidis	Revisiting Urban Dynamics through Social Urban Data: Methods and tools for data integration, visualization, and exploratory analysis to understand the spatiotemporal dynamics of human activity in cities	01/11/2016
Dr. Pirouz Nourian	Configraphics: Graph Theoretical Methods for Design and Analysis of Spatial Configurations	30/09/2016
Dr. Noortje Alders	Adaptive thermal comfort opportunities for dwellings: Providing thermal comfort only when and where needed in dwellings in the Netherlands	16/09/2016
Dr. Laura Kleerekoper	Urban Climate Design: Improving thermal comfort in Dutch neighbourhoods	01/07/2016
Dr. Ahmed Hafez	Integrating Building Functions into Massive External Walls	06/06/2016
Dr. Ahu Sökmenoğlu	A Knowledge discovery approach to urban analysis: The Beyoğlu Preservation Area as a data mine	23/05/2016
Dr. Christina Sager	Energetic Communities: Planning support for sustainable energy transition in small- and medium-sized communities	20/04/2016
Dr. Wim Kamerling	Composite hollow core vaults: An analysis of the Fusée Céramic System and the design of form-active environmental friendly roofs	08/04/2016

TABLE 6.2 Ongoing PhD projects (first promotor situated in AE+T)

NAME	TITLE PHD	DEFENCE
Bert van Bommel	Verantwoord ingrijpen in monumenten; onderzoek naar de methodologie van het ontwerpen van een ingreep in een monument	01/01/2008
Nicholas Clarke	How Heritage Learns. An Ecosystemic Assessment of Energy Use Reduction, Economy and Thermal Comfort (2E+CO) Renovations of Valorized Monumental Housing Complexes in the Netherlands	01/02/2011
Xiaoyu Du	Space Design for Thermal Comfort and Energy Efficiency in Summer	01/07/2011
Tijjani Zubairu	Building Performance Assessment Using Computational Intelligence (BPACI)	08/06/2012
Ioannis Chatzikonstantinou	ICDA: Interactive Computational Decision Support for Architecture	24/09/2012
Joris Smits	The Art of Bridge Design: Identifying a Design Approach for Well-integrated, Integrally-designed and Socially-valued Bridges	01/10/2012
Sanne Granneman	Mitigating salt damage in lime-based mortars by built-in crystallization modifiers	01/03/2013
Max Visser	Combinisme. Integraal Architectonisch Denken van Stad tot Stoel. Aanzet tot een ruimtewetenschap(actie)filosofie	09/04/2013
Dora Chatzi Rodopoulou	European Industrial Heritage Reuse in Review	01/10/2014
Raquel Viula	A Multivariable Approach to the Analysis of Visual Comfort of Classrooms with Daylight	01/12/2014
Foteini Setaki	Acoustic Design by Additive Manufacturing	01/01/2015
Ding Yang	Design as Exploration: Multi-objective and Multi-disciplinary optimization (MOMDO) of indoor sports buildings	14/04/2015
Bob Geldermans	Securing Renewability of Resources in the Built Environment. Fit-out Materials in Open Building Retrofit	01/05/2015
Minyoung Kwon	Optimum Floor Plan Design for Energy Efficient Office Building Renovation	01/09/2015
Phan Anh Nguyen	From Vernacular Dwellings to Green House: The Impacts of Environmental Design on the Living Environment of the People in Central Hanoi	01/09/2015
Tatiana Armijos Moya	Improving Indoor Environment and Energy Performance in Offices	01/11/2015
Dejian Peng	Improving the Performance of Hospitals: An Architectural Analysis of Patient Journeys in China	01/01/2016
Miktha Farid Alkadri	Solar Geometry in Performance of Built Environment: A Design Method for Analysing the Existing Environment by Making Use of Solar Envelopes and Point Cloud Data	01/06/2016
Sara Lindner	Cradle to Cradle im Holzfertigbau – Entwicklung und Evaluierung einer Methodik zur Umsetzung eines Cradle to Cradle inspirierten Einfamilienhaus in Holzfetigbayweise	01/06/2016
Berk Ekici	Computational Intelligence in Decision Making for Self-Sufficient High-Rise Buildings	01/08/2016
Dadi Zhang	Individual Control Devices for Local Acoustic Improvement in Classrooms	01/09/2016
Faidra Oikonomopoulou	Innovative Applications of Structural Glass in Architecture	01/01/2017
Tiantian Du	Automatic Generation of Architectural Space Layout to Optimise the Energy Performance of Office Buildings	01/01/2017

Cemre Çubukçuoğlu	Configurational Layout Optimization for Hospital Design	01/03/2017
Zoheir Haghighi	The Development of Integrated Architectural Solar Elements for Buildings	01/03/2017
Paul Denz	Smart Textile Skins: Functional and Constructional Integration of Smart Textiles into the Building Skin	01/05/2017
Ahmed Felimban	Envelope Integrated Strategies for Solar Management in Jeddah, Saudi Arabia	01/09/2017
Luuk Graamans	Vertical: The Building Design, Systems Design and Performance Analysis of Plant Factories for Urban Food Production	01/01/2018
Nick ten Caat	The FEW Nexus Paradigm in the Built Environment	01/04/2018
Peter Eigenraam	Prefabricated Freeform Shell-like Structures	01/04/2018
Juan Azcarate	Facades-as-a-Service: A Strategic Investment Model for the (Re)Development of Circular Façades	01/07/2018
Adam Pajonk	Investigation of the Potential of Additively Manufactured Functionally Graded Materials for Façade Design	01/09/2018
Ana Tarrafa Silva	Bridging Heritage Conservation and Urban Development	01/12/2018

7 – **SWOT analysis**

Strengths

- Integral approach due to solid body of knowledge on different fields;
- Large & well mixed portfolio of research projects (national, international, industry, government);
- Good collaboration within department;
- Good strategic collaborations with (inter) national partners;
- Recognised by industry and government;
- Excellent international reputation as evidenced by field specific rankings;
- Integrating research and education (MSc BT);
- Supporting talent development;
- An increasing number of staff hold a doctorate.

Weaknesses

- Fixed number of chairs (limiting career development);
- No permanent positions on temporary money;
- Gender and diversity imbalance in all academic profiles;
- Much time is spent on writing research proposals.

Opportunities

- Topics of energy transition, climate change, circularity, heritage and digitalisation are highly societally relevant;
- Design and engineering are increasingly accepted as mature academic activities;
- ‘Top Sector’ policies on Creative Industries and Urban Energy are leading to more national research funding in these key areas;
- With the large number of PhD’s and international activities of our academic staff, the faculty is becoming a centre for research beyond the NL and beyond Europe.

Threats

- Financial framework becoming tighter in the near future;
- Research funds become ever more competitive;
- Lack of tenure prospects for promising young researchers;
- Work pressure, which can lead to less time for making the most of our research projects (in terms of output);
- Work pressure can also lead to less time for creating a shared vision and shared ideas.

8 – **Summary and closure**

This midterm document has described our current developments and status of mission, vision, strategy as well as organisation. It has also highlighted our most important achievements in the review period of 2016, 2017 and 2018. We consider the research of our department of high societal relevance, covering the important themes of climate and resources, comfort and health combined with a focus on developing solutions ('the making' of things, which not only applies to façades but also to other innovations developed) and Performance based Computational design, and of course, considering the existing building stock including heritage.

FIG. 8.1 Specific topics addressed within the section

Hence, we think we are well on our way towards our vision of being world-leading in innovation for a sustainable and healthy built environment. The achievements in the review period in terms of projects, publications and valorisation supports this view. Following our strategy, we aim to further improve this by means of creating a safe and inspiring working environment (i.e. further increasing coherence and collaboration within the department and tackling the challenges of workload), continue collaboration with leading national and international partners, integrate research and education, and further professionalise and coordinate our funding and publication strategy.
We are looking forward to the feedback and discussion with the reviewers on these topics.

9 – **Research projects AE+T**

AMC Revisited

1980-2020-2050

Funder | Programme [grant number]
Amsterdam UMC

Overall budget
€ 70.000

Grant amount
Total: € 70.000

Role TU Delft
Lead partner

Duration
03-2018 > 02-2020

TU Delft researchers (by design)
Prof.dr.ir. Thijs Asselbergs
Prof.dr.-ing. Tillman Klein
Prof.dr. Andy van den Dobbelsteen
Prof.dr.ir. Alexandra den Heijer
Prof.ir. Peter Luscuere
Ir. Annebregje Snijders

Project partners
Delft University of Technology [BK / Management in the Built Environment]
Amsterdam Institute for Advanced Metropolitan Solutions (AMS)
Chief Government Architect (Atelier Rijksbouwmeester -ARBM)
Municipality of Amsterdam

Contact person
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LEFT: AMC 1982.
RIGHT: AMC renewal > towards 2050

The AMC in Amsterdam is the largest academic hospital in the Netherlands and comprises of about half a million square meters of floor space. The design dates back to the end of the seventies and is from the Dutch architects van Mourik and Duintjer. In addition to buildings, covered streets and squares, the complex also includes the medical faculty of the University of Amsterdam.

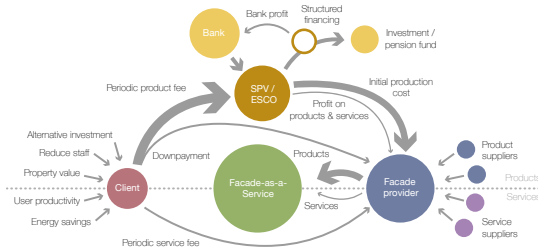
The facades of the 40-year-old AMC are due for renovation. A lot of preliminary research has been done in recent years. AMC is faced with the historical choice about what to do. How do lifetime, circularity, energy requirements, indoor climate and facade renewal influence each other? How to balance with sizeable investments? At the same time, AMC has an architectural value and will become a monument, how to deal with that?

Students, lecturers and researchers from BK TU Delft work together to develop design ideas as breeding ground for the agenda of design-innovation.

Façade Leasing “technology” pilot project at the EWI building, TU Delft, 2016-2017. Credits: Marcel Bilow, 2017

Façade Leasing Demonstrator Project

A cross-disciplinary model for the (re)development of circular Façades-as-a-Service



Façades-as-a- Service model, showing stakeholder relations, activities, and forms of value creation in a service-based façade contracting model (Azcarate-Aguerre et al., 2018)

Acronym
FLDP

Funder | Programme [grant number]
EIT Climate-KIC | *Urban transitions* [kava 2.7.3]

Overall budget
Demonstrator phase (2018-2019): € 4.700.000

Grant amount
Total 1st and 2nd phases: € 170.000
TU Delft part 1st and 2nd phases: € 100.000
Total 3rd (Demonstrator) phase: € 465.000
TU Delft part 3rd (Demonstrator) phase: € 251.000

Role TU Delft
Lead partner

Duration
1st and 2nd phases: 03-2015 > 12-2016
3rd (Demonstrator) phase: 01-2018 > 12-2019

TU Delft researchers
Prof.Dr.-ing. Tillmann Klein [initiator | AE+T]
Arch.Ir. Juan F. Azcarate-Aguerre [project lead | AE+T]
Prof.Dr.Ir. Alexandra den Heijer [initiator | MBE]

Project partners
TU Delft Campus Real Estate, The Netherlands
TU Munich, Germany
University of Exeter, UK
OfficeVitae, The Netherlands
Alkondor Hengelo BV, The Netherlands
Houthoff, The Netherlands
ABN AMRO Lease, The Netherlands
Instituut voor Bouwrecht, The Netherlands
Het Opdrachtgeversforum in de Bouw, The Netherlands

Contact person
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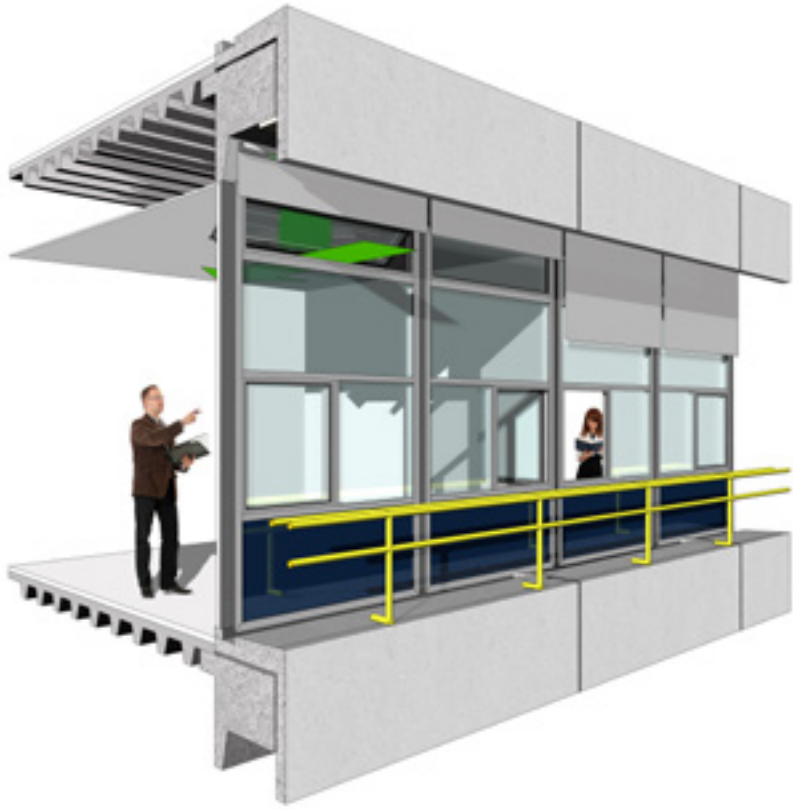
The built environment is a major contributor to climate-change and other environmental degradation indicators on a global scale. The increasing demand for energy and resources required to meet the needs of growing urban populations with rising living standards, together with the deteriorating condition of the existing building stock, are set to increase this negative environmental impact even further in the coming decades. Innovative business and supply models are needed to revert this process, enabling a Circular Economy transition in which economic growth and rising living standards are decoupled from accelerating primary material extraction and waste generation.

The Façade Leasing Demonstrator Project is the third stage in an innovation series supported by EIT Climate-KIC since 2015. It explores the implementation of a circularity-enabling business model for the performance contracting of energy-efficient building envelopes.

Façade Leasing “process” demonstrator project focusing on financial, legal, and managerial drivers and barriers to implementation. Built at the CiTG building, TU Delft, 2018-2019. Credits: Juan F. Azcarate-Aguerre, 2019



Facade engineering concept for the CiTG Façade Leasing "process" demonstrator project 2018-2019. Credits: Juan F. Azcarate-Aguerre, 2018

The current project stage focuses on identifying practical barriers to the implementation of Product-Service Systems, such as Facades-as-a-Service, in the Dutch and European construction sectors. It does so by studying four different perspectives of the Circular Economy transition in the context of façade contracting: Financing, management, technology, and building law. It then proposes targeted solutions to overcome barriers in these different fields, based on lessons learnt from the development of a Façade Leasing Demonstrator project – currently under construction – at the building of the faculty of Civil Engineering and Geo-sciences, at TU Delft. The outcome of the project is the elaboration of a "Façade Leasing model contract", founded on the principles of long-term collaboration and the sharing of aligned economic and ecologic incentive between real estate operators (clients) and Facades-as-a-Service providers (suppliers).

This strategy could decrease the initial investment required for the renovation and construction of high-performance building envelopes. This could, in turn, increase the rate and depth of technical improvement in both new buildings and building energy renovations, leading to the update of a large volume of buildings across Europe which are in urgent need of technical retrofit. Façade Leasing could, meanwhile, accelerate the market uptake of new building technologies, and optimize the reuse and recycling of components and materials within the construction industry, by keeping these technologies in the hands of their manufacturers.

Further information
www.tudelft.nl/facadeleasing

Glass Marble: Recycled glass artware, slowly cooled down to form glass ceramics.

Re3 Glass

A Reduce, Reuse, Recycle strategy for a dry-assembly building system out of waste glass

Funder | Programme [grant number]
4TU. Bouw | *Lighthouse grant*

Overall budget
€ 50.000 + material sponsorship
Since 2018, the programme is supported by the TU Delft Glass Lab resources; material contributions are made by AGC Glass Europe, Sibelco, Maltha Recycling, Royal Leerdam Crystal, Cricursa and Coolrec.

Grant amount
Total: € 50.000 [4TU. Bouw Lighthouse 2017]
TU Delft part: € 46.000

Role TU Delft
Lead partner

Duration
01-2017 > Ongoing

TU Delft researchers
Ir. Faidra Oikonomopoulou [Initiator and project leader]
Ir. Telesilla Bristogianni [Initiator and project leader]
Dr. Fred Veer [Scientific advisor]
Ir. Rong Yu [Laboratory assistant]
Ir. Lida Barou [Designer 2017-2018]
Ir. Tommaso Venturini [Laboratory assistant 2018-2019]

Project partners
University of Twente, NL [Collaboration in 2017 as part of the 4TU.Bouw grant]
Southern Illinois University, USA [Collaboration between 10/2017-12/2017]

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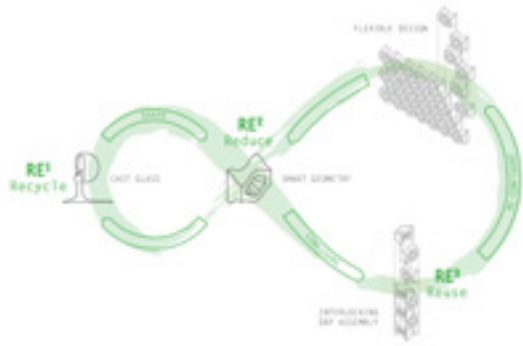
4TU.Bouw

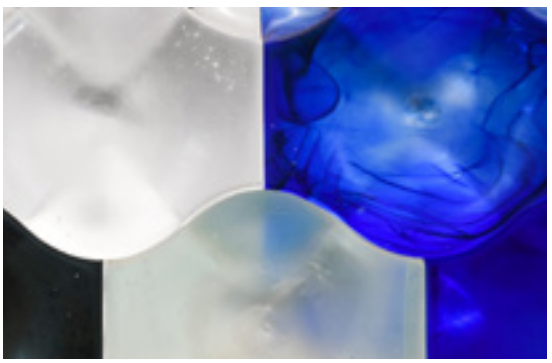


Re3 Glass Concept

Although glass can take almost any shape and colour envisioned, in the field of structural glass, the material is mainly conceived as a 2D transparent element. Escaping this two-dimensionality, the Crystal Houses Façade in Amsterdam, designed by MVRDV and developed by the TU Delft structural glass research group, proved the architectural and structural potential of cast glass in creating three-dimensional, robust and freeform all-glass structures. The Re3 Glass project continues in this path, enhancing the system's sustainability performance and tackling previously faced challenges such as the excess material use, the permanent bonding & the non-recyclability of glued components. For the casting of the components, waste glass is employed.

Currently, despite the common notion that glass is 100% recyclable, the majority of everyday discarded glass objects are neither reused nor recycled. In fact, recipe mismatching or contamination from coatings or adhesives result in the down-cycling or disposal of otherwise topquality glass. Through the project, everyday glass waste, from Pyrex® trays and artware, even mobile phone and computer screens, are redirected from the landfill to the building sector. In addition, cavities and notches are introduced to the design, to achieve lightweight yet strong components and reduce the required material and CO2 emissions during production and transportation. Finally, the developed interlocking shapes result in a stable and stiff system, while circumventing the use of adhesives. This allows for easy assembly and disassembly, and favours the reuse and recyclability of the components.

Bone Capsule: Two component interlocking system out of recycled windows and artware.



Osteomorphic: Interlocking system out of recycled window panes, crystalware, artware, CRT screens and optical lenses.

Following this threefold approach, experiments at the TU Delft Glass Lab with different geometries, glasses and cooling techniques, have resulted in a wide range of clear, coloured, translucent and opaque, marbled glass elements that can form circular, strong & aesthetically intriguing structures.

The project was nominated for the New Material Award 2018 and exhibited at Venice Design 2018, Dutch Design Week 2018, Milan Design Week 2019 & Vitra Schaudepot.

EMERISDA

Effectiveness of Methods against Rising Damp in Buildings

Acronym
EMERISDA

Funder | Programme [grant number]
EU | *Joint Programming Initiative in Cultural Heritage and Global Change*

Overall budget
€ 596.194

Grant amount
Total: € 578.079
TU Delft: € 50.000

Role TU Delft
Project partner

Duration
01-2014 > 01-2017

TU Delft researchers
Dr. Barbara Lubelli [lead]
MSc. Jan Bolhuis
Prof.ir. Rob van Hees
MSc. Linda Miedema

Project partners
Belgian Building Research Institute, Belgium [lead]
Cultural Heritage Agency, The Netherlands
Institute of Atmospheric Sciences and Climate - Italian National Research Council, Italy
Universita' Ca' Foscari, Italy
Restauri Speciali (SME), Italy
Diasen (industry), Italy

Contact person
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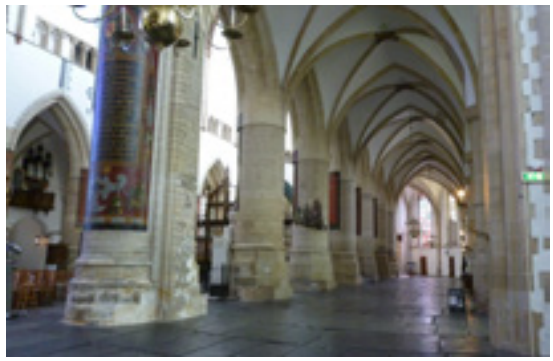


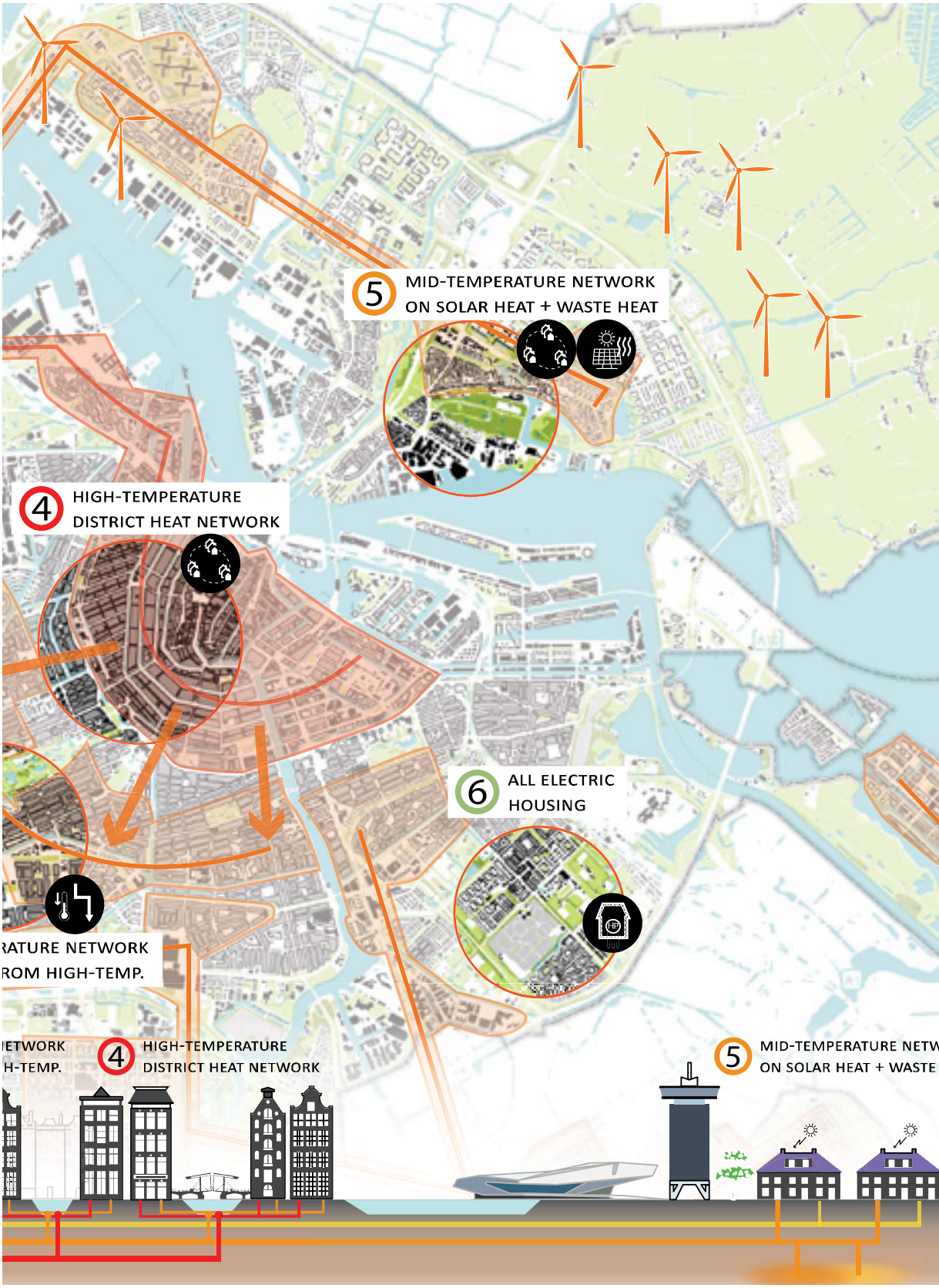
Damage to the stone columns of the St Bavo church in Haarlem (The Netherlands) due to the presence of rising damp and salts

Rising damp is a recurrent hazard to heritage buildings and its relevance is expected to increase in the future, due to climate changes. The wide and differentiated offer of products and methods against rising damp, together with the scarce and fragmented scientific information on their effectiveness, make it difficult (even) for the professionals working in the field to choose a suitable intervention on a sound basis.

The aims of the EMERISDA project are to come to a scientifically based evaluation of the effectiveness of different methods against rising damp and to a define a decision support tool for a conscious choice and application of these methods in the practice of conservation.

The co-operation between research institutes, conservation authorities and SMEs guarantees easy access to documentation on case studies, independent and scientifically based evaluation of interventions, and successful dissemination of results.

Further information
www.emerisda.eu



Amsterdam Energy Transition Roadmap flyer (detail)

City Zero [carbon] Energy

A balanced approach to the city of the future

Acronym
City-zen

Funder | Programme [grant number]
EU | *FP7-ENERGY - Specific Programme "Cooperation": Energy* [608702]

Overall budget
€ 32.000.000

Grant amount
Total: € 32.000.000
TU Delft [CD&S] : € 550.000

Role TU Delft [CD&S]
Project partner and leader of work package WP4 and task T4.2 & T9.3.2

Duration
03-2014 > 12-2019

TU Delft researchers [CD&S]
Prof.dr.ir. Andy van den Dobbelsteen [Lead]
Dr. Craig Martin
Ir. Siebe Broersma
Ir. Michiel Fremouw
Ir. Tess Blom

Project partners
Vito [lead partner]
Amsterdam Smart City
Utrecht University
Westpoort Warmte
Alliander
Hespul
Queen's University Belfast
TH!nk E
DNV.GL
Waternet
NeoSmart
Sanquin
Amsterdam Economic Board
Daikin
Siemens
University of Siena
Municipality of Grenoble
Commissariat a l'énergie atomique
Compagnie de chauffrage de Grenoble
Gaz et Électricité de Grenoble
Atos Worldgrid
Clicks and Links Ltd
AEB
Grenoble's lical energy and climate agency
Grenoble Alpes Métropole
Greenalp

Contact person
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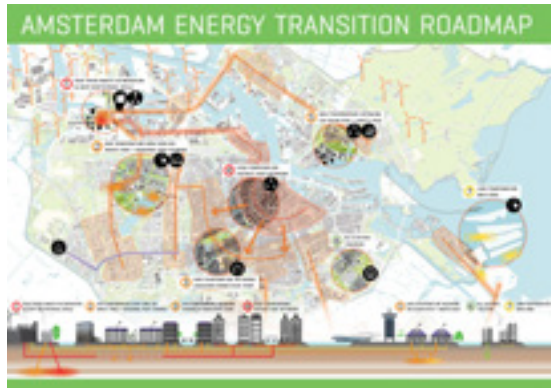
This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 608702.



Amsterdam Energy Transition Roadmap flyer

City-zen energy transition approach. ANALYSIS: Step 1: Energy Analysis (the technical geographical present), Step 2: Present planning and trend (near future energy plans and business-as usual trend), Step 3: Society & stakeholder analysis (political-legal-economic-social climate; ENERGY MASTER PLANNING: Step 4: Scenario for the future (external factors and technical-geographical limitations), Step 5: Energy vision with targets and guiding principles,Step 6: Roadmap with energy strategies and actions.

Currently, over 68% of Europeans live in cities and this number will rise. In 2050, it is expected that 80% of the world population will live in cities. Urban context areas are the place where the transition to renewable energy needs to be, based on a strong involvement of all stakeholders: industries, decision makers, knowledge partners and citizens. All infrastructures can play a role in a zero-energy solution, but it all needs to be decided through transparent and cooperative processes. What is noticeable is that different infrastructures are today mixing, supplementing and even substituting for each other. And it isn't just for domestic heat system and gas grids, but also for electricity, fuels, sewage, drinking water, ICT and solid waste. Integrating change and going beyond current practice to share skills, knowledge and today and the future needs are our primary goal.

The objectives of this project therefore are:

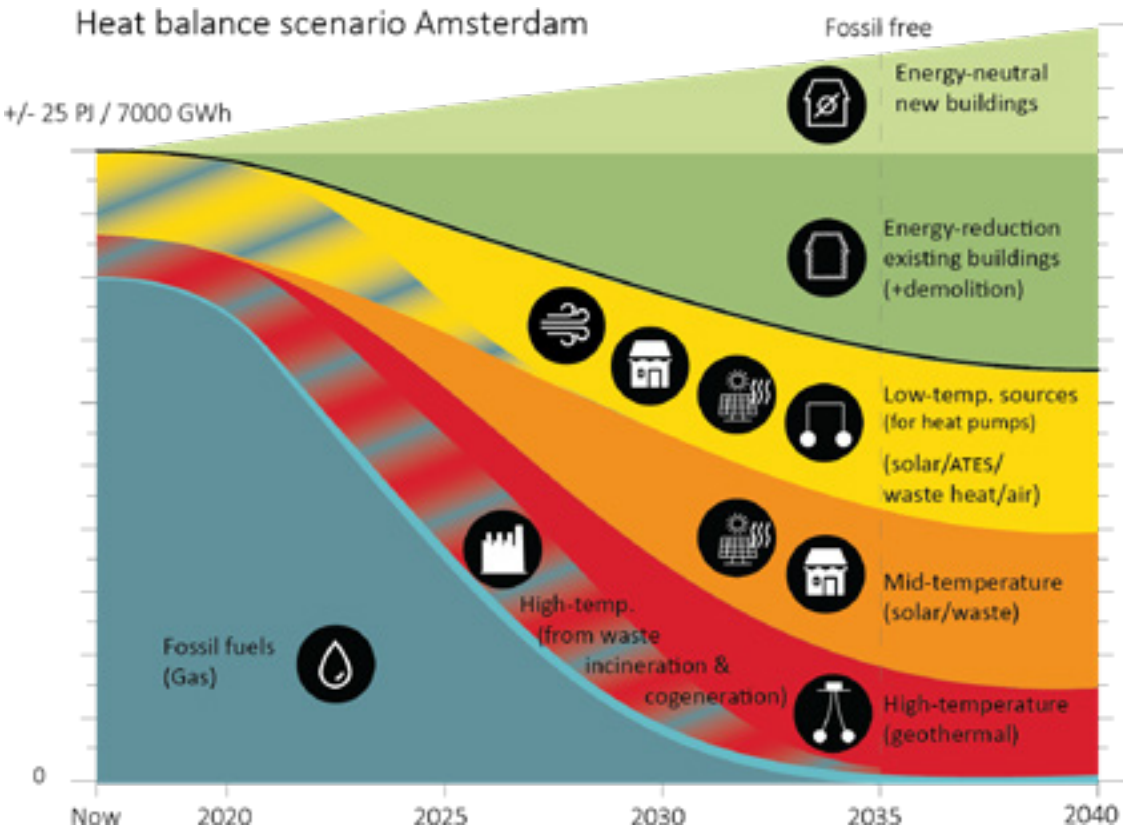
1 **Showcasing innovations in the urban contexts of Grenoble and Amsterdam.**
By applying (technical) innovations in our cities, we learn how to overcome barriers, how to build business models and how to make technology both user-friendly and attractive. These innovations are both on system level (smart grids, district heating) as well as on household level (renovation, citizen engagement, home batteries and games).

2 **Contributing to the 20-20-20 targets of both cities.**
The City-zen innovations will directly save 59,000 tonnes of CO2 each year. At the same time, the infrastructure is being used more efficiently and is made futureproof. This will allow future innovations to be applied more easily. Fact: the European CO2 emission per capita is 6.8 tonnes/year. City-zen helps to save the CO2 emission of 8.676 Europeans, not only for this year but for many years to come.

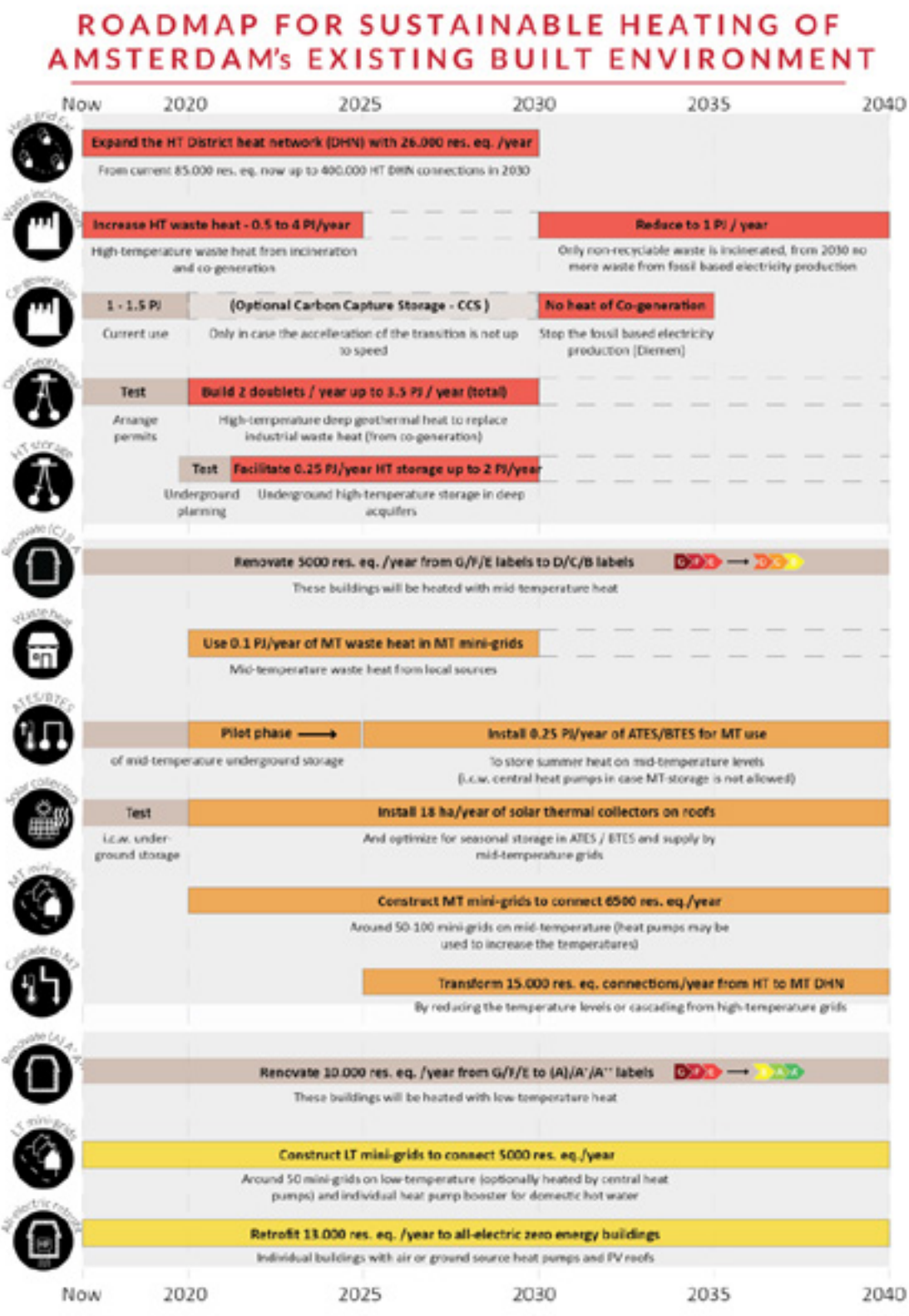
3 **Cities, knowledge institutions, citizens and industries are working together.**
By bringing together academic knowledge, industrial technology and everyday questions of locals, City-zen contributes to solving the cities' challenges. Alone you might go faster, but together we will get further!

4 **Understanding the complex playing field of energy transition.**
An integrated methodology for cities to build a roadmap to abandon fossil energy is developed and applied via a roadshow in Grenoble, Amsterdam and 8 other cities in Europe. A game is developed to enable and speed up decision making processes.

5 **Upscaling of innovation.**
City-zen focusses on New Urban Energy solutions, which will help cities to become energy neutral. All innovations are evaluated on their scaling potential and will lead to many more Smart Urban Energy projects throughout Europe.



Heat balance scenario for Amsterdam



Heat roadmap for Amsterdam, divided among high- (HT), mid- (MT) and low-temperature (LT) heat sources

Innovation is at the heart of the project: now is the right time for large-scale implementation of new solutions and smart urban technologies. For technology and process development, workshops supported by technology teams in the demonstrator cities, have been organised as part of the project to reduce the gap between innovation and implementation and to share material knowledge.

The success of the technology implementation also depends on the involvement of citizens. Accordingly, the project recognises the key position of this group. They have been involved through user groups, and an advisory board with societal representatives was installed. A serious game was created to engage citizens in an innovative way in the development of their smart city.

All these approaches match the ambitions of Amsterdam and Grenoble to be eco-friendly cities. For both cities an energy transition roadmap was developed, presented and discussed with citizens and stakeholders. The Amsterdam roadmap got national coverage on television and radio.

Future cities, smart, open, with a high level of liveability and prosperity are no longer a utopia with City-zen!

Further information
www.cityzen-smartcity.eu/

SusCritMat

Sustainable Management of Critical Raw Materials

Acronym
SusCritmat

Funder | Programme [grant number]
EU | *KIC EIT Raw Materials* [16248]

Overall budget
€ 1.113.314

Grant amount
Total: € 1.113.314
TU Delft: € 155.975

Role TU Delft
Project partner

Duration
01-2017 > 04-2020

TU Delft researchers
Dr. David Peck [lead]
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Ir. Tanya Tsui [also PhD]

Project partners
Entwicklungsfonds Seltene Metalle [ESM Foundation] [lead]
Bureau de Recherches Géologiques et Minières [BRGM -The French geological survey]
École Polytechnique Federale de Lausanne [EPFL]
EIT Raw Materials GmbH
Swiss Federal Laboratories for Materials Science and Technology [EMPA]
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. [Fraunhofer]
Granta Design Limited
Leiden University
Outotec, Finland
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Stakeholder in the supply chain. The research in the EU KIC EIT Raw Materials project, SusCritMat, is aimed at developing knowledge on the topic of sustainable critical raw materials. The focus is the role and impact of critical raw materials, as defined by the EU, across the whole supply chain, allowing stakeholders to identify and mitigate risks. The TUD-BK activity is on components in the circular built environment.

The project has the challenging aim (i) to research, develop and introduce courses aimed at PhDs, MSc's, professionals and executives on complex and department overarching topics for the first time, and (ii) to make these courses adaptable to a variety of different formats by providing a modular structure. These courses will develop new skills which will help participants to easier understand the impact and role of critical raw materials in a whole value chain view and by this have an added value for the companies by which they are or will be working. The overarching concept of discussing environmental and social aspects will prepare students to gain a broad view and face future challenges in Europe and globally. An emphasis on different tools, approaches and data foundations will teach participants individual and informed research methods in this complex area, and will thus foster competitiveness, innovation and entrepreneurship. The application of such courses by other institutions will help to disseminate a new approach of hybrid teaching/learning to other members of KIC Raw Materials and outside this community

Further information
https://suscritmat.eu

One of the Dutch case studies of the project

Smart Urban Isle (SUI)

Smart bioclimatic low-carbon urban areas as innovative energy isles in the sustainable city

Acronym
SUI

Funder | Programme [grant number]
JPI Urban Europe | *ERA-NET Cofund Smart Cities and Communities* [438.15.412]

Overall budget
€ 1.910.740

Grant amount
Total: € 1.449.188
TU Delft: € 250.000

Role TU Delft
Project partner & work package leader

Duration
03-2016 > 09-2018

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Dr.ir. Benedetto Nastasi [post-doc]

Project partners
Consultores de Automatización y Robótica [project lead]
The Cyprus Institute, Cyprus [CyI]
Middle East Technical University, Turkey [METU]
Technical University Iasi, Romania [TUI]
Software Quality and Performance, Romania [SQnP]
Zurich University of Applied Sciences, Austria [ZHAW]
ANERDGY AG, Austria
European Centre for Renewable Energy, Austria [EEE]

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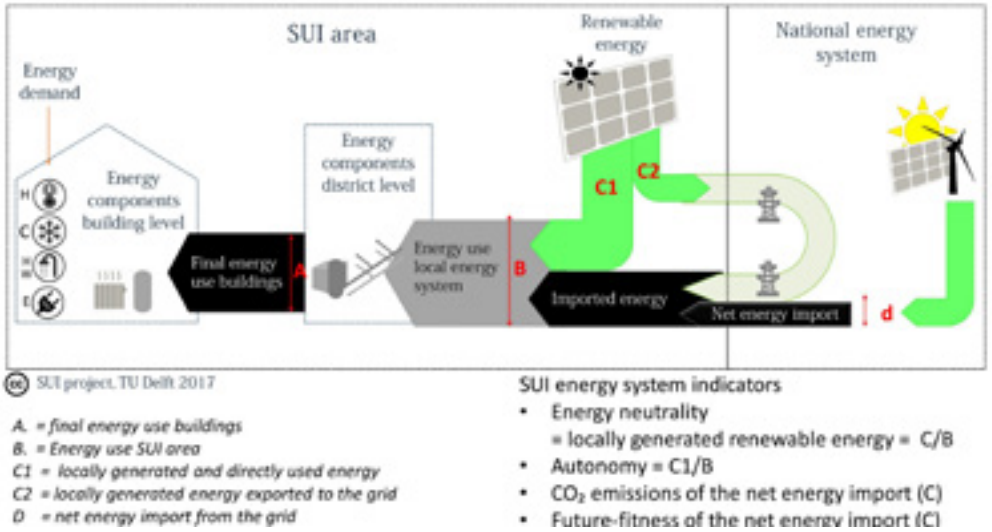
The 'smart Urban Isle' (SUI) project is a JPI Urban Europe project, with partners from Spain, Austria, Cyprus, Romania, Switzerland, Turkey and the Netherlands. A 'smart Urban Isle' is defined as 'an area around a (public) building that locally balances the energy as much as possible, resulting in minimized import and export of energy from outside this area'. The project consisted of three complementary research blocks: (1) bioclimatic design, (2) management platform and (3) mini-networks. Bioclimatic design aimed at maximum comfort inside the buildings with minimum energetic cost. The management platform dealt with the automatic active measures that can be taken up in the SUI area. The SUI mini-networks block focussed on the development of local area energy concepts, investigating how to facilitate the generation, storage and supply of energy in the SUI.

The department of AE+T was mainly involved in block 1: bioclimatic design, and, as work package leader, in block 3: mini-networks. For several case studies, 2 of which were in the Netherlands, energy plans were developed, both at building level and at neighborhood scale.

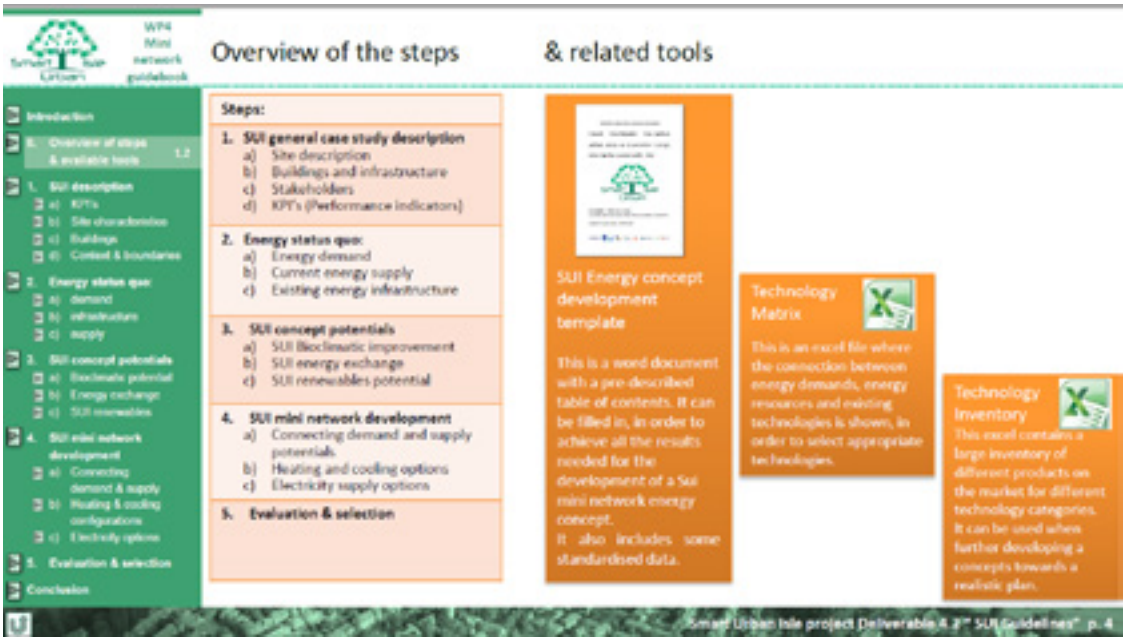
For the development of a locally balanced energy system for each case study, a step by step approach was developed and applied, consisting of the following steps:

1. case study description
2. energy status quo
3. SUI concept potentials
4. SUI mini network development
5. evaluation

The application of the approach has shown that it provides a clear structure, including some basic energy concepts, while at the same time leaving room for the development of new and innovative configurations based on the local energy demand and local energy potentials.



Energy Performance Indicators of a 'SUI' area



Screenshot guidebook

For the Dutch case studies, the approach led to an innovative local energy system concept with a high share of local renewable energy supply. As a result, two follow-up projects for further development have been granted in 2019 (nationally funded by RVO, www.rvo.nl) and are currently being carried out in cooperation with stakeholders from industry, end-users, housing corporations and local municipalities: LT ready (on affordable renovation measures that enable low-temperature heating) and deZONNET (on local feed-in heat grids bases on decentralized PVT (PV + thermal) panels).

Further information
http://smarturbanisle.eu/

Colour, Form and Space

Rietveld Schröder House Challenging the Future

Funder | Programme [grant number]
The Getty Foundation | *Keeping it Modern Grant*

Overall budget
€ 125.000

Grant amount
Total: € 125.000
TU Delft: € 120.000

Role TU Delft
Project partner

Duration
11-2015 > 11-2018

TU Delft researchers
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Ir. Sander Pasterkamp
Prof.Dr.Ir. Andy van den Dobbelsteen

Project partners
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The Getty Foundation

The Rietveld Schröder House, 2015 [photo M.T. van Thoor]

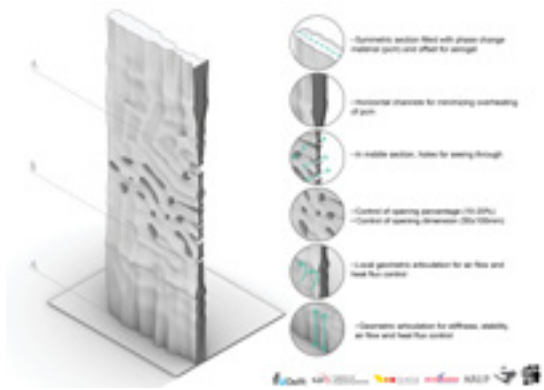
The Rietveld Schröder House of 1924 is recognized as a UNESCO World Heritage site for its radical innovation in domestic architecture. Developed by renowned Dutch architect and furniture designer Gerrit Rietveld for his client Truus Schröder-Schräder, the residence is the first large-scale declaration of De Stijl design ideals. The house is now maintained by the Centraal Museum Foundation, but Rietveld's experimental use of materials, combined with the wear-and-tear from thousands of visitors each year, creates a demanding maintenance schedule. The Getty grant supported the development of a conservation management plan that balances sensitivity to the architect's design intent with the building's complex conservation needs. The project included an oral history that captures the knowledge of one of Rietveld's assistants, who played a pivotal role in past interventions to the home, as well as the broad dissemination of the project research through a free online publication.

Further information
http://www.getty.edu/foundation/initiatives/current/keeping_it_modern/report_library/schroder_house.html

Double Face installed

Double Face 1.0 and 2.0

A lightweight, adjustable, optimized Trombe wall based on phase change materials and additive manufacturing



Design concept

Funder | Programme [grant number]
4 TU Centre of Excellence for the Built Environment | *Lighthouse project*
Technology Foundation STW | *Research through Design Program* [14574]

Overall budget
Phase 1: € 50.000 [4TU]
Phase 2: € 268.421 [STW]

Grant amount
Phase 1: Total: € 50.000; TU Delft part: € 35.000
Phase 2: Total: € 249.521; TU Delft part: € 249.521

Role TU Delft
Lead/Project partner

Duration
Phase 1: 06-2014 > 02-2015
Phase 2: 05-2016 > 09-2018

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Ir. Yvonne Wattez
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Stavroula Tsafou MSc MAS

Project partners
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GlassX AG, Switzerland
Rubitherm GmbH, Germany
Esteco SpA, Italy
Arup Amsterdam, The Netherlands

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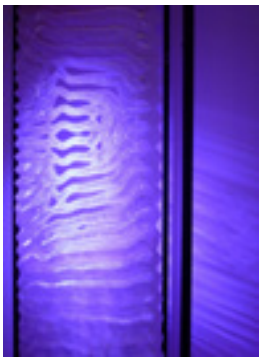
NWO Applied and Engineering Sciences

The Double Face 2.0 project is part of the research program Research through Design with project number 14574, which is financed by the Netherlands Organization for Scientific Research (NWO) and Taskforce for Applied Research SIA.

Double Face 2.0, as a follow up from Double Face 1.0, is a novel Trombe wall (Solar wall) joining a strong identity and high technical performances. A Trombe wall is a passive system generally made out of thick and heavy stone-like material placed behind a layer of glass and air. By harnessing the energy from the sun, a Trombe wall can reduce the energy demand of buildings for heating. By making the wall adjustable, i.e. rotatable in our case, it can also capture heat from internal sources thereby acting as a cooling device. By adding a thin insulation layer, the heat is better trapped inside the material. Thus, in winter during the day the system captures and temporarily stores heat from the sun; in the evening and at night it releases this heat into a room (heating mode). In summer during the day, it captures and stores heat from internal sources; and at night it releases this heat into the atmosphere (cooling mode).

In response to the need of energy saving, such novel high-performance building elements can be shape-opsimised for passive climate control and can also increase users' engagement. Given a design concept, computational approaches help optimising and customising high-performance building elements for any environment and any type of user. Double Face 2.0 was developed by research through design involving designing, 3D modelling, robotic FDM printing, prototyping, experimenting, simulating and simulation-based optimising. A prototype of a lightweight, adjustable, translucent Trombe wall was developed, using an insulator (translucent aerogel) and a heat storage material (salt-hydrate phase change




TOP: Venice Biennale
BOTTOM: Robot printing

material (PCM)) encapsulated in optimised and customisable shapes. Both the external surface was optimized in order to improve the heat transfer for the different modes (solar radiation, IR radiation and convection), and the internal structure was segmented for overcoming overheating of the PCM and for having an equal light transmittance.

Except for being optimized for light transmittance and heat transfer, the beauty of the materials also lies in the crystal formation of the PCM, the flake-like appearance of the aerogel granules and the pearl-like gloss of the printed PETG.

Further information
https://journals.open.tudelft.nl/index.php/spool/article/view/2090/2442

Eusebius church Arnhem [photo: Hielkje Zijlstra]

KaDEr Gelderland – Karakteristiek Duurzaam Erfgoed in Gelderland

Characteristic & Sustainable Heritage Gelderland

Acronym
KaDEr

Funder | Programme [grant number]
Provincie Gelderland | *Programma Cultuur & Erfgoed Gelderland*

Overall budget
€ 634.000

Grant amount
Total: € 634.000
TU Delft: € 634.000

Role TU Delft
Lead partner

Duration
05-2017 > 08-2021

TU Delft researchers
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Dr. Sara Stroux
Lidwine Spoormans MSc
Dr. Steffen Nijhuis
Dr. Bieke Cattoor
Dr. Hilde Remoy
Herman Vande Putte MSc
Eric van der Ham MSc
Dr. Martin Tenpierik

Project partners
Provincie Gelderland

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provincie Gelderland

On location with students in Reuversweerd [photo: Hielkje Zijlstra]

In 2017 HA started the KaDEr research project for the Province of Gelderland. The aim of the collaboration between the Delft University of Technology and the Province of Gelderland is to define an adjusted framework based on the way in which the province of Gelderland acts up to this point, with regard to the preservation of built monumental heritage to come up with innovative policy where scientific research must be carried out into whether and if a paradigm shift will take place in the future. Only through change sustainable preservation of heritage can take place. Together we investigate which change this should be. The classic, object-oriented restoration mission will have to make place for sustainable and therefore future-proof management, in which the following sustainability themes will be leading:

1. energetic durability
2. financially healthy perspective
3. functional use
4. knowledge safeguarding in the long term

In this process, everything is brought into balance with the monumental values and sustainability is placed in broad perspective. In addition, the financing and the exploitation per object, in conjunction with the environment, must provide a healthy future perspective for the owners and users based on functional use, with investments and results in balance. In addition, the safeguarding of craftsmanship and the transfer of knowledge.

City of Zutphen Living lab in KaDEr project [photo: Hielkje Zijlstra]

The KaDEr project basically consists of four parts: Framework, Living Labs, Education and Safeguarding of Knowledge. The general policy is analysed by theoretical and historical data research. In addition, eight subprojects have been formulated: 1. Energy scan 2.0, 2. Post-insulation of the architectural layer, 3. Design Atlas Baaksebeek & IJsselvallei, 4. Church visions (kerkenvisie) Winterswijk, Aalten, Oost Gelre, 5. Assessment model for sustainability measures, 6. Energy transition / Roadmap 2030, 7. Design Atlas Geldersch Arcadia and 8. Financial feasibility of churches.

To follow situations in practice, four Living Labs are: XL-Estates (Baaksebeek & IJsselvallei / Geldersch Arcadië), L-city (Zutphen, Elburg, Winterswijk), M-Typology (Churches) and S-building (Reuversweerd, Groote Noordijk).

The eight subprojects two by two are linked to those Labs. Educational projects are also incorporated in the Living Labs annually by a MSc3 / 4 graduation studio (Zutphen, Reuversweerd, Winterswijk), a MSc 2 design project (Religious heritage, housing) and a technical exercise (Building Assement). The Living Lab-L participates in the EU Interreg project Innocastle.

In this way we will provide a framework for the new policy for Geldelrand in 2021 with regard to the sustainable preservation of built heritage and advise a working method to follow projects in practice and to steer policy accordingly

Salt efflorescences on repair mortar applied on tuff stone

Monumenten*en*Kennis

Funder | Programme [grant number]
Ministry of Education, Culture and Science (OCW) [MS-2014-1204] and [MS-2017-214]

Overall budget
€1.054.000

Grant amount
Total: € 550.000
TU Delft: € 290.000

Role TU Delft
Project partner

Duration
01-2015 > 12-2018

TU Delft researchers
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Dott. Silvia Naldini
Dr.ir. Wido Quist
Ir. Jacqueline van Dam
Dr.ir. Hielkje Zijlstra
ir. Ruben Klinkenberg

Project partners
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Cultural Heritage Agency of the Netherlands (RCE), The Netherlands

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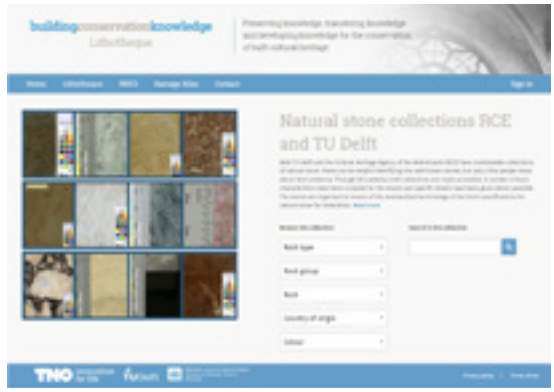

TOP: Screenshot of the digital lithoteque, disclosing the stone collections of RCE and TU Delft
BOTTOM: Screenshot of the Monument Diagnosis and Conservation System (MDCS)

Monumenten*en*Kennis is programmatic collaboration between the chair of Heritage & Technology, RCE and TNO, supported by the Ministry of OCW. Monumenten*en*Kennis performs as a knowledge center for the conservation of materials in heritage. The research done amongst the partners aims at better understanding of damage processes to come to more effective conservation of heritage buildings and preservation of historic building materials. The complementary expertise of the three partners is made available via a web-portal for professionals in the field, such as conservation architects, Monumentenwacht, heritage officers and craftsmen. Also monument owners are provided with useful information. The open-access platform was created to share practice-oriented knowledge.

Within the framework research has been done on stone and modern building materials, among others, the following topics were studied:

1. Creating a tool for recognition of commonly used building stones in the Dutch heritage context;
2. Inventorying state-of-the-art models to predict the remaining service life of stone in heritage buildings and a survey on how the topic of remaining service life is dealt with in daily conservation practice;
3. The degradation mechanism(s) of Weibern and Ettringen tuff stone;
4. Nineteenth and twentieth century surface treatments for stone like materials- their historic use and nowadays recognition;
5. Compatibility criteria for repair mortars. Both in laboratory and based on experience of (stone) masons and conservators;
6. Re-applying water repellents in relation to re-pointing brickwork;

Reports written on the topics studied are available via the web-portal, were presented at national and international conferences and the knowledge was infused in the Monument Diagnosis and Conservation System (MDCS). MDCS is an interactive support tool for the inventory and evaluation of damage to monumental buildings.

This system is one of the results of the project. During visual inspections MCDS helps to identify the types of materials and the types of damage. Based on the damage types found, hypotheses on possible causes are suggested. On the basis of the final diagnosis, conservation can be planned. MDCS provides a wealth of background information on degradation processes and maintenance techniques. Also, the user learns to recognize materials. Thus it is a source of knowledge for professionals and ideal for students. The system enables the user to visually monitor the state of conservation of a heritage building over time.

Within the project a digital lithotheque was created containing scanned surfaces of samples from the stone collections of RCE and TU Delft. The lithotheque can be used to identify both building and decorative stone in heritage buildings and promotes the use of the physical collections available at both institutes. The website is available in Dutch, English, and German.

Further information
https://www.monumentenkennis.nl

Management in the Built Environment

Research

Overall coordinator
— Prof.dr. Ellen van Bueren

Coordinators
— Dr. Hilde Remøy
— Prof.dr. Paul Chan

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FIG. 1.1 . Staff members MBE

1 – **Organisation, vision and strategy**

This report has been compiled at an important moment in time. As of July 1st, 2019, parts of the OTB research institute have joined the Management in the Built Environment (MBE) department. In addition, following the advice of the 2016 research assessment, the faculty management team decided to have one research programme per department. Together, these decisions offer us the opportunity to combine the integration of multiple groups in one department with the development of a joint research programme, building upon the strengths of the former four research programmes in which MBE-staff participated. The process of developing a joint research programme with a matching mission, vision and strategy has just started. In this report, we show you where we come from, and our achievements as registered in the separate research programmes. We also give you a preview of our joint ambitions and the process through which we will aim to achieve these ambitions.

Based on the experiences in the joint research themes, in which many of us already collaborate, we look with confidence to the next years. The aim of the MBE research programme is to theoretically understand the management and governance challenges in the built environment, and to develop innovative solutions, methods and tools to improve the management and governance of the built environment, within and across different functions and scales (buildings, portfolios and urban areas) and different project phases and lifecycle stages (from initiation, design and construction to management, maintenance and redevelopment). This knowledge is crucial to respond to and anticipate today's societal challenges, such as urbanisation, climate change, digitalisation and an ageing population, and to increase the resilience of the built environment to respond to these challenges, as they will radically impact the built environment and call for transitions - systemic change - of management and governance of this environment.

Finding ourselves at the epicentre of education for architecture and the built environment in the Netherlands, MBE aims at educating research leaders in the built environment with a global reach. The underlying mission of MBE research is to develop management research on the grand challenges in the built environment, consisting of and related to sustainable resource management (including the use of land, energy, material, water, capital and human resources), availability, affordability, and accessibility of housing and other urban functions, urbanisation and related infrastructure. Our objectives are:

- To further our theoretical understanding of management in the built environment, and to produce action-oriented knowledge and tools aiming to support stakeholders involved in the management in the built environment;
- To produce future researchers with a global reach, developing and nurturing a PhD community that develops a broad and deep body of knowledge within the current research fields of the department, and developing cutting edge research in new research fields, attracting more PhD candidates and visiting fellows;
- To develop education research, contributing to deliver top education and educating future researchers, building strong connections between research and education;
- To continue engaging with industry and societal stakeholders to ensure the impact of our research in industry and society, focusing on the grand challenges like Circular Economy and Global Housing;
- To maintain and strengthen our public and private sector policy connections, influencing policy making through research valorisation;
- To shape and grow our presence in academic, editorial and research societies boards, to further strengthening and developing international research networks.

In order to reach these objectives, we have formulated the following strategy:

- To focus and consolidate PhD research around the existing research foci of the department, carefully selecting candidates, supervising and monitoring candidates using the '4 eyes' principle, in collaboration with the Graduate School;
- To build strong connections between research and education by focusing graduation theses on the topics of staff research;
- To focus research and staff resources on a limited number of priority research topics and themes in which MBE excels and that contribute to developing research and valorisation, making room for the development of new, cutting edge research;
- To develop research and steer our research activity by aiming at acquiring external research funding through leading and contributing to national and international consortia for research proposals and projects;
- To continue working with existing knowledge, industry and societal platforms including Stichting Kennis Gebiedsontwikkeling (SKG), Leiden Delft Erasmus collaboration, the Center for People and Buildings (CfPB), het Opdrachtgeversforum, Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute), Comparative Housing research Expertise Centre (CHEC), Expertisecentrum Woningwaarde and Bouw- en Techniek Innovatie Centrum (BTIC);
- To organise and host international research meetings and conferences, contributing to enhancing and further developing existing research networks where MBE play a leading role (ENHR, ERES, CoreNET, CIB) and stimulate new collaborations;
- To stimulate PhD students and research staff to publish research in journals with high impacts, while maintaining valorisation through online learning, articles in newspapers, practice journals magazines, and keeping the strong presence of the department in events, and in social and traditional media;
- To organise research and writing "bootcamps" for PhD students and tenured staff, developing research and writing skills, reflection and collaboration, and contributing to fostering the inclusivity and integrity of the department.

The targets for the period until 2021 are:

- To develop 1 successful national or international scientific research proposal as lead partner per section per year (Horizon Europe, NWO), and contributing as a partner in other proposals, aiming at collaborating – not competing - within the department and the faculty;
- To recruit 5-10 PhD students per year, and to include all research staff in the supervision of PhD students;
- To develop and win a major research project on the grand challenges that the department focuses on in research;
- To develop and win at least one research proposal with existing and/or new industry partners;
- To co- organise and host at least one international event (conference, research summer school) every second year;
- To focus MSc thesis research around the research of tenured staff and PhD students;
- To have implemented the faculty 1/1/1 target on publication as a minimum for tenured staff, and to commit to publication agreements made for tenure-track staff, postdocs and PhD students, and furthermore, to focus on publications in Q1 or Q2 journals, which are journals that are top ranked or middle to high ranked for the research field of publication.

FIG. 1.1 Design, Construct, Manage.

Strategy Recommendations 2016 Research Review

The faculty research programmes over the period 2010-2015 were reviewed by an external committee of peers in 2016, following the assessment protocol of the Association of Universities in the Netherlands (VSNU). Three aspects are assessed: research quality, relevance to society and viability, on a four-point scale ranging from 1 (world leading/excellent) to 4 (unsatisfactory). For a full explanation of the indicators and scores see the Standard Evaluation Protocol 2015 – 2021 on the VSNU website). In the 2016 Research Review, the MBE department took part in two research programmes, the Innovations in Management in the Built Environment (IMBE) programme, and the Housing in a Changing Society programme. With the integration of the OTB department a part of another programme came over to MBE: Urban and Regional Studies.

Housing in a Changing Society

The Housing in a Changing Society (HCS) programme was awarded:

- research quality 2
- relevance to society 1
- viability 2

The review panel made four recommendations:

1. While HCS has maintained a fairly constant level of research outputs, they should capitalise on their good research credential to produce more impactful peer-reviewed papers, both in terms of quality and quantity;
2. With a high level of research grants, HCS should make the best use of these research incomes to train more PhD candidates to build up a critical mass of research staff;
3. HCS may consider enhancing their collaboration with international universities to secure large-scale research grants and establish joint PhD programmes;
4. HCS should exercise more stringent control to ensure that their PhD students can complete their study within the normal period of four years.

1. Publishing in a range of impactful journals and books is priority in the group. The ambition is to publish on housing issues in different journals representing different disciplines and perspectives such as planning, finance, energy efficiency, architecture, sociology and management. The chair holders feel responsibility for this ambition in their group.
2. The HCS group has a wide international network and a solid experience in participating in large international project and leading work packages. Maintaining these networks and exploring future opportunities for new consortia including PhD-positions has high priority in the group.
3. Since many years the group cooperates with many universities in projects, editorial boards and education. Moreover, the group holds different visiting positions in universities across the world Australia, China, South Africa, United Kingdom and is also hosting many guests from across the world. Members of the group take part in PhD examinations: Hong Kong Polytechnic, University of Pretoria, Aalborg University, Nottingham Trent, University of Lille, University of Geneva, University of Ghent, KTH Stockholm, KU Leuven, Montfort University, University of Murcia, Urban Institute Moscow. The Housing group appeared an obvious partner in European funded projects (H2020, FP7, IEE, Interreg, DG Employment) and was invited to participate in a long series of projects. These networks are well maintained and produce joint output and create fertile ground for future projects and programmes.
4. Good supervision of PhD-candidates and keeping the time line of 4 years is top priority of the graduate school, the promotors and daily supervisors.

Urban and Regional Studies

The Land Policy Group at Urban Area Development was part of the Urban Regional Studies group. The Chair holder was as programme leader coordinating the URS programme. The review of this programme was as follows:

— research quality 1
— relevance to society 1
— viability 2

The review panel has made four recommendations:

1 Stronger research collaboration between the different URS staff members;
2 More crossovers between URS sub-disciplines;
3 More PhD candidates; potential for postdocs;
4 Increase the number of professor positions.

The position of the Land Policy group, which is formed from two sub-groups from the former URS programme, in MBE allows for new research collaborations and new cross-overs, but with MBE-disciplines. Novel PhD candidates have been appointed. However, this does not involve a large growth as other PhD students have graduated. The increase of professor positions is being accommodated at Urbanism.

Innovations in Management in the Built Environment

The IMBE programme was awarded

— research quality 2
— relevance to society 2
— viability 2

The review panel made seven recommendations.

5 Strike a right balance to encourage IMBE staff to produce peer-reviewed journal papers and other forms of publications, here also encourage PhD's to publish in journals to enhance further career opportunities;
6 Continue to define and refine strategies for new research topics and collaborations with relevant industry and societal/governmental partners;
7 Continue to develop the core research area, methodologies and theories to strengthen main activities;
8 Take advantage of the high QS subject ranking in architecture and the built environment to attract more PhD candidates, visiting fellows and external network collaborations;
9 Solicit support from the industry to secure more competitive research grants both nationally and internationally;
10 Maintain a critical mass of staff members (scientific staff, research staff, and PhD candidates) to continue the research momentum and excel;
11 Maintain a strong communication platform and continue to enhance the important connection to societal relevance.

Before the Research Assessment 2016, the IMBE staff was working on enhancing the quality and quantity of publications, aiming to publish in high-ranked journals registered in Scopus or equivalent databases. Since then, we aim at keeping the faculty's 1 | 1 | 1 policy as a minimum. We achieve results by keeping publication on the agenda in strategy meetings, research meetings and in the yearly R&D cycle of tenured staff. From 2015 onwards, the number of papers published in peer reviewed scientific journals (Scopus registered or similar) has increased steadily.

Nationally, IMBE is the leading research group in built environment management topics, and develops strategies for new research topics and collaborations with relevant industry and societal/governmental partners, such as the Central Government Real Estate Agency, the Dutch provinces, municipalities, social and semi-public parties, universities, and different initiatives by industry or industry branches. The practice chairs Gebiedsontwikkeling (Urban Area Development) and Publiek Opdrachtgeverschap (Public Commissioning in Construction) with their industry platforms 'Stichting Kennis Gebiedsontwikkeling' (Foundation on Knowledge in Urban Area Development) and 'Opdrachtgeversforum in de bouw' are especially successful in this type of collaboration. These structural collaborations also facilitate the building of partnerships and co-funding for obtaining research funding from the Dutch National Science Foundation and international calls from the EU. In this way, these collaborative, transdisciplinary research strategies have also contributed to the international visibility and reputation of the group, resulting in an increased participation in international research consortia, besides the roles already played in international research networks, such as ENHR, ERES and CoreNET.

IMBE plays an important role in TU Delft research programmes on Circular Economy and Industry 4.0, programmes that are supported by the industry as well. IMBE is collaborating with these industry and societal/governmental partners in several research programmes and projects, leading and participating in expert panels, advisory boards, research centres, and research commissioned by practice. Examples of projects are Campus tools € 140000 (2017-2018), Evaluatie Convenant Kantoren Rotterdam € 80000 (2015-2018), AEDES € 100000 (2017-2020), and Transitiecampus Accez € 300000 (2018-2020).

IMBE continuously develops its core research area, methodologies and theories. With funding from larger programmes, also PhD students are appointed, which helps to develop the research further. The recruitment of assistant professors through tenure track procedures helps to selectively attract academics with specific expertise and skills, theoretically and methodologically. Internal activities that contribute to developing the core are strategic meetings with all IMBE staff, IMBE research meetings and research meetings of the IMBE chairs. Also, the organisation and hosting of conferences and seminars contributed to development and promotion of the core research areas.

From 2015 to 2018, IMBE has had an increasing number of visiting PhD's, researchers and professors, and has broadened its international and external network collaborations also through mobility of its own staff. The IMBE staff are frequently invited as visiting fellows and professors to different universities worldwide based on their track-record, expertise on and through joint projects and programmes, leading to new collaborations, joint project proposals and publications and new fellows visiting Delft. Visitors to IMBE include Professors: Andrew Baum, University of Oxford – Saïd Business School (2018-2019), Pat McAllister, Reading University (2017-2018) Fulong Wu, Bartlett School of Planning (2017), Ole Møystad, NTNU (2016). Fellows: Christopher Heywood, Melbourne University (2017-2019), Malgorzata Rymarzak, University of Gdansk (2017-2018), Serhat Basdogan, Yildrim University (2017-2018), PhD: Hannah Baker, University of Cambridge (2017), Jens-Philip Petersen, Technical University Denmark (2017), José Manuel Pagés Sanchez, HafenUniversity Hamburg (2017).

European and national research programmes but also private funding schemes increasingly require collaboration with practice and in many cases co-funding by practice. IMBE is working on increasing its research funding through this type of projects. Examples of successful projects are the Horizon 2020 and FP7 projects REPAiR (2016-2020), UKNA (2012-2016), and NWO project FUTURA (2013-2018) and 4C control tower (2016-2018).

The number of PhD candidates who started and completed their PhD has increased from 2016 to 2018. The number of PhD students completing their thesis in 2016-2017-2018 was 3 - 2,2 - 3,2. The number of PhD students starting in these same years was 1 - 5 - 5. In 2019, 8 new PhD students are expected, in line with the increased efforts to recruit (funded) PhD candidates. The number of tenured staff is slowly declining, in accordance with general TU Delft policy. This leads to an increased work load, requiring a rebalancing of educational and research tasks. IMBE is concerned about this development. IMBE is now functioning with what is experienced as a minimum number of staff.

IMBE communicates research activities and results through TV, radio, news, social media, blogs, columns, (public) lectures, MOOCs, leading and participating in (international) research societies, public and societal organisations, organising and participating in conferences and teaching, at the university and at several post-initial education programmes. Relevant websites are the employee's pages at the TU Delft website and www.gebiedsontwikkeling.nu (with monthly 10,000 unique visitors).

TABLE 1.1 Selected output indicators

		RESEARCH QUALITY	RELEVANCE TO SOCIETY
Assessment dimensions	Activities, organisation, facilities/assets, output	**Activities** - Ambition level and impact of research projects - Organisation of international conferences - Academic events	**Activities** - Editorship of professional journals - Role in practice and policymaking - Advisor/election to professional associations - Events for practitioners
		Organisation - Multidisciplinary team composition - Participation in academic networks - Taking part in consortia - Attracting PhD students	**Organisation** - Research centres and platforms - Participation in 'golden triangle' networks - Taking part in consortia - Contract research
		Facilities/assets - Databases - Boards	**Facilities/assets** - Valorisation through digital media
		Output - Articles in peer-refereed scientific journals - Academic books - Academic book chapters - PhD theses - Conference papers	**Output** - Articles in professional journals - Professional books - Media presence
	Use	- Citations - H-index - Invitations	- Attendance at MBE meetings/ conferences/seminars - Visibility and use of websites - Change of public or private policies, regulations, organisations, procedures, etc. - Invited speeches - Participation in projects
	Marks of recognition	- Invitations to important conferences and seminars - Election to academic or academic professional associations - Selection by excellent researchers - Invited keynote speeches - Editorial boards - Assessment committees - Visiting positions	- Prizes and awards - Advisor/election to professional associations - Invited keynote speeches - Editorial boards - Committees - Advisory positions

2 – **Research in numbers**

TABLE 2.1 Research output department 2016-2018

	2016	2017	2018	2016	2017	2018
MAIN RESEARCH OUTPUT	**MBE AS IT WAS 2016-2018**			**MBE AS IT IS IN 2019**		
Refereed articles	24	30	32	56	58	56
Non-refereed articles	1	4	0	2	6	1
Books	2	1	3	2	2	3
Book chapters	17	10	15	20	12	23
PhD-theses	5	2	7	7	4	14
Conference papers	33	29	26	66	44	31
Professional publications	25	42	26	96	69	44
Publications aimed at the general public	7	3	1	11	4	2
Total Main Research Output	**114**	**121**	**110**	**260**	**199**	**174**
OTHER RESEARCH OUTPUT						
Media contritbutions and coverages	13	14	11			
Abstracts	6	13	8			
Editorial work: editorial activity	10	8	4			
Editorial work: publication peer review	4	3	8			
Bookediting	3	0	3			
Exhibition	0	0	0			
Memberships	19	15	30			
Talk or presentation (conference)	25	37	42			
Total Other Research Output	**80**	**90**	**106**			
TOTAL	**194**	**211**	**216**			

TABLE 2.2 Staff members department

STAFF	**2016**		**2017**		**2018**		**2019**	
	NR	FTE	NR	FTE	NR	FTE	NR	FTE
Scientific Staff	36	10,41	33	9,91	29	10,05	45	16,04
Researchers (incl Postdocs)	14	6,31	15	7,13	22	6,73	17	10,08
PhD candidates	13		15		19		41	
Total research staff	63	16,72	63	17,04	70	16,78	103	26,12
Visiting Fellows	21	5,88	27	5,96	13	2,46	15	3,35
Total Staff	**84**	**22,6**	**90**	**23**	**83**	**19,24**	**118**	**29,47**

TABLE 2.3 Research income 2016-2018

	2016		2017		2018	
	K€	%	K€	%	K€	%
FUNDING						
Direct funding [1]	1.391	50%	1.421	50%	1.365	45%
Research grants [2]	251	9%	355	13%	281	9%
Contract research [3]	317	11%	349	12%	552	18%
Own contribution	-47	-2%	-129	-5%	-146	-5%
Other [4]	855	31%	820	29%	988	32%
Total Funding	**2.767**	**100%**	**2.817**	**100%**	**3.041**	**100%**
EXPENDITURE						
Personnel costs	-2.053	92%	-2.094	88%	-2.205	89%
Other costs	-189	8%	-283	12%	-279	11%
Total Expenditure	**-2.242**	**100%**	**-2.377**	**100%**	**-2.485**	**100%**
RESULT	**525**		**440**		**557**	

[1] Direct funding (basisfinanciering / lump-sum budget).
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and the Royal Academy).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations industry, government ministries, European organisations and charitable organisations.
[4] Funds that do not fit into the other categories.

TABLE 2.4 Length of PhD candidacies and success rate

ENROLMENT		**STARTING YEAR**					
		2010	2011	2012	2013	2014	TOTAL
GENDER	Male	0	0	2	2	3	**7**
	Female	1	2	1	3	1	**8**
	Total	**1**	**2**	**3**	**5**	**4**	**15**
GRADUATED							
≤ 4 years [1]	NR	0	0	1	1	1	**3**
	%	0%	0%	33%	20%	25%	**20%**
≤ 5 years [1]	NR	1	0	2	3	3	**9**
	%	100%	0%	67%	60%	75%	**60%**
≤ 6 years [1]	NR	1	1	3	3	3	
	%	100%	50%	100%	60%	75%	
≤ 7 years [1]	NR	1	2	3	3	3	
	%	100%	100%	100%	60%	75%	
Total Graduated	NR	**1**	**2**	**3**	**3**	**3**	
	%	**100%**	**100%**	**100%**	**60%**	**75%**	
Not yet finished	NR	0	0	0	0	0	**0**
	%	0%	0%	0%	0%	0%	**0%**
Discontinued	NR	0	0	0	2	1	**3**
	%	0%	0%	0%	40%	25%	**20%**

[1] In the case of the started PhD's in a given year the lead time was considered and cumulatively drawn over the years. A PhD who graduated in "≤ 4 years", is therefore again included in "≤ 5 years", in "≤ 6 years" and in "≤ 7 years". The table "Total Graduated" shows the total number of PhDs candidates that successfully completed there studies.

3 – **Overview of the MBE research**

MBE is one of four departments in the Faculty of Architecture and the Built Environment. Its research contributes to specialist knowledge development, organised in three sections, with in total fifteen chairs. The programme works on socially relevant research themes that contribute to the main objectives of the department.

MBE research is organised around:

- Three disciplinary sections that give depth to our specialisms:
  - Real Estate Management
  - Urban Development Management
  - Design and Construction Management
- Participation in various cross-university and cross-faculty research programmes and initiatives, like the 1 million Homes, Circular Built Environment, Health, Digitisation, Heritage;
- Participation in various knowledge centres like the Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute), Centre for People and Buildings (CfPB), Comparative Housing research Expertise Centre (CHEC), Expertisecentrum Woningwaarde, Stichting Kennis Gebiedsontwikkeling (SKG), strategic collaborations between Leiden-Delft-Erasmus (LDE) Centre for Sustainability (focusing on circular economy), BOLD Cities (focusing on Big Open and Linked Data) and BTIC.

The MBE Research Programme is led by prof.dr. Ellen van Bueren, dr. Hilde Remøy and prof.dr. Paul Chan.

The themes are open to all staff and involve extensive collaboration with other research groups in the university. Research leaders representing the disciplinary sections and priority research themes all contribute to the management of the programme. Furthermore, we encourage staff to develop their scholarship and research on other topics, especially on innovative emerging research questions and education within the fields of MBE. These may develop into research themes as a record of successful publication and activity builds up.

FIG. 3.1 Structure department MBE.

Real Estate Management

Research leader: Dr. Hilde Remøy

Research Area

To achieve a built environment that performs well and delivers value to the end user in terms of spatial, functional and technical quality, cost effectiveness and sustainability, it is necessary to incorporate the interests, requirements and constraints of the various stakeholders in all phases of the lifecycle (from initiation to use) and at different scale levels (buildings, real estate portfolios, urban areas and markets). Real Estate Management therefore by definition has an interdisciplinary nature, combining the scientific fields of policy, geography and planning sciences, organisational studies, economics, law, mathematics and sociology with design and engineering – mainly architecture, urbanism and building technology.

Main research topics

The main research topics of the section Real Estate Management are led by principal investigators, who are full professors or associate professors. The topics are viable topics, within which several researchers are working on different research projects, and supervising the section's PhD students and post-doctoral researchers.

- Real Estate Management studies and develops strategies for sustainable management of buildings, portfolios, locations and (geographical) markets, in the use phase of existing buildings, and the initiation phase of adaptive reuse and new-build. The chair focuses on the user and the demand side of real estate, taking a life cycle approach, and applying design thinking. The main focus of the chair is:
  - the relationship between real estate quality (including sustainability), value and costs,
  - how adaptive reuse of real estate can add value and contribute to a sustainable built environment
  - the added value of real estate for an organisation.
- Public Real Estate focuses on the challenges of managing public real estate portfolios by building theory on improving decision-making processes and finding new concepts for the built environment. The chair's mission is to support organisations' decisions about managing their public real estate portfolios, resulting in inspiring, meaningful, functional, affordable, resource-efficient and sustainable built environments. Current challenges are an increasingly dynamic and demanding community, pressure on available budgets and energy resources and professionalising the organisation that needs to implement (system) changes.
- Housing systems aims to unravel the functioning of the housing market by focussing on demand, supply and price and their interdependence. To identify structural changes, both quantitative modelling orientated research as qualitative research is necessary, considering the role of different tenures, government policies and the role of financial institutions on the housing market. The societal goal is to deliver answers for the current problems on the housing market. The results are a steady stream of Phd defences, scientific and professional articles, more than 50 lectures per year for societal parties, monitoring key elements of the housing market, policy advices with impact for government bodies and the industry and huge media coverage.
- Housing Management develops and evaluates organisational strategies for the management and (re)development of the housing stock to increase the socioeconomic and environmental sustainability of housing provision. In recent and coming years the chair mainly focusses on two themes: 1) how principles of a circular economy can be implemented in management and (re) development of the housing stock, and 2) how actors (residents, contractors, developers,

investors, governments) can collaborate to attune housing provision to preferences and financial possibilities of households

— Indoor environment focuses on people and their health and comfort, influenced by buildings and environmental factors, indoors and outdoors. People spend 80-90% of their time indoors. Diseases and disorders related to indoor exposure have increased. To better understand and improve the indoor environment, we need to acknowledge the fact that the indoor environment is more than the sum of its parts, and that its assessment should start from human beings rather than benchmarks.

Track record

The number of (funded) research projects and (scientific) research output has grown substantially in a variety of Real Estate Management subfields. Examples of major research projects include:

— A major research project for industry, government end civil organisations in the Groningen Region, advise for the minister of Economic affairs: proposal for a compensation for all home owners in the earth quake region and an advise for an instrument to buy dwellings of owner occupiers in the earth quake region who have difficulties to sell their dwelling.

— CHARM - Circular Housing Asset Renovation & Management - No More Downcycling, funded by Interreg, Vincent Gruis, Ad Straub, Sultan Çetin-Ozturk;

— Interreg 2 Seas Triple-A, Stimulating the Adoption of low- carbon technologies by home-owners through increased Awareness and easy Access, funded by Interreg, Erwin Mlecnik;

— REPAiR – Resource Management in Peri-urban Areas: Going Beyond Urban Metabolism, funded by Horizon 2020, Hilde Remøy, Executive board member, and Erwin Heurkens. Project led by Prof. A. Van Timmeren (2016-2020);

— KaDEr - Karakteristiek DUURZAAM Erfgoed Gelderland, funded by the province of Gelderland. Hilde Remøy, Herman vande Putte and Ilir Nase. Project led by Hielkje Zijlstra.

— Amsterdam Reloaded - user-led approaches to affordable residential adaptive reuse of heritage buildings in Amsterdam, funded by the AMS Institute Stimulus Call, Hilde Remøy and Darinka Czischke (2016-2017);

— Current regulatory trends in social housing and affordable housing in European countries: Exploring funding scope and models for the EIB. Study commissioned by the European Investment Bank (EIB). Czischke, D., & van Bortel, G. (2017). Delft University of Technology.

— “Samen Wonen, Samen Onderzoeken” (“Living Together, Researching Together”) Research project funded by the NWO Smart Urban Regions of the Future (SURF) Pop Up grant (EUR 50,000) Main applicant: Prof Vincent Gruis; Co-applicant and project leader: Dr Darinka Czischke

Major publications

— Alghamdi, N., den Heijer, A., and de Jonge, H. (2017) Assessment tools’ indicators for sustainability in universities: An analytical overview. International Journal of Sustainability in Higher Education, 18(1), 84-115
— Bluyssen, P. M., Zhang, D., Kurvers, S., Overtoom, M., and Ortiz-Sanchez, M. (2018) Self-reported health and comfort of school children in 54 classrooms of 21 Dutch school buildings. Building and environment, 138, 106-123
— Czischke, D. (2018) Collaborative housing and housing providers: towards an analytical framework of multi-stakeholder collaboration in housing co-production. International Journal of Housing Policy, 18(1), 55-81
— Y. Gong, P. Boelhouwer and de Haan J. (2016) Interurban house price gradient: Effect of urban hierarchy distance on house prices, Urban Studies 53(15) 3317-3335.
— Remøy, H., and Street, E. (2018) ‘The dynamics of “post-crisis” spatial planning: A comparative study of office conversion policies in England and The Netherlands. Land use policy, 77, 811-820.

Major events

- Hilde Remøy, Peter de Jong, Erwin Heurkens: Organisers and chairs of the European Real Estate Society (ERES) Annual Conference, Delft, June 2017. The conference is the leading European conference on real estate research, with more than 400 participants.
- Luz Maria Vergara: 'Urban Challenges in the Global South: Cross-learning between research and online education'. Session coordination and lecture with Igor Pessoa (TU Delft). Breakout session at the IHS Conference 2018. Empowering Cities and Citizens. Learning and co-creating in an urbanising world, Rotterdam, Netherlands.
- Darinka Czischke: Keynote lecture at the closing plenary of the International Social Housing Festival, Amsterdam, 21 June 2017. "Collaborative Housing: The re-emergence of collective self-organised housing in Europe".
- Hilde Remøy: Key-note speaker GIF (German Society of Property Researchers) 25th anniversary meeting in Frankfurt, April 2018.

Prizes and awards

- Luz Maria Vergara: Excellence in Teaching award 2017 for Luz Maria Vergara for the MOOC Rethink the City. New Approaches to Global and Local Urban Challenges, bestowed by AESOP (Association of European Schools of Planning).
- Peter Boelhouwer: On April 25th 2016, Prof. dr. Peter Boelhouwer, Professor of Housing Systems at the Faculty of Architecture and the Built Environment, was appointed Officer in the Order of Orange-Nassau.

Leading roles

- Peter Boelhouwer: chairman of the Coordination Committee, European Network for Housing Research (ENHR). ENHR provides an organisational platform for housing research in (and outside) Europe. It has about 1000 individual and nearly 100 institutional members across Europe and participants from worldwide.
- Darinka Czischke: member of the Coordination Committee, and founder and joint co-ordinator, ENHR Working Group 'Collaborative Housing, European Network for Housing Research (ENHR)
- Hilde Remøy: board member European Real Estate Society (ERES), president 06.2018 – 06.2019. ERES is the biggest network for researchers in real estate across Europe, and is affiliated with real estate research organisations worldwide.
- Monique Arkesteijn: board member European Real Estate Society (ERES); board member of CoreNet Global, the global association for corporate real estate.

Website

https://www.tudelft.nl/bk/over-faculteit/afdelingen/management-in-the-built-environment/

Design and Construction Management

Research leader: Paul Chan

Research area

The key domain in Design & Construction Management addresses questions of process control in the development and realisation of the construction and renovation of buildings, with building process innovation as a specific area of attention. The aspects of design management and cost/quality are integrated at the building level in the development and realisation phases. The section responds to the challenges of managing construction projects with an emphasis on the added value of design, engineering and construction companies in the construction supply chain. Process innovations are developed that contribute to ensuring and improving the quality of housing, focusing on energy efficiency, environmental impact, safety and health, usability, of both existing and new housing.

Main research Topics

— With grand societal challenges such as the environmental and ecological crisis and the provision of affordable and decent housing in the context of rapid urbanisation, the Architectural Engineering and Construction (AEC) industry is facing higher performance demands for its products and services. To respond to these challenges, Design and Construction Management (DCM) delivers research and education around new ways of reconfiguring work processes in the production of the built environment to meet the goals of creating a circular economy that emphasises greater responsiveness, reliability, quality and resource efficiency in the through-life delivery of built environment projects. DCM is also developing capability in understanding and addressing the opportunities and challenges posed by digital innovation in the context of the fourth industrial revolution. The ambition of DCM to address social, environmental and technological change through the production of future built environments is realised by engaging with four challenging themes. These include examining questions of (1) technological change and its impacts on ways of designing, constructing and managing built assets; (2) institutions, institutional work and institutional change; (3) how people cope with change, and (4) configurations of systems in producing the built environment. To answer these questions, DCM engages with key supply and demand-side actors, including clients, end-users, consultants, contractors, as well as policy makers and regulators, to co-produce evidence-based insights, build scenarios and foresights, and support the AEC sector to make sustainable transitions.

— Construction Management and Entrepreneurship (CME) focuses on the challenges of managing construction projects with an emphasis on the added value of design, engineering and construction companies in the construction supply chain. To respond to current societal needs, such as the energy transition and the circular economy it is crucial to tap the innovation capacity of the entire construction chain. The focal aim of CME is to explore new theories and concepts related to the development of innovative, entrepreneurial power in the construction supply chain. Important themes are (circular) business models and supply chain management, value capture strategies in architectural and engineering companies and entrepreneurial behaviour to transform innovations into successful business goals. In the coming period, CME will study 1) risk related behaviour of construction companies in the supply chain, especially as actor in Integrated Project delivery and circular construction projects, and 2) the impact of (tech) start-ups on innovation processes in the circular construction supply chain.

— The focus of Building Law is the interpretation, development and implementation of legal instruments for modern and innovative forms of organisation of building activities. This involves both existing and new instruments. It refers to different scales: from individual buildings to inner-city re-developments. Aims: the emergence of new technology leads to changes in design processes for buildings. New design

processes lead to legal questions. For example, (1) supply chain cooperation leads to questions regarding the legal form of relations between parties, (2) BIM models, in which different parties contribute, can lead to questions of liability if the design holds a fault. To answers this type of questions, Building Law closely cooperates with designers, builders and other actors to fully analyse the issue. Building Law wants to come up with answers to the questions which are legally sound and feasible in practice, such as: how can legal instruments enable the development of designs and buildings which are aimed to satisfy continuously higher performance requirements?

- Housing Quality and Process Innovation performs research and education on innovations of policies and processes to improve the physical quality of new and existing housing to achieve a carbon free building stock in 2050. The physical quality is elaborated in terms of energy performances, sustainability, safety, health, accessibility and functionality of houses. In recent years HPQI, in collaboration with BEE (Building Energy Epidemiology), worked on a combination of evaluation research with big data sets on the indicators for real energy use and the progress of energy renovations in NL and the EU, and the analyses of energy renovation processes in China. Since 2018 much effort has been put in the development of a national platform for innovation in the Netherlands: The Building and Technology Innovation Center (BTIC). This platform will develop large national research and innovation programmes for the Energy transition in the existing building stock, Digitisation, Circular building economy, Renewal of infrastructure and Climate adaptation. This creates huge opportunities for new research within the faculty. HQPI has developed close relations to several universities interested in combined activities. This already resulted in a TU Delft summer school given in Xi'an for Chinese students.
- Public Commissioning focuses on identifying and professionalising the field of 'Commissioning' in the public sector, building knowledge in this area and providing education about the role of the client in the construction process. In particular, the chair focuses on clients in asset management, not only on the professionalisation of commissioning with respect to a specific task, but also on the demands that places on public organisations, the necessary organisational structures, processes and competencies.
- Building Energy Epidemiology (BEE) performs research and education on buildings and their energy systems, focusing on the assessment of operational performances. BEE operates along two lines: 1) Building stocks (e.g., national, housing associations, cities), with the questions how to assess their energy and environmental performances making use of actual energy and socio-economic data and building stock models. The aim is to deliver robust data to policy and decisions makers on efficient strategies for a carbon free building stock; 2) Buildings, with the questions how to develop data-driven automated inspection methods and to diagnose underperformance in terms of energy use, environmental impacts and indoor climate and how to steer on high operational performances against the background of smart complex energy systems. The aim is to deliver robust methods to the building, energy and HVAC industries ensuring high operational performances.

Track Record

- The number of (funded) research projects and (scientific) research output has grown substantially in Design and Construction Management. Examples of major research projects include:
- The EU project Episcope combined with funding from Aedes. From 2014 till now, and continuing into the BTIC programme next year, analyses on the AEDES-data of the social housing stock and the progress on energy renovations. This has been the core of the PhD theses of Faidra Filippidou (completed 2018), Paula van den Brom (defence jan/feb '20) and Herman van der Brent (started 2018). Henk Visscher.
- 4C Control Tower, a multi-institutional, joint academic-industry project to develop a Cross Chain Control Center (4C Control Tower) that is radically transforming logistics in the Dutch building sector so that firms across the value chain can become more integrated to meet the aspirations of more resource-efficient circular buildings. Ruben Vrijhoef.

- Commissioning within public organisations, funded by Het Opdrachtgeversforum in de bouw (Dutch Construction Client Forum) and the Dutch Water Boards. Marleen Hermans, Ad Straub, Lizet Kuitert, Bart Suijkerbuijk, Sarah Kamphuis.
- Transaction costs and cognitive-behavioral barriers to promoting building energy efficiency – strategies on sustainability challenges for rapid Chinese urbanization (2014-2020), funded by Chinese Scholarship Council, Tianjin University and Chongqing University, Henk Visscher and Queena Qian (lead), Ad Straub, Frits Meijer, with PhD students Taozhi Zhuang, Jiefang Ma, Hongjuan Wu, Yuting Qi, Ling Jia.
- Building Market Briefs - Climate KIC, 2017 – 2019. Henk Visscher, Arjen Meijer
- ABRACADABRA: Assistant Buildings' addition to Retrofit, Adopt, Cure And Develop the Actual Buildings up to zeRo energy, Activating a market for deep renovation, H2020, 2016 – 2018. Henk Visscher.
- TRIME - Trias Mores Energetica, focuses on behaviour aspects to reduce energy demand in the housing sector, EU-IEE, 2015 – 2017. Henk Visscher, Arjen Meijer.

Major publications

- Ioannou, T. & Itard, L. (2017) In-situ and real time measurements of thermal comfort and its determinants in thirty residential dwellings in the Netherlands , Energy and Buildings. 139 (2017), 487-505.
- Koolwijk, J. S. J., Van Oel, C. J., Wamelink, J. W. F. and Vrijhoef, R. (2018) Collaboration and integration in project-based supply chains in the construction industry, Journal of Management in Engineering, 34(3), 04018001 (Editor's Choice Paper).
- Nakamba, C., Chan, P. W. and Sharmina, M. (2017) How does social sustainability feature in studies of supply chain management? A review and research agenda, Supply Chain Management: An International Journal, 22(6), 522-541.
- Qian, Q. K., Ho, W. K. O., Ochoa, J. J., & Chan, E. H. W. (2019) Does aging-friendly enhance sustainability? Evidence from Hong Kong. Sustainable Development, 27(4), 657-668.
- Visscher, H., Laubscher, J., & Chan, E. (2018) Introduction: Building governance and climate change: roles for regulations and related policies. In R. Lorch, J. Laubscher, E. H. W. Chan, & H. Visscher (Eds.), Building governance and climate change, regulation and related policies (pp. 1-7). Abingdon, UK: Routledge.

Major events

- Dr. ir. Louis Lousberg co-led the organisation of the 'Project Management Congress 2019: Research meets practice' Conference (10-12 April 2019). Collaboration across six faculties in TU Delft, over 200 delegates from industry and academia.
- Prof. dr. ir. Paul Chan led the organisation of the annual ARCOM conference for 2016 (Construction Work and the Worker, Manchester, 5-7 September 2016) and 2017 (Brutally Innovative Construction, Cambridge, 4-6 September 2017).

Prizes and awards

- Laure Itard: Dutch patent nr 2014467, 13-01-2017, ''Method and instrumentation for determining at least one thermal parameter of a wall'.
- Laure Itard: First Prize RAAK-Award 2017 (Stichting Innovatie Alliantie) for the (Dutch) project Installaties2020; 2017, November 30th.
- Paul Chan: Emerald Literati Highly-Commended Paper Award in 2016: Eizakshiri, F., Chan, P. W. and Emsley, M. W. (2015) Where is intentionality in studying project delays? International Journal of Managing Projects in Business, 8(2), 349-367.
- Lizet Kuitert: David Langford Commemoration Award: Kuitert, L., L. Volker and M. Hermans (2017) Public Commissioning in a New Era: Public Value Interests of Construction Clients, in: Annual Conference of the Association of Researchers in Construction Management (ARCOM).
- Dr. Marina Bos-de Vos: Cum Laude PhD thesis (2018) "Open for business: Project-specific value capture strategies of architectural firms" as part of the NWO funded research project

"FuturA - Future Value Chains of Architectural Services".
— Dasa Majcen: Cum-Laude PhD thesis (2016) "Predicting energy consumption and savings in the housing stock".

Leading roles

— Laure Itard: Member of Impuls group TVVL (set up of new research themes).
— Paul Chan: Editor of the journal "Construction Management and Economics", and chair of the Association of Researchers in Construction Management (2016-2018).
— Queena Qian: Editor of Housing and the Built Environment
— Henk Visscher: Scientific director Building and Technology Innovation Centre; CIB: Coordinator of Taskgroup TG 79: Building Regulations and Control in the face of Climate Change; ENHR: coordinator of working group Energy Efficiency and Environmental Sustainability of Housing

Website

https://www.tudelft.nl/bk/over-faculteit/afdelingen/management-in-the-built-environment/

Urban Development Management

Research Leader: Ellen van Bueren

Research Area

- Urban Development Management (UDM) concerns the art of managing the decisions of the many stakeholders involved in the development of urban areas towards high quality sustainable urban places. UDM aims to design concepts, principles, institutions and instruments that support effective strategies with outcomes that produce and promote an urban environment that meets the demands of sustainability and resilience. These strategies consist of streams of decisions and actions—represented in city policies, spatial plans, governance arrangements, and development contracts—that shape the way actors behave and forge networks, arenas and coalitions for implementing change in urban areas. The aims are realised through the participation in academic and practitioner-oriented partnerships (e.g. SKG (0.4 fte. Full Professor, 0.6 Associate Professor, and team), ACCEZ (1 post doc), LDE (0,2 fte. researcher, 1 postdoc), AMS (1 post doc), mobilising support and long-term (co-) funding for knowledge development, through carrying out funded shorter-term research positioned within a longer term research agenda (e.g. the urban transformation agenda, the circular built environment agenda), and through the initiation of and participation in research calls by national and international funding organisations (NWO, JPI, H2020, Interreg). The building of the research agenda is supported with a growing group of PhD-students (from 0 in 2015 to 8 in 2019, with 1 promotion in 2017, and 1 promotion in 2018).
- Housing Institutions & Governance focuses on how to create adequate housing for all and on how housing contributes to welfare with emphasis on international comparison and cross-country learning. Key research questions are: 1) How to achieve adequate housing for all? 2) What does housing mean for welfare? The strategy of the chair is 1) aiming for long term projects that include research positions for PhD-candidates or postdocs, 2) aiming for cooperation in department, faculty, university and international partners to develop a joint research agenda. Results so far include 1) 1Mhomes (strategic faculty fund, 2 postdocs) how to create homes in the near future: on architecture, urban planning, building technology, governance and finance, 2) H4.0E (INTERREG, 1PhD): creating affordable zero energy dwellings with new technology, 3) UPLIFT (H2020, postdoc): homes as means of integration for young people in Europe, 4) Global Housing (part of Global Urban Lab): 2ALL, Addis Ababa Living Lab (NWO, 2 PhDs + 1 postdoc), other PhDs with scholarships; housing at the centre of urbanisation (UNHabitat)
- Governance of land development is about the interaction between planning, property rights and property markets, and the governance of the relationship between the private interests of landowners and common societal goals. The research focus is on evaluating and innovating the governance of land development. The concepts of effectiveness, efficiency and legitimacy play a major role in this. Current projects focus on the authorities as land developers, new land development legislation: better practice, the Europeanization of the governance of land development, innovative and participatory land policy instruments, and bridging internal and external effectiveness towards a legitimate governance of land development.
- Area Development connects public, private and third sector organisations involved in the practice of area development across The Netherlands. The five interrelated core objectives of Area Development are to develop knowledge and instruments for area development practice, connect actors, professional disciplines and policy sectors relevant to the field, promote (more) quality, sustainability and progress in projects, contribute to relevant education and research programs, stimulate the exchange of knowledge between academic research and practice. The Area Development research program focuses on four key aspects of urban area development projects: value, process, collaboration, and design. Key research questions focus on these aspects, particularly how to understand them in the context of public-private-civic

governance around spatial projects in the built environment. Examples are: what is the impact of professional design studies on specific area development strategies? or: what are the institutional barriers/enablers in the private financing of public infrastructure in area development projects?

Main research topics

- Institutions and institutional change, and the governance and management thereof are binding concepts, drawing on theories on state-market-society relationships and the action perspectives available to different groups.
- Policies, plans, and evaluation of these plans and policies, including the decision-making processes in which they emerge and are implemented, is another binding focus within the section, drawing on literature on policy and planning in the public and private spheres and applied to urban planning and development, including land use and housing.
- Urban transformations: identifying governance challenges and strategies for urban transformation, i.e. the densification and mixed-use development of existing urban areas, leading to questions of land use, accessibility, housing affordability and resilience.
- Circular development of urban areas and regions: the exploration of the implications of a circular or closed-loop economy on the governance and management of urban development, including land use, housing, economic functions and infrastructures and the institutions and institutional changes needed to implement these changes.
- The analysis and design of transdisciplinary research and education environments. Today's urban challenges call for joint problem-solving approaches between academia and practitioners, both in education and research. The UDM section operates in many of these environments. The development and functioning of such environments, as well as the output and impact they deliver, are part of the research focus.

Track Record

The section has several (funded) research projects and (scientific) research output. Examples of major research projects include:

- RURALIZATION, Willem Korthals Altes. RIA Horizon 2020 project running between 2019 and 2023 with 18 partners and which aims to contribute to rural regeneration by foresight activities, reflecting on promising practices of rural newcomers and new entrants into farming and by research and development of novel ways into providing access to land (https://www.tudelft.nl/2019/bk/facilitating-rural-newcomers/ www.ruralization.eu).
- FIESPON, Willem Korthals Altes. ESPON project coordinated by EPRC (University of Strathclyde) in Financial instruments and territorial cohesion. (2017-2019).
- Urban Agenda, Willem Korthals Altes. Short study commissioned by the European Parliament on Urban Agenda: Assessment from the European Parliament's Perspective (2019).
- Promoting the contribution of private savings to pension adequacy: Integrating residential property with private pensions in the EU, Joris Hoekstra, Marja Elsinga, Marietta Haffner, Kees Dol. European Union's EaSi Grant Programme under grant agreement No VS/2015/0218.
- ACCEZ Circular Area Development (2018-2020): This project aims to analyse the meaning and implications of the circular economy concept for the development of urban areas from dimensions of. ACCEZ is a collaborative between the Province of Zuid-Holland, VNO-NCW West (employers' association) and universities of Leiden, Delft, Rotterdam and Wageningen, Ellen van Bueren and Karel van den Berghe.
- World Bank Group: Developing an urban systems-based framework for evaluating the contribution of donor projects to urban resilience, illustrated by the case of Accra, Ghana (2018), Aksel Ersoy.
- H4.0E - Housing for zero Energy - Affordable and sustainable housing through digitization (2018-2021) Funded by Interreg NWE, Marja Elsinga (lead TUDelft team), Henk Visscher, Harry van der Heijden, Arjen Meijer, Marietta Haffner, and PhD students Cynthia Souaid and Shima Ebrahimigharehbaghi.

Major publications

- De Jong, M., Chen, Y., Joss, S., Lu, H., Zhao, M., Yang, Q., & Zhang, C. (2018). Explaining city branding practices in China's three mega-city regions: The role of ecological modernization. Journal of cleaner production, 179, 527-543.
- Donoso, R.E. & Elsinga, M. (2018). Management of low-income condominiums in Bogotá and Quito: The balance between property law and self-organisation. International Journal of Housing Policy 18(2), 312-334.
- Korthals Altes, W.K. (2018) Annington versus Deutsche Annington: Private Equity and Housing in the Anglo-Saxon and Rhenish Contexts, Housing, Theory and Society 36(2), 228-253
- Squires, G., Heurkens, E. & Peiser, R. (eds.) (2018). The Routledge Companion to Real Estate Development. London: Routledge.
- Steen, K., & van Bueren, E. (2017). The defining characteristics of urban living labs. Technology Innovation Management Review, 7(7).

Major events

- Tom Daamen and Co Verdaas: SKG Jaarcongres Gebiedsontwikkeling, the yearly conference on area development is one of the main events in this field of research and practice in the Netherlands.
- Marja Elsinga: ENHR Working group Comparative Housing Policy, The future of affordable housing, Delft, November 2016, main organiser.
- Marja Elsinga: Delft Design for Values Seminar Housing and Values, Delft, March 2018, main organiser.
- Ellen van Bueren delivered the keynote 'Learning from Urban Living Labs: Opportunities for replicating and scaling up context dependent lessons' at the II International Seminar on Nature-Based Solutions (NBS): Promoting Urban Nature for More Resilient Cities. Examples from Brazil and Europe, Brasilia, Brasil, July 10-11, 2018.
- Ellen van Bueren delivered the keynote 'Local Implementation of Integrated Urban Solutions: Lessons from the Netherlands' at the Macao International Environmental Co-operation Forum and Exhibition: Sustainable and Resilient Eco-Cities – Key Challenges and Opportunities, in Macao, April 13th 2018.

Prizes and awards

- Joris Hoekstra: EU H2020 grant for UPLIFT: Urban PoLicy Innovation to address inequality with and for Future generaTions (starts January 2020).
- Hedwig van der Linden was granted the NRP Master Award 2018 for her research.

Leading roles

- Mariette Hafner is member of the Coordination Committee, European Network for Housing Research (ENHR).
- Erwin Heurkens is Associate Editor of the Taylor and Francis Smart And Sustainable Built Environment journal (SASBE).
- Willem Korthals Altes is Lead Applicant of the H2020 project RURALIZATION.
- Ellen van Bueren was member of the Council for the Environment and Infrastructure, the primary strategic advisory board for the government and parliament in the fields of physical environment and infrastructure, for the advise on the development of new markets in response to technological developments, from June 2016 to March 2017.
- Ellen van Bueren chaired the action team Framework Circular Building, part of the Dutch sector wide Platform CB'23, where public and private actors develop shared understanding, definitions, norms, and tools for circular building, from September 2018 to July 2019.
- Tom Daamen delivered a keynote at the Next Generation 16th World Conference Cities And Ports, in Quebec City, Canada – June 11-14, 2018.

Website

https://www.tudelft.nl/bk/over-faculteit/afdelingen/management-in-the-built-environment/

4 – **Participation in faculty-wide and TU Delft research initiatives**

The MBE Department participates in several University and Faculty research programmes and initiatives.

MBE & 1Mhomes - Creating a million adequate homes for future generations

Research Leader: Marja Elsinga

The ambition of the faculty wide 1Mhomes project is to contribute to a vision on the housing challenge in its societal context. The housing context changed a lot in the last decades as a result of neoliberalisation and financialisation of housing markets. This has changed the interplay between actors in housing, there interests and the (lack of) joint ambitions. Housing production and design became more profit and efficiency driven and less focused on outcomes such as the quality in terms of wellbeing, landscape and sustainability. This focus on efficiency included specialization: housing design, urban design, policy, building technology, finance, management all with their own focus on efficiency. 1Mhomes aims to focus on the housing outcomes in the context of societal transitions and ambitions. MBE addresses the following research questions:

- How to shape (mass) housing production that fits the energy ambitions and financial means of households? (AE&T, MBE)
- How to accommodate values such as wellbeing and sustainability in housing strategies and policies? (MBE, A)
- What are norms for adequate living, how to calculate housing need, how about multiple space use and how can the existing buildings contribute to solving the problem? (all)

Website: https://www.tudelft.nl/en/architecture-and-the-built-environment/research/research-at-bk-bouwkunde/education-innovation/

Circular Built Environment

Research leader: Tillmann Klein (AE&T), with participants from all MBE sections

Platform for researchers of the Faculty of Architecture and the Built Environment and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute) with the aim to promote the development of knowledge towards a circular built environment that enables the design of future buildings, cities and infrastructures.

Circular Built Environment (CBE) has a living lab approach, conducting live scale projects and experiments in cooperation between researchers & educators, public sector, private sector and society.

Circularity is a transdisciplinary and systemic approach, concerning the different scale levels from city to building, component and material. Here, social, technological, environmental and economic aspects are of major importance as well as stakeholders, processes and design.

CBE is connected to the research agenda on circular economy and circular built environment of the BauHow5 network (Chalmers, UCL, TU Münich, ETH Zürich, and TU Delft).

Website: https://www.tudelft.nl/en/architecture-and-the-built-environment/research/research-themes/circular-built-environment/

REPAiR REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism

Research Leader: Arjan van Timmeren and Alex Wandl

REPAiR applies a geodesign approach including waste and resource management in order to reveal the local space-specific challenges of waste and resource management using life cycle analyses (LCA) and Urban Metabolism. The key challenge for REPAiR is to integrate models and methods from, among others, the environmental sciences, geographic sciences and economic sciences with design and spatial planning methods, both on a software and process level. The integrated models and methods will enable local and regional stakeholders to use the geodesign decision support environment (GDSE) within a workshop setting to develop fast and reliable alternatives for spatial sustainable development strategies. The main objective of REPAiR is to demonstrate the feasibility and validity of the GDSE as a tool for enhancing waste and resource management.

Researchers and role MBE

Hilde Remøy and Erwin Heurkens. MBE contributes to research on developing solutions and strategies for circular, sustainable resource management, focusing on policy and governance issues. MBE also has an important role in developing and accommodating the co-creation methodology applied in Living Labs, that is an important part of REPAiR's structure.

KaDEr - Karakteristiek DUURZAAM Erfgoed Gelderland

Research leader: Hielkje Zijlstra

The goal of the collaboration between Delft University of Technology and The Province of Gelderland is to define an adjusted framework for heritage management to arrive at innovative policies based on scientific research, departing from the way in which the Province of Gelderland so far acts with regard to the maintenance of monumental built heritage.

Researchers and role MBE

Hilde Remøy, Herman vande Putte and Ilir Nase. MBE contributes to this research by developing a scan for the possibilities of adaptive reuse management for religious heritage in Gelderland.

5 – **Main national and international research collaborations**

The MBE research programme has many partners in industry, government, and society across the Netherlands. We also have many international links including EU member states, other European countries, Australia and New Zealand, North and Latin America, especially Chile, and Asia, especially China. We list here only the most significant partners.

Amsterdam Metropolitan Solutions (AMS)

Vincent Gruis and Ellen van Bueren are principal investigator at the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). AMS is a public–private collaboration between TU Delft, Wageningen University Research and the MIT as core academic partners, with TNO (Dutch Applied Research Organisation), Amsterdam Smart City, The Waag Society, City of Boston, KPN, Accenture, Alliander, Cisco, ESA, IBM, Shell and Waternet. Its principal aim is to formulate research on urban governance and management with respect to the urban challenges of sustainability and quality of life, including resource and food security, mobility and logistics, water and waste management, and health and wellbeing.

Contact: Prof. dr. ir. Ellen van Bueren.
Website: https://www.ams-institute.org

Leiden–Delft–Erasmus (LDE) Centre for Sustainability and LDE Centre for BOLD cities

Prof. Ellen van Bueren was a board member of Leiden–Delft–Erasmus collaborative centres on BOLD Cities (on the meaning of big open and linked urban data for citizens and decision-makers) from 2015-2018, which has resulted in the active involvement of MBE-staff in BOLD Cities research and still is a daily board member of the Centre for Sustainability (with a focus on the circular economy, strategically aligned with EIT Raw Materials, the province of Zuid-Holland and the cities of The Hague, Rotterdam, Leiden and Delft).

Contact: Prof. dr. ir. Ellen van Bueren.

Opdrachtgeversforum in de Bouw

The Dutch Construction Client Forum (Opdrachtgeversforum) is a circle of fourteen (semi)public clients who exchange experiences, share and develop knowledge and initiate ideas on new themes in construction and infrastructure. The Client Forum wants to contribute to the professionalisation of the commissioning of (semi) public organisations and to bring about innovation and quality improvement in the construction sector.

The Dutch Construction Client Forum has established the Chair of Public Commissioning at the Faculty of Architecture at Delft University of Technology. The chair focuses on the professionalisation and scientific development of the discipline that belongs to the interaction of (semi)public clients with market parties in the (re)development, realisation, maintenance and management of the built environment.

Contact: Prof. dr. ir. Marleen Hermans.
Website: http://www.opdrachtgeversforum.nl/

Centre of Expertise on Housing Value (Expertise centrum Woningwaarde)

The Centre of Expertise on Housing Value started in 2012 as an initiative of OTB, currently part of the Department Management in the Built Environment, and the Dutch Statistical Office (CBS). The focus of the Centre is on the development of housing values and the risks associated with investing in housing.
One of the regular activities of the Centre is the quarterly production of a Housing Market Monitor that provides an up to date analysis of the housing market. The Monitor is based on virtually all existing Dutch statistics on the housing market. The results of this market analysis are presented on Dutch television and discussed with practitioners and scientists during colloquia, organised by the Centre. As a result, the Centre is part of a large network of public and private organisations, involved in the housing market. For these organisations the Centre translates the results of market analysis into solutions for societal issues and policy issues. Furthermore, three PhD-projects have been conducted within the Centre since 2012.

Finished PhD-projects since 2016:

- André Ouwehand: Menging maakt verschil (mixing makes a difference), finished in 2018
- Job Taiwo Gbadegesin: Towards a new policy direction for an improved housing delivery system in Nigerian cities, finished in 2018
- Yunlong Gong: The Spatial Dimension of House Prices, finished in 2017

Ongoing PhD-projects:

- Qi Tu: Improving and extending the Dutch house price model
- Bo li: The emerging private rented sector in urban China
- Joke Terlaak: Homemaking by single person households
- Peter Verburg: Het gemeentelijk investerings-raadsel (the mistery of municipality investments)

Contact: Prof. dr. Peter Boelhouwer.

Stichting Kennis Gebiedsontwikkeling (SKG)

The Dutch Stichting Kennis Gebiedsontwikkeling (SKG) [Foundation for Area Development Knowledge] connects a growing number of public, private and third sector organisations involved in the practice of area development across The Netherlands. Next to their generous donations, SKG partners co-define the knowledge agenda of the Area Development chair together with Delft University of Technology (TU Delft). This allows SKG to fulfil its mission: to promote a professional, reflective area development practice that is aimed towards a sustainable built environment.

At TU Delft, the Area Development chair is part of the Faculty of Architecture and the Built Environment. Its network stretches across all schools relevant to the area development domain—particularly Civil Engineering, Public Management, and Industrial Design. Outside of TU Delft, the Area Development chair warmly collaborates with several research institutes and university departments with similar or complimentary domains, e.g. spatial planning, urban economics, real estate, and infrastructure. It also partners with private research and consultancy firms on specialised themes and projects.

Contact: Dr. ir Tom Daamen.
Website: https://www.gebiedsontwikkeling.nu/

Building and technology Innovation Centre (BTIC)

In 2018 the Building and Technology Innovation Centre was initiated to organise and boost the required innovation in the building and technology sector to be able to reach the 2050 goals in the build environment. These goals include: a CO2 free, circular and climate adaptive build environment. The BTIC stimulates and facilitates the initiation of long term, broad integral research and innovation programmes on:

1. Energy transition of existing buildings;
2. Circular Building Economy;
3. Digitization;
4. Renewal of infrastructure;
5. Climate adaptation.

BTIC is a collaboration between Knowledge institutions (4 TU Bouw, Universities of applied science, TNO), the Building industry (Bouwend Nederland, Techniek NL, Koninklijke Ingenieurs NL) and the Government (Ministries of Inner Affairs, Infrastructure and Water and Economic Affairs). On behalf of 4 TU Bouw, Henk Visscher is as scientific director part of the management of BTIC, together with a representative of Bouwend Nederland (Richard Mulder) and TNO (Huib Keizers).

Contact: Prof. dr. ir. Henk Visscher.
Website: http://www.btic.nu

Center for People & Buildings (CfPB)

The Center for People and Buildings is a centre of expertise that focuses on the relationship between people, work and working environment so as to promote research, product development and the transfer of knowledge in this area. The centre of expertise does so particularly for and with end users: businesses and institutions whose primary sphere of interest is not real estate. CfPB also promotes the multi-disciplinary collaboration between chairs of various universities among themselves and the professional practice insofar as the relationship between people, work and working environment is involved. The department of MBE is a member of the board of the centre of expertise.

Contact: Ir. Wim Pullen.
Website: https://www.cfpb.nl/en/

6 – **PhD Research**

Applications

Opportunities for PhD research in the MBE Programme are generally advertised on the department and faculty websites – as a ‘call for PhD candidates. There is a lot of interest in pursuing a PhD at our department and we provide information on various topics to help potential candidates in their applications. Applicants must write proposals in response to the topics on which we have capacity to supervise, and applications must demonstrate competence to undertake research in the topic, preferably including success in academic publications.

A large and increasing part of our PhD candidates are funded through research projects. Another large part of our candidates come with their own funding in the form of national or international scholarships. We may provisionally accept candidates subject to them securing funding. We may be able to advise but the primary responsibility for finding funding in these cases rests with the candidate.

The A+BE Graduate School provides extensive support to those applying and completing a PhD at TU Delft Faculty of Architecture and the Built Environment. All PhD candidates must complete a programme of doctoral education to obtain 45 credits or 15 credits per year. You can obtain credits through successful completion of specialist courses, generic courses on transferable skills and through ‘on-the-job’ activities including publication, conference presentations and teaching.

All applications should be made through the Graduate School and the website will also direct you to other resources for prospective PhD candidates.

http://www.bk.tudelft.nl/en/research/graduate-school-a-be/

TABLE 6.1 PhD projects finalised period 2016-2018 (first promotor situated in Innovations in Management in the Built Environment)

NAME	TITLE PHD	DEFENCE
Keenan, J.M.	Understanding Adaptive Capacity in Real Estate	19/04/2016
Curvelo Magdaniel, F.T.J.	Technology Campuses in cities	08/09/2016
Papadonikolaki, E.	Alignment of Partnering with Construction IT	29/11/2016
Alghamdi, N.A.A.	University Campuses in Saudi Arabia. Sustainable Challenges and Potential Solutions	09/05/2018
Bos-de Vos, M.	Project-specific value capture strategies of architectural firms	19/06/2018
Strang, H.P.C.W.	Toezicht en Coordinatie in het Bouwproces.	27/03/2018

TABLE 6.2 PhD projects finalised period 2016-2018 (first promotor situated in Housing in a Changing Society)

NAME	TITLE PHD	DEFENCE
Aziabah Akanvose, A.B.	Better public housing management in Ghana, an approach to improve maintenance and housing quality	24/05/2018
Bedir M.	Occupant behaviour and energy consumption in dwellings.	04/12/2016
Bin Mohd Noor, M.Z.	FlexZhouse: New business model for affordable housing in Malaysia	30/01/2017
Brinksma, H.	Toekomstbestendig renoveren	24/11/2017
Deng, W.	Young People's Housing Opportunity in Post-Reform China	14/09/2018
Donoso Gomez, R.E.	Affordable Condominium Housing. A comparative analysis of low-income homeownership in Colombia and Ecuador	28/09/2018
Filippidou, F.	Energy performance progress of the Dutch non-profit housing stock: a longitudinal assessment	20/06/2018
Gbadegesin, J.T.	Towards a new policy direction for an improved housing delivery system in Nigerian cities	04/09/2018
Ioannou, A.	Thermal comfort and energy related occupancy behavior in Dutch residential dwellings	09/11/2018
Murphy, L.C.	Policy instruments to improve energy performance of existing owner occupied dwellings	14/11/2016
Ouwehand, A.L.	Menging maakt verschil. Hoe bewoners buurt- en wijkverandering ervaren en waarderen ondanks en dankzij herstructurering	11/06/2018
Stutvoet, E.N.M.	"Energietransitie: omarm de complexiteit. Ontwikkeling en grootschalige toepassing van energieneutrale renovatieconcepten voor de naoorlogse sociale woningvoorraad	05/09/2018
Teye, A. L.	Diffusion and Risks of House Prices in the Netherlands	16/03/2018
Venselaar, M.H.	Work Floor Experiences of Supply Chain Partnering in Dutch Social Housing	01/12/2017
Vergara d'Alençon, L.M.	Low-income homeownership and housing maintenance in Santiago, Chile	15/11/2018

TABLE 6.3 PhD projects finalised period 2016-2018 (first promotor situated in Urban and Regional Studies)

NAME	TITLE PHD	DEFENCE
Ahmadi, D.	Living with Diversity in Jane-Finch	13/11/2017

TABLE 6.4 Ongoing PhD projects (first promotor situated in MBE)

NAME	TITLE PHD	START
Arkesteijn, M.H.	Corporate Real Estate alignment. A Preference-based design and decision approach	01/07/2011
Armijos Moya, T.E.	Green climate control system	01/11/2015
Van der Bent, H.S.	How to improve the energy performance of the assets of housing associations	01/04/2018
Bohm, N.	Developing an assessment tool for transdisciplinary learning environments (urban living labs)	01/09/2019
Van den Brom, P.I	Providing an insight in the influence of occupant behaviour on the residential energy consumption	01/03/2015
Bucci Ancapi	Visual gaming methodologies to co-design public space projects with the community in Chile	01/11/2019
Çetin-Ozturk, S.	Digital Technologies For Circular Asset Management: Potential applications in social housing sector	01/08/2019
Choe, K.	Housing System and Institution	22/02/2010
Cortés Urra, V.A.	Housing in a Changing society	01/03/2019
Dol, C.P.	Home ownership in a changing society; expansion of the sector, risks and a new role home ownership as a welfare provision	01/08/2018
Dos Santos Vieira Brysch, S.L.	Towards a new Existenzminimum: seeking affordable solutions in current Collaborative Housing in Europe	01/03/2018
Eijkelenboom, A.M.	Evidence Based Design, healthcare facilities	01/06/2017
Gaete Cruz, M.	Collaborative design of resilient public space projects	01/09/2018
De Geus, E.	Campus of the future	01/09/2019
Hoomans, S.	Elephants in the Boardroom? Sustainable values-based strategic decision-making in a Dutch housing association	08/04/2017
Jansen, B.	CIK: The Circular Kitchen	01/04/2018
Janssen, C.	Sociale duurzaamheid bij gebiedsontwikkeling	01/03/2019
Jia, L.	Mitigating the risks affecting housing energy retrofitting promotion in China	01/09/2016
Kamphuis, S.	Building to learn. An exploratory study of the professionalization of public clients in the construction sector	01/09/2023
Kang, V.	Flexibility and public accountability in municipal land development projects	01/10/2011
Kim, B.	Housing Justice with the Capability Approach: Bringing ethics at the centre of housing policy discourse	01/10/2017
Koolwijk, J.S.J.	Supply chain integration in the construction industry	01/05/2011
Koreman, M.C.J.	Planning for new rural generations: Rural newcomers and access to land	01/09/2019
Kuitert, L.	Safeguarding Public Values by Public Client Organisations in Construction	15/11/2016

Li, B.	The emerging private rented sector in urban China	01/09/2018
Ma, J.	Understanding homeowners' behaviour in residential energy retrofitting in China's northern heating region	01/09/2016
Mens, J.S.	Flexibel, ottom-up urbanism: new opportunities for co-creating futures cities?	04/09/2017
De Mul, Y.R.R.R.	Positie van de onderaannemer binnen de bouwrechtelijke relaties	01/07/2016
Nagelkerke, M.C.J.	Voorwaarden evenwichtig DBFM-contract	01/07/2011
Oates	Governance in Integrated Urban Development	01/10/2019
Ortiz Sanchez, M.A.	User Experience and Energy Consumption in Homes	01/09/2015
Overtoom, M.E.	Transformation of vacant properties from a user perspective	01/04/2016
Qi, Y.	evaluating retrofit technologies in existing residential buildings	28/09/2016
Rasooli, A.	Determination of thermo-physical characteristics of dwellings as input for energy models for buildings and the building stock	01/04/2015
Smolders, J.W.A.M.	An investigation into the causation of non-confirming material entering the construction supply chain into Australia	23/06/2017
Souaid, C.	Assessing Innovative Affordable Zero Energy Housing	01/10/2018
Steenbergen, G. van	Gebiedsontwikkeling, van bovenaf naar onderop; Op zoek naar de rol van het middenbestuur	
Van Stijn, A.	REHAB: Developing circular retrofit solutions for late post-war habitats	15/01/2018
Suijkerbuijk, B.E.D.M.	Implementatie van de marktvisie bij Waterschappen	01/09/2018
Tempels Moreno Pessõa, I.	Planning with self-organised initiatives: from fragmentation to resilience	04/06/2019
Terlaak Poot, J.M.	Homemaking by single person households	16/02/2016
Tu, Q.	Improving and extending the Dutch House Price Model	01/09/2013
Valks, B.	Smart campus tools	12/04/2018
Verburg, P.J.	Relation between municipal investment policy and local prosperity development	01/03/2017
Wang, B.	The influences of High-Speed Rail on the sustainable urban and regional development	01/11/2017
Wilcox	Towards developing sustainable neighbourhoods through housing typologies and land use diversity	01/09/2019
Wu, H.	Improving the supply chain of prefabricated housing form a transaction costs perspective	09/09/2016
Yan, J.	Social Housing Governance in Urban China, Away from a Monopolistic Provision Channel	17/09/2015
Zhang, D.	Customization of Indoor Environmental Quality in Classrooms	05/09/2016
Zhuang, T.	Decision Making of Urban Renewal in China	01/09/2015

7 – **SWOT analysis**

Strengths

- Particularly with the addition of the new MBE colleagues we have a lot of professors and other talented scientists in our department to make a real impact.
- We are increasingly working together with colleagues within the department, from other departments and outside the faculty and university. This strengthens our profile and creates innovative research pathways.
- We are increasingly focussing on research in collaboration with Industry on themes of our choice, not in the shape of a principal-client relationship, but as co-researchers and developers.
- Our specialism, linking management and governance to specific challenges in the built environment, enables us to make a real contribution to society and to a relatively targeted field of science. Within this field, we have enough variety in sub-disciplines to tackle the often multi-facetted challenges.
- The research culture within the department has improved strongly in the past decade, with a visibly increased focus and success on fund raising from for example NWO, Interreg, Horizon2020 and on acquiring PhDs and postdocs.
- We benefit from the sound reputation of TU Delft, the Faculty and our professors.

Weaknesses

- One of our key ambitions is to have a strong focus on end users of real estate. Although Several chairs do focus on the end user, it could be stressed even more clearly.
- Although having improved a lot in recent years already, we still think there are more opportunities to connect our research with that of colleagues from other departments, particularly to foster our ambitions to conduct and develop research through design.
- Some highly relevant competences need to be further developed within our team to contribute to some of the big challenges, particularly in the field of digitisation and circular economy. At the same time, there is limited flexibility to adapt the tenured staff.
- Our core knowledge base as well as methodological principles could be made more explicit, although the ‘principle researcher’ model that we are growing towards also implies a variety in knowledge and methodological specialisations.

Opportunities

- The introduction of the Faculty wide research themes (e.g. Digitalization, 1 Million Homes, Circularity) create opportunities to further strengthen our cooperation with other departments.
- New Horizon Europe themes are expected to link very well to our own research ambitions and competences.
- The Building Technology & Innovation Center (BTIC) will generate a lot of new funding opportunities, also for our research.
- NWO is increasingly open to research proposals that have a multidisciplinary nature and are explicitly linked to societal challenges.

Threats

- Management and governance may not be recognised as core fields or research in the context of the built environment, when the emphasis will be (re)directed to technological solutions, and this could hamper funding opportunities.
- The ratio between effort and success rate in acquisition of funding could get worse, which will put more stress on our staff.

8 – **Reseach projects MBE**

Social Value of Nuclear Decommissioning and Site Remediation

Funder | Programme [grant number]
Engineering and Physical Sciences Research Council [NNL/UA/012]
UK Nuclear Decommissioning Authority

Overall budget
€ 120.770 (£107.560)

Grant amount
Total: € € 120.770 (£107.560)

Role TU Delft
Lead partner

Duration
01-2016 > 12-2019

TU Delft researchers
Prof.dr. Paul W Chan [Principal Investigator; External Supervisor]

Project partners
Arup, United Kingdom
Nuclear Decommissioning Authority, United Kingdom
University of Manchester, United Kingdom

Contact person
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Dounreay Fast Reactor (Source: Photo taken by the researcher, Cara Mulholland)

This project investigates the concept of social value and what this means in the context of managing projects. The driver for this study was to respond to the introduction of new legislation in the UK, namely The Public Services (Social Value) Act, 2012. This PhD study focuses specifically on the role stakeholder communication and framing plays in making sense of what social value means in nuclear decommissioning and site remediation. This study is funded under the auspices of the Engineering and Physical Sciences Research Council (EPSRC) Industrial CASE studentships programme, with co-funding provided by the Nuclear Decommissioning Authority (NDA). The PhD student, Cara Mulholland, is based at The University of Manchester and has been supervised by Paul Chan, Chair of Design and Construction Management.

Further information
www.mub.eps.manchester.ac.uk/thebeam/2019/01/07/social-value-of-nuclear-decommissioning-and-remediation/

Commissioning within Public Organisations

Funder | Programme [grant number]
Het Opdrachtgeversforum in de Bouw

Overall budget
€ 850.000

Grant amount
Total: € 850.000
TU Delft: € 850.000

Role TU Delft
Lead partner

Duration
01-2017 > 12-2021

TU Delft researchers
Prof.dr.ir. Marleen Hermans
Dr.ir. Ad Straub
Dr.ir. Leonie Koops
Ir. Lizet Kuitert
Ir. Hanneke Veldhuis
MSc. Sarah Kamphuis
Drs. Simone Rots
Vacancy

Project partners
ProRail
Rijkswaterstaat
Rijksvastgoedbedrijf
Schiphol
NS-stations
Nationale Politie
Provincie Noord-Holland
Hoogheemraadschap Hollands Noorder Kwartier
Gemeente Rotterdam
Gemeente Den Haag
Erasmus Universiteit (Campus & Offices services)
Radboud UMC
De Alliantie
Mitros

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The chair of Public Commissioning in Construction aims to professionalise the field of 'commissioning' in the public sector by improving the general understanding of construction clients and their role and domain of work in asset management; identifying the key capabilities of those clients and their organisations; generating supportive knowledge and tools for this target group. The research focusses on:

1. **Public values.** Public organisations are required to comply with and safeguard a number of public values, performance related as well as process related. We explore what public values should be ensured by public client organisations operating in the built environment, how the safeguarding of public values can be assured in the client organization and how public construction clients can safeguard public values in the process of public service delivery.
2. **Organisational structures.** Different aspects influence the approach to commissioning and the professionalism required of the client and its organisation. Through various studies, we want to gain insight into how the commissioning role is embedded in organisations. In addition, we conduct a sector-wide study of learning practices, and their embedding in the practice of (semi)public clients.
3. **Collaboration with market parties**. This research focuses on investigating changing relationships between clients and contractors in construction and infrastructure. The research examines assessment frameworks, the control mechanisms used, success and failure factors and the way in which (new) forms of collaboration are embedded in and between the organisations involved.

Developments of Energy Renovations in the Dutch Housing Stock

Funder | Programme [grant number]
EU | *IEE – EPISCOPE*
AEDES

Overall budget
EPISCOPE (2013-2016): € 2.459.226
AEDES (2013 -2021): € 329.000

Grant amount
EPISCOPE:
Total: € 2.459.226
TU Delft part: € 144.455
AEDES: € 329.000

Role TU Delft
EPISCOPE: Project partner
AEDES: Lead partner

Duration
EPISCOPE: 04-2013 > 03-2016
AEDES: 01-2014 > 5-2021

TU Delft researchers
Prof.dr.ir. Henk Visscher
Dr. Nico Nieboer
Faidra Filippidou
Paula van den Brom
Herman van der Bent

Project partners
Institute for Housing and Environment [IWU], Germany
Buildings Performance Institute Europe [BPIE], Belgium
Building and Civil Engineering Institute [ZRMK], Slovenia
Danish Building Research Institute - Aalborg University [SBi], Denmark
Austrian Energy Agency [AEA], Austria
Building Research Establishment Ltd [BRE], United Kingdom
National Observatory of Athens [NOA], Greece
Flemish Institute for Technological Research [VITO], Belgium
Politecnico di Torino - Department of Energy [POLITO], Italy
STU-K, Czech Republic
Energy Action Energy Action Limited, Ireland
Budapest University of Technology and Economics [BME], Hungary
Valencian Institute of Building [IVE], Spain
Cyprus University of Technology [CUT], Cyprus
Pouget Consultants, France
Norwegian University of Science and Technology [NTNU]

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The energy transition in the European Housing stock has been supported and steered by various EU and national policies and regulations. The Energy Performance Certificate indicating the energy efficiency of buildings, required by the EU Energy Performance of Buildings Directive (EPBD), has been an important tool for the existing buildings. It was used to inform and stimulated home owners, but also used to set and monitor improvement goals. In the Netherlands, Aedes the umbrella organisation for housing associations, created a huge data base (SHAERE) with the EPC's of more than 2 million dwellings to monitor the progress in reaching the goal of an average label B in 2020. We have used this data bases for several research goals. Within the EPISCOPE project we compared the Developments in the Netherlands with other EU countries. More specifically for the energy transition in the Netherlands we analysed the progress in realising the goals in terms of renovations and actual energy reduction. This is worked out in 3 PhD theses, a special issue of Energy and Buildings and several other Journal articles.

Further information
http://episcope.eu/iee-project/episcope/

https://www.sciencedirect.com/journal/energy-and-buildings/vol/132/suppl/C

Housing for zero Energy

Affordable and sustainable housing through digitization

Acronym
H4.0E

Funder | Programme [grant number]
EU | *Interreg North West Europe* [NWE705]

Overall budget
€ 4.230.000

Grant amount
Total: € 2.540.000
TU Delft: € 450.000

Role TU Delft
Project partner

Duration
03-2018 > 11-2021

TU Delft researchers
Prof.dr.ir. Marja Elsinga [lead TUDelft team]
Prof.dr.ir. Henk Visscher
Dr. Harry van der Heijden
Dr. Arjen Meijer
Dr. Marietta Haffner
Cynthia Souaid
Shima Ebrahimigharehbaghi

Project partners
Vlaams Brabant, Belgium [lead partner organisation]
South West College, United Kingdom
Europäisches Institut für Innovation - Technologie e. V., Germany
Municipality of Almere, The Netherlands
3 Counties Energy Agency, Ireland
Open Systems Lab, United Kingdom
Kamp C, Belgium

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Interreg North West Europe project Housing 4.0 Energy (H4.0E) aims to develop a market for small, affordable near-zero energy homes (NZEHs) by adapting and applying new digital technologies, thus stimulating both consumer and supplier interest. Made up of five partner countries in North West Europe (NWE), the three and a half year H4.0E project will facilitate the uptake of low carbon and digital technologies, products, processes and services in the NWE housing sector to reduce carbon emissions and improve quality of life for homeowners in the region and beyond.

The issue

The EU 2030 Framework for climate and energy sets targets for cutting 40% of CO2 emissions, increasing the share of renewable energy to greater than 27% and providing at least 27% energy savings across Europe. The North West Europe (NWE) region is the most industrialised region—as well as the most prolific CO2-emitting region—in Europe. Within this region, the private housing sector alone accounts for nearly one-third of all CO2-emissions, as there is currently no great push within this industry to achieve EU targets. Meanwhile, decreasing household size, changing patterns of regional population density and other social factors have led to a significant decline in demand for large, expensive and energy-inefficient homes; and in turn, this has led to the increased desire for smaller, more affordable energy-efficient high quality living spaces. The main goal of Interreg North West Europe Housing 4.0 Energy, therefore, is to offer people in NWE access to new affordable near-zero energy/low carbon homes (NZEHs) and zero energy/low carbon homes (ZEHs), effectively aiming to reduce home building costs by 25% and carbon emissions by 60%.

Housing 4.0 Energy for a better North West Europe

Housing 4.0 Energy (H4.0E) will develop an affordable ZEH market by adapting and applying new technologies, thus creating both consumer and supplier interest. Made up of five partner countries in North West Europe (NWE), the three-year H4.0E project will facilitate the uptake of low carbon and digital technologies, products, processes and services in the NWE housing sector to reduce carbon emissions and improve quality of life and affordability for residents in the region and beyond.

Digitization (4.0) techniques and the development of a H4.0E digital platform—designed to facilitate the digitalization of building homes and transferability of these techniques—will ignite fundamental changes in design, manufacturing and construction within the housing industry to meet both EU targets and the needs of homeowners in NWE. Using a client-based approach, H4.0E partners will work with local stakeholder groups—especially local authorities, housing associations, architects, self-builders, construction companies and current homeowners—across North West Europe. Starting from the needs, budget and expectations of end users, the project will identify and remove financial, legal and other obstacles related to housing preferences to meet the expectations of investors & diverse groups of small households. The project will be tested and monitored for viability in six pilot sites (in IRL, DE, NL, BE) representing varying levels of industry and carbon emissions, ranging from cities in low carbon regions to rural areas in less carbon conscientious regions. H4.0E is funded by € 2.5 Million in European Regional Development Fund (ERDF) funding with a total budget of € 4.2 Million.

Project pilots and outputs will include 48 NZEH/ZEH units in four regions & consumers' evaluations, and partners are to attend regular seminars and events throughout the programme to monitor project progression and ensure effective collaboration. All NZEH/ZEH units will be constructed within the first 18 months of the project, allowing for extensive monitoring during the following months. Parallel testing in the six pilot sites will allow for transnational comparisons & learning; however, every pilot will maintain a distinct focus. The six H4.0E pilots include:

1. Gemeente Almere (Almere, Netherlands): WikiHouses in urban areas, demonstrating digitised (4.0) self-building (WP5)
2. Province Flemish Brabant (Flemish Brabant, Belgium): NZEH/ZEH units in rural areas to be let to candidates on the waiting list of the local social letting agency (IP1)
3. Elfi-Tech (Schwäbisch Gmünd, Germany): Multiple NZEH/ZEH buildings for students (IP2)
4. 3CEA (Carlow, Kilkenny & Wexford, Ireland): NZEH/ZEH units for low income groups in rural areas & monitoring user behaviour (IP3, 4 & 5)

All pilots feed data into the main output: the H4.0E Energy Building Technology that enables zero energy/emission housing building on a larger scale.The Housing 4.0 Energy partnership includes eight organisations from five different countries in North West Europe.

Further information
https://www.nweurope.eu/projects/project-search/h40e-housing-40-energy/

The changing cooperation between clients and contractors in the hydraulic engineering sector

Funder | Programme [grant number]
Principals Council of the Dutch Water Authorities

Overall budget
€ 265.080

Grant amount
Total: € 265.080
TU Delft: € 265.080

Role TU Delft
Lead partner

Duration
09-2018 > 10-2022

TU Delft researchers
Prof.dr.ir. Marleen Hermans
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MSc. Bart Suijkerbuijck

Project partners
Unie van Waterschappen
Hoogwaterbeschermingsprogramma
Hoogheemraadschap Hollands Noorderkwartier
Waterschap Noorderzijlvest
Waterschap Rivierenland
Waterschap Delfland
Waterschap Scheldestromen
Waterschap Hollandse Delta

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Dredging (photo: Unie van Waterschappen)

In 2016 the Dutch Water Authorities, 'Hoogwaterbeschermingsprogramma' and sector organisations of contractors and engineers jointly presented their vision on the cooperation of the future: 'The Water Board Market of the Future'. One of the relevant aspects of the implementation of the market vision is the way in which the professionalisation of the sector - both on the client's side and on the contractor's side - is shaped. After all, a different way of working together in realising construction projects goes hand in hand with different demands on the tasks, roles, knowledge and behaviour of those involved.

This research focuses on the implementation of new (aspects of) cooperation forms and their consequences for attitude and behaviour on the part of clients and contractors, control mechanisms and the way in which these new forms of cooperation are embedded in the client organisation.

The research will focus on the following aspects:

1. Contributing to the increase of knowledge and insights and the implementation of the market vision as an instrument in the professionalisation of clients (and contractors) in the field of hydraulic engineering.
2. Contributing to increase the capacity for learning and innovation in the light of the experience gained by water boards.
3. Evaluating the market vision on the basis of developments in the sector and monitoring the progress on formulated targets and the adjustment of those goals.

Circular Area Development Binckhorst

Accelerating the Circular Economy Zuid-Holland (Accez)

Acronym
Accez-Binckhorst

Funder | Programme [grant number]
Province of Zuid-Holland | *Accez Programme* [PZH-2018-658193468]

Overall budget
€ 1.039.083

Grant amount
Total: € 1.039.083
TU Delft: € 328.700

Role TU Delft
Lead partner

Duration
09-2018 > 09-2020

TU Delft researchers
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Project partners
Erasmus University Rotterdam
Leiden University
Wageningen University

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Achieving circularity in the near future starts today. An area developed today for residential purposes for example will influence our built environment for decades. This means that special criteria or rules have to be developed on how we deal with such decisions and transformations. The aim of the project is to develop necessary knowledge for the transition towards a Circular Economy and how technical knowledge can best be used into the governance aspects of these developments. More specifically this project aims to test and examine circular area development for the Binckhorst (a specific area in The Hague). Within this discussion, the circular discourse is frequently used and has the potential to bring together contemporary and future area development with other important transitions as the energy transition, industry 4.0, social inclusiveness and climate change adaption.

The project itself is set up in an innovative way, namely as a co-creation project. This entails that knowledge production (cf. theory and policy) is not only done by the involved research institutions, but also with the relevant private and public stakeholders, this by organizing workshops, round tables etc.

Further information
https://www.accez.nl/

A Systems Perspective on Urban Flood Resilience

How institutions contribute to urban flood resilience, illustrated for the Greater Accra Metropolitan Assembly, Ghana

Funder | Programme [grant number]
The World Bank | *The Independent Evaluation Group*

Overall budget
€ 34.750

Grant amount
Total: € 34.750
TU Delft: € 34.750

Role TU Delft
Lead partner

Duration
06-2018 > 09-2018

TU Delft researchers
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Dr. Nikki Brand
Prof.dr. Ellen van Bueren

Project partners
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This study looks at the topic of flood resilience and the role of the World Bank. It presents a framework for evaluation in the context of systems thinking, which provides an integrated overview about how institutions 'across the board' contribute to improving flood resilience. These insights can be used to identify and discuss the influence of the World Bank.

To illustrate what insights the framework can bring, it has been applied to the case of Accra, Ghana, a flood prone area. The study should be considered as a first, explorative exercise to combine insights from a geographical and institutional analysis, in order to develop an integrated perspective on urban flood resilience, related to the operation of an international donor. Although preliminary in nature, the study identifies the challenges surrounding geographically widespread flood vulnerabilities and complex institutional contexts at the ministerial, inter-sectoral and city levels involved in resilience efforts. While it is difficult to establish the perceived and actual influence of the World Bank's interventions on urban resilience, the case study illustration shows how its contribution towards institutional capacity strengthening, coordination and collaboration in flood management is locally recognized. Despite the considerable challenge of operationalizing the issue of urban flood resilience and donor influence, the case study indicates that urban flood resilience is first and foremost a cross-sectoral, cross boundary and cross jurisdictional issue. Although steps are being taken towards greater streamlining of institutional efforts, institutional fragmentation and coordination challenges remain.

Urban Transformations (of innercity and brownfield areas)

Funder | Programme [grant number]
Ministerie van Binnenlandse Zaken [National Department of Domestic Affairs]
G40 [the 40 biggest municiplaities in the Netherlands]
G4 [the 4 biggest cities in the Netherlands (Randstad]
NEPROM [Dutch association for property developers]
Bouwend Nederland [Dutch association for the construction industry]
IPO [Dutch association for the 12 provinces]
VNG [Dutch association for municipalities]
IVBN [Dutch association for real estate investors]

Grant amount
Total: € 140.000
TU Delft: € 140.000
Note: for the coming 2-3 years (2020-2022) amounts like this will be to awarded again to the TU Delft exclusively, based on the specific needs of the program.

Role TU Delft
Lead partner

Duration
01-2017 > 01-2022

TU Delft researchers
Dr. Wouter Jan Verheul
Dr.ir. Tom Daamen
Dr.ir. Erwin Heurkens
Mr.dr. Fred Hobma

Project partners
Ministerie van Binnenlandse Zaken [2017]
Platform31 [2018-2022]

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Transformed Kop van Zuid / Katendrecht, Rotterdam (photo: Erwin Heurkens)

To deliver the knowledge that is needed to transform brownfield areas into mixed-use residential areas to build 1 million homes in Dutch urban areas, the TU Delft Urban Development Management (UDM) group is the research-partner of two combined (consecutive) programmes: Agenda Stad (‘urban agenda’) guided by the Minsiterie van Binnenlandse Zaken (Ministery of Domestic Affairs), and Programma Stedelijke Transformatie (Programme on urban transformations), guided by a delegate organization ‘Platform 31’, commissioned by a consortium of public and private funding partners.

The TU Delft UDM group of researchers delivers knowledge, case studies, reflection sessions, key-notes during conferences, workshops, papers and essays for a large variety of practitioners working on all kinds of inner city and brownfield transformation challenges. Publications that have been written for this programme are about topics such as: existing and new (innovative) policy instruments, fragmented land ownership, governance (steering) dilemmas, or financial issues of urban transformations. The task of the TU Delft UDM role as knowledge partners is not only to deliver useful knowledge for practitioners, but also to develop new educational materials for teaching students how to cope with difficult transformation challenges.

The Circular Kitchen (CIK)

Acronym
CIK

Funder | Programme [grant number]
EU | *EIT Climate-KIC*

Overall budget
€ 2.266.140

Grant amount
Total: € 1.074.060
TU Delft: € 349.809

Role TU Delft
Lead partner

Duration
01-2018 > 01-2022

TU Delft researchers
Prof.dr.ir. Vincent Gruis
Ir. Anne van Stijn
Dr.ing. Gerard van Bortel
Ir. Bas Jansen

Project partners
Chalmers
Amsterdam Institute for Metropolitan Solutions (AMS)
Bribus keukens
ATAG
Dirkzwager Groep
Eigen Haard
Waterweg Wonen
Woonbedrijf
Ymere
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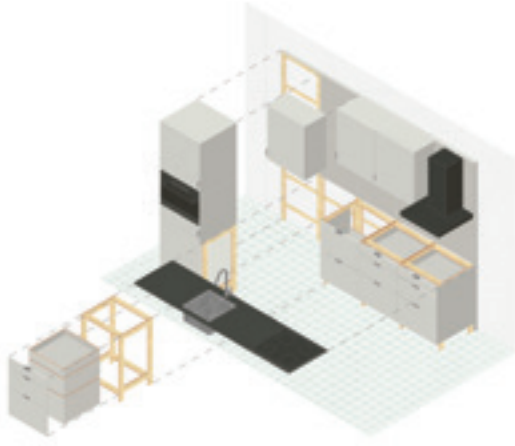

The Circular Kitchen

Buildings consist of many components such as installations, kitchens, bathrooms, etc. These can be replaced by circular components during maintenance and renovation, leading to a bottom-up implementation of a circular economy in the built environment.

In project CIK, the TU Delft, Chalmers, AMS Institute, industry partners and clients develop one such circular component: The Circular Kitchen. In four years the CIK will be developed to a prototype and market-ready product which will be implemented in demonstration exemplars as part of deep retrofit projects in the Netherlands and Sweden. In the CIK the design, business and industrial model are developed in parallel to each other.

Triple-A researches the impact of Home Energy Monitoring Systems on renovation behavior

Triple-A

Stimulating the Adoption of low- carbon technologies by home-owners through increased Awareness and easy Access

Acronym
Triple-A

Funder | Programme [grant number]
EU | *Interreg 2 Seas Mers Zeeën, Priority Low carbon technologies* [2S02-029]

Overall budget
€ 5.297.095

Grant amount
Total: € 3.178.257
TU Delft: ERDF: € 425.065; Province of South-Holland: € 106.266

Role TU Delft
Project partner

Duration
01-2017 > 01-2021

TU Delft researchers
Dr.ir. Erwin Mlecnik
Dr.ir. Ad Straub
Dr.ir. Frits Meijer

Project partners
City of Antwerp
City of Breda
Kent County Council
City of Mechelen
Public Service for Energy Efficiency (PSEE), Picardie, FR
City of Rotterdam
AG EOS
Ghent University
Eandis
Fluvius

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One of the mobile consultancy centers developed in the framework of Triple-A (copyright: City of Mechelen)

The Triple-A project accelerates the Adoption of low-carbon technologies by transnational cooperation between local authority partners, who face the common challenge to stimulate home-owners to adopt low-carbon technologies. Jointly they develop and implement a (Triple-A) method that increases Awareness of low-carbon technologies among home-owners and simultaneously secures easy Access to technologies that fit their needs and resources.

Within the Triple A-project local and regional authorities from Belgium (Antwerpen, Mechelen, Ostend), France (PSEE Picardie), the Netherlands (Breda, Rotterdam) and the United Kingdom (Kent County Council) join forces to encourage home-owners in making their existing single-family homes more sustainable and thus reduce their energy consumption. They are supported by 2 universities (TU Delft and Ghent University), and by a Belgian utility (Eandis/ Fluvius).

Main research outputs of the project are ICT solutions, home energy monitoring system testing, concepts for collaborative actions, and for the use of demonstration exemplars to increase the adoption of low-carbon technologies.

TOP: Triple-A partners
BOTTOM: IEA EBC Annex 75 group visiting TU Delft for a joint Triple-A/IEA workshop and 3-day research meeting.

Peer-reviewed articles
Mlecnik, E., Straub, A. & Haavik, T., 2019. Collaborative business model development for home energy renovations, Energy Efficiency, Vol. 12 (1), pp 123–138, 16 p.

Meijer, F., Straub, A. & Mlecnik, E., 2018. Consultancy Centres and Pop-Ups as Local Authority Policy Instruments to Stimulate Adoption of Energy Efficiency by Homeowners, Sustainability, 10 (8), 14 p., 2734.

Public reports
Meijer, F., Straub, A. & Mlecnik, E., 30 Apr 2018. Impact of Home Energy Monitoring and Management Systems (HEMS): Triple-A: Stimulating the Adoption of low-carbon technologies by homeowners through increased Awareness and easy Access D2.1.1. Report on impact of HEMS, 37 p.

Meijer, F., Straub, A. & Mlecnik, E., 30 Jan 2018. Concepts for consultancy centres and pop-ups for the adoption of low-carbon technologies by homeowners: Triple-A: Stimulating the Adoption of low-carbon technologies by home-owners through increased Awareness and easy Access, 77 p.

Mlecnik, E., Meijer, F. & Bracke, W., 30 Jan 2018. Strengthening local authority web portals for the adoption of low-carbon technologies by homeowners: Triple-A: Stimulating the Adoption of low-carbon technologies by homeowners through increased Awareness and easy Access, 71 p.

Activities
Public workshop “Upscaling energy renovation to the district level”, Mlecnik, E., Konstantinou, T. & Winkels, Z. (Organisers & Moderators), TU Delft, 25 Sep 2019.

Research workshop “Local policy instruments to support the adoption of energy saving in the housing stock”, Mlecnik, E. (Session organizer, Moderator & Speaker), SUES 2018: Sustainable Urban Energy Systems Conference, TU Delft, 8 Nov 2018.

Public presentation “Adviesloketten ter bevordering van de toepassing van energie-efficiënte renovatiemaatregelen”, Mlecnik, E. (Speaker), National Renovation Platform Working Group Save the Climate, De Bilt, The Netherlands, 20 Sep 2018.

Public workshop “Collaboration for the adoption of HEMS”, Mlecnik, E. (Organizer & Speaker), Ghent, Belgium, 13 June 2018.

Public workshop “Business development of pop-up centers for home renovation”, Mlecnik, E. & Straub, A. (Organisers), Antwerpen, Belgium, 13 Oct 2017.

Public workshop “Triple-A: stimulating the Adoption of low-carbon technologies by home-owners through increased Awareness and easy Access”, Mlecnik, E. (Speaker), Canterbury, UK, 12 June 2017.

Public presentation “Opportunities of websites for the adoption of energy saving technologies”, Mlecnik, E. (Speaker), Rotterdam,

The Netherlands, 18 May 2017.

Networking
The Triple-A project works closely together with the Working Group IEA EBC Annex 75 “Cost-effective Building Renovation at District Level Combining Energy Efficiency & Renewables”, which assembles about 45 researchers from 13 countries every six months. Annex 75 (http://annex75.iea-ebc.org) is part of the IEA-EBC Programme, an international energy research and innovation programme in the buildings and communities field. Erwin Mlecnik is recognized as national participant in this group.

The researchers in this group aim to develop specific opportunities and take advantage of district-level solutions at urban scale, and to clarify the cost-effectiveness of various approaches combining both energy efficiency measures and renewable energy measures at the district level. The objective of the TU Delft participation is to develop joint guidance to policy makers, companies working in the field of the energy transition, as well as building owners for transforming cost-effectively the city’s energy use in the existing building stock towards low emission and low energy solutions.

Further information
http://www.triple-a-interreg.eu/

Circular Housing Asset Renovation & Management-CHARM

No More Downcycling

Acronym
CHARM

Funder | Programme [grant number]
EU | *Interreg North-West Europe* [NWE 760]
Rijksdienst voor Ondernemend Nederland (RVO) | *CETSI*

Grant amount
Total: € 4.134.430
TU Delft: € 610.725

Role TU Delft
Lead partner

Duration
10-2018 > 10-2022

TU Delft researchers
Prof.dr.ir. Vincent Gruis
Dr.ir. Ad Straub
Sultan Çetin-Ozturk

Project partners
Accord Housing Association, Birmingham, UK
Paris Habitat, FR
Woonbedrijf, Eindhoven, NL
Zonnige Kempen, Westerlo, BE
European Federation for Living (EFL)
Kamp C, Westerlo, BE
University of Birmingham, UK

Contact person
Dr. ir. Ad Straub
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Increasing resource efficiency in the housing sector is of great importance for a sustainable society. A circular economy promotes optimal reuse of building materials at at least an equivalent value (e.g. bricks reused as bricks). The 'CHARM: Circular Housing Asset Renovation & Management - No More Downcycling' project develops and implements an asset management approach that prevents downcycling of materials in renovation and construction of social rented dwellings. CHARM develops and implements an asset management approach that prevents downcycling of materials in renovation and construction of social rented dwellings by creating:

1. circular building strategies tested in demonstration examplers;
2. guidelines for a circular procurement strategy for social housing organisations;
3. material exchange platforms to enable circular flows of materials and building components in the social rented sector.

Further information
https://www.nweurope.eu/projects/project-search/charm-circular-housing-asset-renovation-management/

Smart Campus Tools

Acronym
SCT

Funder | Programme [grant number]
Dutch universities

Overall budget
€ 310.000

Grant amount
Total: € 310.000
TU Delft: € 150.000

Role TU Delft
Project partner

Duration
01-2016 > 01-2021

TU Delft researchers
Prof.dr.ir. Alexandra den Heijer
Ir. Monique Arkesteijn MBA
Dr.ir. Alexander Koutamanis
Ir. Bart Valks

Project partners
Facility Management Directors of 14 Dutch universities
Radboud University, Property Management
TU Delft, Campus and Real Estate

Contact person
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Examples of smart tools as used by universities or other organisations (e.g. ABN AMRO, Microsoft)

The Smart campus tools project researches how technology can support universities to make more effective and efficient use of their campus. The research collects cases at both universities and corporates, and studies both the implemented smart campus tools and their use in campus decision-making processes. Financed partly by the Dutch universities, the project has included a network of more than 30 public and private organisations working on the subject, in which knowledge is generated and shared to support universities in their campus development and management.

Further information
https://managingtheuniversitycampus.nl/

Urbanism

Research

Urbanism research council
— Contact: Evert Meijers (research leader)

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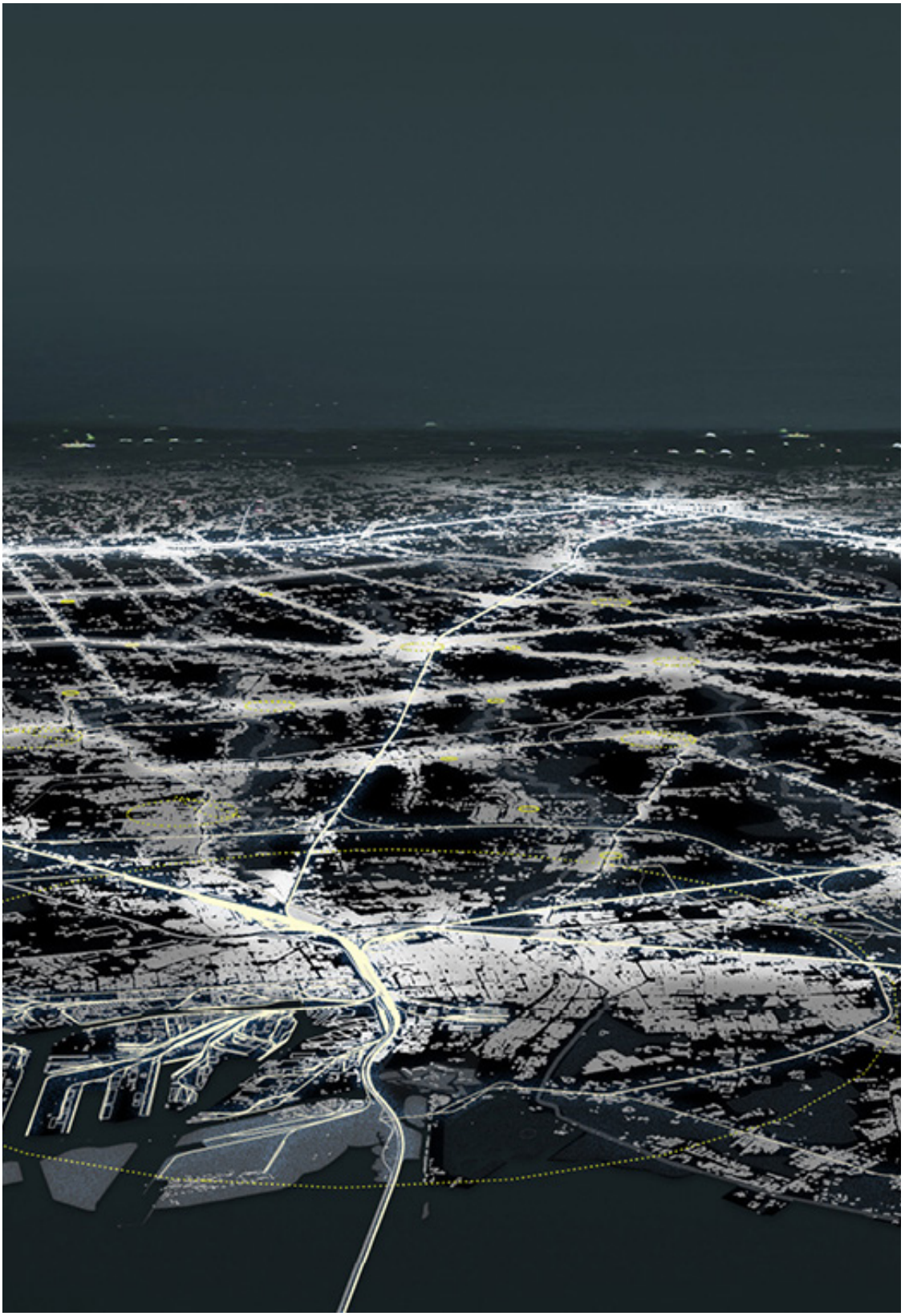

FIG. 1.1 Spacergy

1 – **Our mission**

The more than 100 members of the Urbanism department are united in contributing to the Urbanism mission, namely to advance, share and apply knowledge on how the built environment interacts with humans and their behaviour, and how design, planning and engineering interventions in this built environment can better satisfy human and societal needs. Here, ‘advance’ refers to our research, ‘share’ to our education and dissemination, and ‘apply’ to our conviction that Urbanism needs to be an action-oriented, forward looking practice.

This mission is visualised by our ‘Urbanism Triangle’, a framework to structure our research.

Operating within a broader context characterised by environmental, climate, socio-cultural, demographic, technological and economic change, our research focuses on the interaction between people, places and plans. Below, we first describe these cornerstones of this Urbanism Triangle, before turning to what connects them, which can be described as ‘research on design’, ‘research through design’ and ‘research for design’. This three-fold classification broadly represents the three research strands of our research. The different disciplines constituting urbanism place a different emphasis on parts of this triangle, while also bringing their distinct disciplinary epistemology and methodology, tools and traditions to the table. Together, they provide an in-depth understanding of how (spatial) design, planning and engineering can optimise our built environment according to our needs.

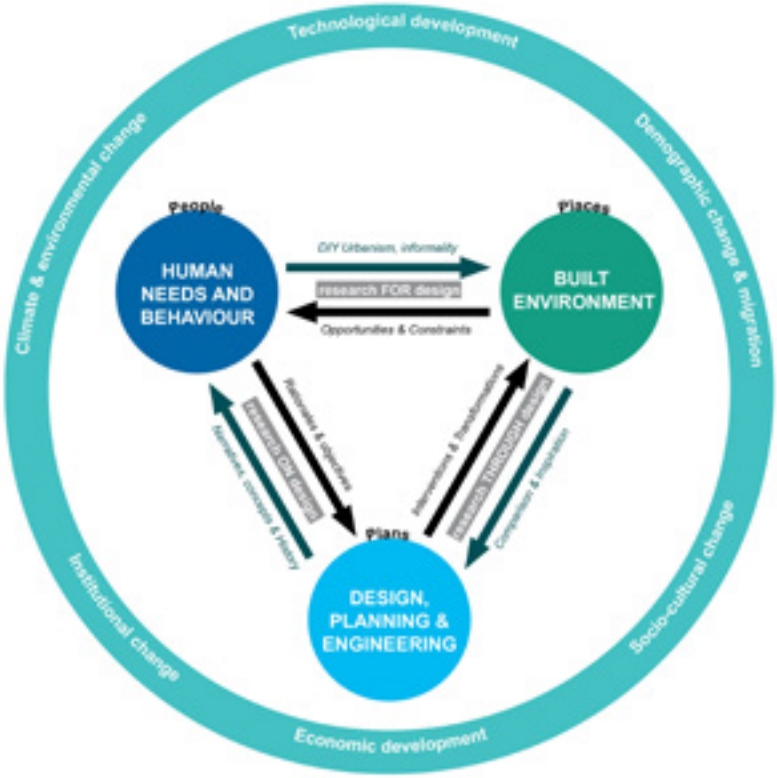

FIG. 1.1 The Urbanism Triangle

Dimension 1 - People: Human needs and behaviour

Needs as point of departure and benchmark for evaluation

The essence of the Urbanism Triangle is that human and societal needs are both the point of departure that guides spatial interventions and the benchmark against which design, planning and engineering interventions in the built environment will be evaluated. Human needs can be categorised in different ways. Maslow's five-tier pyramid of needs is well-known: physiological, safety, love, esteem and self-actualisation , while the 'capabilities' of Sen (2005) and Nussbaum (2001) in spatial justice literature are also essential human needs as well. But from the urbanism point of view, the threefold classification of Alderfer (1969), and the recent reinterpretation and elaboration by De Haan et al., provide a more comprehensive approach that allows further specificity for urbanism's mission.

Generic commonalities and attention for local conditions

Different needs are held universally for all people; yet, their importance varies from person to person and what satisfies them is dependent on cultural, geographical, social, economic and political-institutional contexts. In other words, need satisfaction calls for attention to local conditions. Taking into account human needs thus allows us to both search for generic commonalities in the functioning of cities and territories while simultaneously considering the influence of local conditions, thereby avoiding the pitfall of asserting that every individual city or territory is an irreducible special case. The behaviour of people is oriented towards satisfying these needs.

Micro and macro-levels of needs satisfaction

Meeting the needs of current and future generations was originally at the heart of the concept of sustainability , which has, however gradually become more broadly interpreted. Liveability is another overarching concept, which has been described as the extent to which the quality of life of a territory is a reflection of the needs of the people. Therefore, human needs translate into societal needs. The overarching concepts of sustainability and liveability then act as measures of how well human needs are satisfied – or frustrated. As such, our research is focused both on the micro-level of needs satisfaction of individuals, as well as the macro-level of societal needs.

TABLE 1.1 Source: Elaboration of De Haan et al., 2014.

Category	Need	Urbanism aims to contribute to:
Existence	Sustenance & livelihood	Affordable, accessible and nutritious food, drink and other ways to sustain life
	Shelter	Protection against the elements
	Health	Protection of mental and physical well being
	Safety	A safe physical environment
	Security	A safe social and institutional environment
Relatedness	Interaction & Social cohesion	Opportunities for social, economic and other types of interactions
	Ecological health	Protection of intrinsic qualities of natural ecosystems
	Knowledge & beliefs	Making sense of the world, to understanding the social and physical environment, one's role in them and ways to shape them
	Beauty & pleasure	The enjoyment and appreciation of our environment
	Comfort & convenience	A comfortable environment and a life without hardship
Growth	Culture & identity	A sense of belonging and connection
	Equity & justice	Fair treatment and equal opportunities amongst all beings across time
	Purpose & expression	Reasons for being and opportunities for the pursuit of personal and collective interests
	Influence & respect	Valuing one's opinions, desires and actions and opportunities to affect the course of events
	Freedom & autonomy	Self-determination, the possibility to voice opinions without constraints or penalties and opportunities for self-reliance and self-organisation

Dimension 2 – Places: the Built Environment

A broad definition beyond the urban and incorporating multiple scales

It is important to first note that we have a broad interpretation of 'built environment' – incorporating not just the urban environment, but also the landscape and ecosystems that they are situated in; essentially, every environment that is human-made, hence also including infrastructures that link cities, and the cultivated landscapes in between. Second, we address many different spatial scales in considering the built environment. This ranges from streetscapes, to neighbourhoods, cities, (metropolitan) regions and even larger territories at the national and continental (European) scale – not to mention bodies of open water.

Dimension 3 – Plans: Design, planning and engineering

Creative and informed interventions and transformations

At the traditional heart of Urbanism is the creative yet informed process of developing actual spatial interventions in the form of urban designs, regional designs, landscape architectural designs, engineering solutions, spatial visions and strategies, and governance and institutional practices aimed at effective interventions in the built environment. We believe there is great value in addressing these interventions holistically through the combination of various design and planning disciplines. Levels of technology and advances in engineering are an important factor in our designs and plans. In the end, we want to 'make a difference' with regard to urgent challenges related to the desire to better satisfy human and societal needs. In the typical Dutch geographical context, integrative urban-design and spatial-planning traditions provide an important foundation for this element of the Urbanism Triangle.

The Delft approach to urbanism

Our research is well-known for what some have termed the 'Dutch Model' or 'Delft approach'; a distinctive approach that is firmly rooted in:

1. the history of the Dutch design and planning tradition;
2. the history of our department;
3. the embeddedness in a Faculty of Architecture and in a university of technology;
4. our specific location in a delta region forming part of a larger polycentric metropolitan area with specific vulnerable and prosperous conditions of land and water.

THE DELFT APPROACH IN BRIEF:

- A strong intertwining of **research and design**, and hence strong emphasis on the application of knowledge for the greater good of society through evidence-informed spatial interventions and transformations.

- The **multidisciplinary integration** of planning, design, landscape architecture, environmental technology and design, urban data science and urban studies in order to obtain a comprehensive understanding of the interactions between people, places and plans.

- The **multi-scalar approach** to urbanism - from street-scapes, to neighbourhoods, cities, metropolitan areas, regions, national and continental territories; we pay particular attention to how interventions on one scale may interact with human and societal needs satisfaction on another scale. We analyse, design and plan at and across a variety of scales.

- A strong focus on (new) **technology and engineering**, posing opportunities and constraints for spatial design and planning, while always keeping an eye on the methodological and data acquisition possibilities of new technologies.

- In the process of designing plans and strategies much attention is paid to **multi-actor** decision-making and the engagement of all relevant stakeholders, in particular, citizens.

- A distinct, additional thematic focus on the challenges of polycentric urban structures and highly urbanised delta regions. More generally, this represents our **sensitivity to local conditions**, while simultaneously taking our Delft approach to urbanism into the international arena.

- These approaches also guide the way we educate future urbanism professionals and how we organise our education, with **a close relation between education and research** being striven for.

History

Urbanism as a discipline started in Delft right after WWII with the appointment of two professors, one more oriented towards urban design (Van Eesteren) and the other towards research that supported design interventions and landscape architecture (Van Lohuizen). Engineering was also an important part of the curriculum, as the engineering of the territory has always been crucial in preparing the land for occupation.
Hence, from the very beginning, design, engineering and research have been strongly intertwined, and spatial interventions have been approached from multiple disciplinary perspectives. The range of disciplines involved has only grown over time, extending the traditional focus on urban design and landscape architecture to urban and regional planning and environmental technology and design. In the last decade, Urbanism witnessed the addition of urban data science and urban studies.

Technology and engineering

Our position in a Faculty of Architecture, and a technical university, reflects our intervention-oriented approach, as well as a strong focus on technology and engineering providing opportunities and constraints for what we can establish in design and planning. We aim to make a real change in the world, which is why we maintain close links with design practice, and aim to be strongly involved in planning debates. In our relationships with actors in policy and practice we seek to translate scientific (written) knowledge into tacit knowledge and (perspectives for) inventions, taking into account the fact that 'generic' scientific knowledge must often be contextualised. Much attention is devoted to engaging a wide variety of stakeholders on a multitude of spatial scales, and in particular, citizens. Also, we aim to remain at the forefront of methodological advances made possible by technological development - in particular digitalisation and automation, but also engineering solutions for Delta regions. For instance, we experiment with virtual reality, 3D urban modelling and data science. We also aim to understand the spatial impacts of new technologies, which range from, for instance, autonomous driving to the automation of the economy more generally.

Location

Our thematic focus is often related to the specific challenges that are bound up with our location in a highly urbanised delta region, where adaptation, resilience and competing interests are of key importance. Moreover, we are located in the Randstad - one of the most classic examples of a polycentric urban region in the world, which requires that we pay particular attention to the relationships among cities at higher spatial scales, as well as the specificities of the spaces in between. Regional planning and design address these complex spatial configurations.

A shared mission and approach, but not a single school of thought

Sharing a mission, research object (the interactions between people, plans and places) and a distinct approach does not imply that there is a single Delft school of thought, in the sense that we have a single, shared perspective, or unified theoretical framework to depart from. Quite the opposite, Urbanism is constituted by different disciplines that all bring their own ontological,

epistemological and methodological perspectives. We believe this is a strength as long as we all contribute to the shared mission, focus our research on the named interactions, and apply our Delft approach. The Urbanism department is organised along these disciplines, although the (historically evolved) section names do not always exactly equate with these disciplines.

Organogram Urbanism department

There have been some changes in our organisation in recent years. The environmental modelling section was significantly extended by the inclusion of the 3D geoinformation group which grew out of the geo-information and technology section. Right now, it has obtained such a critical mass that current plans are to administratively split the large environmental modelling group in one group focused on 'environmental technology & design', and another concentrating on 'urban data science'. Obviously, these are also quite distinct specialisms. Recently, as of July 1, 2019, the Urban Studies section was created in Urbanism as a result of the reorganisation of the former OTB department. Here, in alphabetical order, we describe the different disciplines that allow for the multidisciplinary approach to Urbanism challenges.

FIG. 1.2 Organogram Urbanism department

Environmental Technology & Design

The Environmental Technology & Design section focuses its research on the sustainable development of neighbourhoods, cities and regions, addressing the environmental challenges in the interaction of people, technology and design. The section discusses dynamic environmental parameters when devising designs, plans, programmes and policies, from the buildings to the global scale, thereby addressing issues of liveability in the sense of human well-being and environmental quality. We address the multiple adaptation challenges of the near future: urban climate (change) adaptation, energy (change) adaptation and 3rd industrial revolution and the needs of a regenerative economy. Over the next few years the section will focus on the following three aspects:

- (Territorial) Metabolism as a framework for modelling complex urban systems' flows – water, energy, food, people, et cetera – as if these systems are an ecosystem. The goal is to develop ways of designing with flows to systematically improve the sustainability of cities and regions.
- Urban Climate Adaptation: The study of urban climates combines the fields of (among others) climatology, meteorology, landscape architecture and urban planning and design, and extends to the health and social sciences. Essential topics are the Urban Heat Island (UHI) effect, heat stress and the influence of the urban climate on the energy use of buildings.
- Environment, Design & Behaviour: People are both part of the problem and the solution in sustainable development. The goal here is to develop and translate knowledge from environmental psychology into design guidelines for liveable and sustainable environments.

Landscape Architecture

Landscape Architecture focuses on knowledge acquisition, strategy development and design exploration of landscape compositions and systems in the built environment. Through fundamental design-oriented research and practical projects, scholars in landscape architecture explore the potential of spatial, temporal and material dimensions of landscape – including ecological, social and technical aspects – advancing future-oriented action and thinking on the development of urban landscapes through different scales. The ability to explore and work with the urban landscape as a palimpsest, spatial-visual structure, scale-continuum, and as social and natural processes makes landscape architecture indispensable to current spatial challenges. The research elaborates on landscape design foundations, landscape architecture compositions and urban landscapes. Projects focus on: green-blue landscape infrastructures, metropolitan parks and gardens, polder landscapes, urban landscape characterisation, architecture and landscape, landscape-based urban development, estate landscapes.

Spatial Planning & Strategy

The spatial planning and strategy section is concerned with the formulation, implementation and evaluation of policies, visions, strategies, plans and programmes for urban regions. Members of the section are involved in research to understand and advise on how to coordinate and manage spatial development in large urban regions, including the global south. A central focus is the issue of governance. Research is often interdisciplinary in order to address the complex interactions between different policy sectors (e.g. transport, housing, water), different levels of decision-making (e.g. local, regional, national) and different types of actors (e.g. governments, NGOs and citizens). Research frequently addresses the performance of urban regions in terms such as environmental sustainability, social cohesion and economic competitiveness. Members of the section regularly employ comparative methods to examine international case studies and to understand how lessons for policy and practice can be transferred. The research carried out in the section seeks to be relevant and accessible to the needs of policy-makers and practitioners involved in urban and regional transformation. The researchers in the section are well connected to communities of practice across many parts of the world including Europe, Asia and Latin America.

Urban Data Science

The urban data science section focuses on the technologies and governance models underpinning geographical information systems (GIS) and spatial data infrastructures. It aims at designing, developing, and implementing better systems to model (3D) cities, buildings and landscapes, as well as the governance mechanisms employed in concepts such as the ‘open city’ and ‘the city as a service’. The two groups forming this section, 3D geoinformation and urban data governance, help in environmental modelling, urban planning and design, crisis management, navigating in large indoor environments, etc. In addition, they contribute by researching the role (geographic) data has in solving the challenges of sustainable and smart built environments in general and in the ‘open city’ more specifically. Their research approach centres on 3D data reconstruction, 3D data validation and modelling 3D data for urban applications. One of the pillars of their work is the strong belief in implementing research ideas, for all projects, to collect real-world data, test hypotheses by implementing open-source software, and only publish when their approach has been thoroughly validated. The source code of these projects is freely available under open-source licenses (on GitHub). In addition, qualitative and quantitative research methods are applied (e.g. desktop research, literature review, interviews, surveys, cross jurisdictional case study research).

Urban Design

The Urban Design section has a long tradition of research. This research is concerned with the design of the physical form of existing urban areas and their future adaptations due to processes of urban transformation. The research focus is on the complex relationships between urban form, land-use, social processes, health objectives and climate challenges and addresses topics like adaptation, sustainable development, resilience and livability. The Urban Design section has expertise in spatial analysis in the different spatial scales of the region, city and neighbourhood and focuses on the evaluation of the built environment, e.g. the performance and quality of urban space, including the relationship of architecture and open space and the spatial organisation of public and private space. Urban Design develops innovative concepts and approaches for urban analysis and design, acknowledging contextual and functional changes that call for a rethinking of theory and methods in Urban Design. Recent developments in technology and requirements due to the environmental act are driving forces for research topics and development of design methods, resulting in a strong engagement in cross-sectional topics as Delta Urbanism, 1 Million Homes and Urban Modelling. Topics deriving from this also include the accommodation of future urban growth through intensification and densification and its implication for redesign in respect to sustainable settlement development.

Urban Studies

The Urban Studies group investigates people-place relationships at different spatial scales, from neighbourhoods to cities and regions. The research is focused on a better understanding of how neighbourhoods, cities and regions develop, and how different spatial configurations and structures emerge (within and between cities), and how these configurations affect socio-economic outcomes for people across spatial scales. The multi-level interaction between people and places is central. They investigate how the urban context affects individuals and their lives, and how people influence the socio-spatial structures around them. A better understanding of these people-place interactions is crucial for the design and planning of cities and regions, and for the design of spatial policies that contribute to the quality of places. The group contributes to important challenges related to contemporary urbanisation. These include increasingly complex connections and networks of cities and regions, both nationally and internationally; growing levels of inequality and the spatial footprint of inequality; and changing structures of urban governance and citizen engagement in urban policy. The research in Urban Studies is multi-disciplinary and empirical in nature, using both qualitative and quantitative research methods, with a strong emphasis on the use of very large longitudinal register data sets and advanced statistical techniques. Increasingly, computational social science methods are used for a theory driven analysis of novel digital data resources (‘big data’).

TABLE 1.2 Selected output indicators

		RESEARCH QUALITY	RELEVANCE TO SOCIETY
Assessment dimensions	Activities, organisation, facilities/assets, output	**Activities** - Internationally funded research projects - Nationally funded research projects - Outreach: organisation of conferences & seminars connected to European or global organisations - Outreach: inter- and intra-university academic conferences and seminars	**Activities** - Commissioned research projects - Outreach: curatorships and exhibitions - Outreach: Conferences, seminars and workshops targeting practitioners and end-users - National research projects/programmes for professionals - International research projects oriented at application (e.g. INTERREG, ESPON) - Media appearances: television, radio, internet
		Organisation - Involvement in organising scientific events and conferences - Participation in international academic centres - Participation in international academic networks - Participation in academic consortia	**Organisation** - Participation in co-funded centres - Participation in knowledge networks including professionals and end-users - Role in practice and policy-making
		Facilities/assets - Accommodation - Library - ICT Networks & data storage - Databases - Repositories	**Facilities/assets** - Publicly accessible repositories
		Output - Peer-reviewed journal articles - PhD dissertations - Academic books and scientific book chapters - Books, Refereed journal articles - Editorships of books and special issues of high-ranked journals	**Output** - Peer-reviewed journal articles - Applied research reports - Professional books - Professional journal papers - Editorships of professional journals
	Use	- Citations in WoS, Scopus and G-Scholar - Downloads of books and/or book chapters, reads of articles	- Examples of extensive use of Urbanism outputs - Use of scientific and professional publications in practice - Co-operation with societal groups and impact to general public - Attention on social media for Urbanism outputs
	Marks of recognition	- Major personal grants (ERC, VENI/VIDI/VICI) and participation in peer-reviewed projects - Member of research review panels - Editorships - Honorary positions - Citations in WoS, Scopus and G-scholar - Prizes and awards - Invitations for keynote speeches	- Awards - Practice chairs (co-)financed by external partners - Key advisory positions - Key positions in practice - Partner in private urbanism office - Invitations for commissioned research and invited public lectures and contributions to workshops, panels, award committees etc.

2 – **Research in numbers**

TABLE 2.1 Research output department 2016-2018

	2016	2017	2018	2016	2017	2018
MAIN RESEARCH OUTPUT	**URBANISM AS IT WAS 2016-2018**			**URBANISM AS IT IS IN 2019**		
Refereed articles	47	42	61	75	65	101
Non-refereed articles	1	3	3	1	4	4
Books	3	1	3	3	3	4
Book chapters	28	21	18	35	31	33
PhD-theses	5	3	11	6	4	13
Conference papers	62	46	31	69	51	39
Professional publications	38	29	19	46	44	43
Publications aimed at the general public	5	2	5	6	2	5
Total Main Research Output	**189**	**147**	**151**	**241**	**204**	**242**
OTHER RESEARCH OUTPUT						
Media contritbutions and coverages	19	7	17			
Abstracts	2	7	6			
Editorial work: editorial activity	16	5	11			
Editorial work: publication peer review	3	0	2			
Bookediting	8	9	6			
Exhibition	3	2	0			
Memberships	10	3	7			
Talk or presentation (conference)	27	31	26			
Total Other Research Output	**88**	**64**	**75**			
TOTAL	**277**	**211**	**226**			

TABLE 2.2 Staff members department

STAFF	**2016**		**2017**		**2018**		**2019**	
	NR	FTE	NR	FTE	NR	FTE	NR	FTE
Scientific Staff	30	9,65	32	10,44	32	10,28	45	15,15
Researchers (incl Postdocs)	24	10,71	24	12,09	29	10,71	22	13,52
PhD candidates	45		44		41		38	
Total research staff	99	20,36	100	22,53	102	20,99	105	28,67
Visiting Fellows	31	0,59	25	0,98	30	0,57	41	3,77
Total Staff	**130**	**20,95**	**125**	**23,51**	**132**	**21,56**	**146**	**32,44**

TABLE 2.3 Research income 2016-2018

	2016		2017		2018	
	K€	%	K€	%	K€	%
FUNDING						
Direct funding [1]	1.597	46%	1.719	41%	1.559	35%
Research grants [2]	908	26%	1.223	29%	1.014	23%
Contract research [3]	975	28%	1.563	37%	2.111	47%
Own contribution	-508	-15%	-657	-16%	-686	-15%
Other [4]	466	14%	359	9%	494	11%
Total Funding	**3.439**	**100%**	**4.207**	**100%**	**4.491**	**100%**
EXPENDITURE						
Personnel costs	-3.026	83%	-3.447	79%	-3.702	79%
Other costs	-635	17%	-905	21%	-1.002	21%
Total Expenditure	**-3.661**	**100%**	**-4.352**	**100%**	**-4.705**	**100%**
RESULT	**-223**		**-145**		**-214**	

[1] Direct funding (basisfinanciering / lump-sum budget).
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and the Royal Academy).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations industry, government ministries, European organisations and charitable organisations.
[4] Funds that do not fit into the other categories.

TABLE 2.4 Length of PhD candidacies and success rate

ENROLMENT		**STARTING YEAR**					
		2010	2011	2012	2013	2014	TOTAL
GENDER	Male	3	6	2	4	0	**15**
	Female	3	1	3	1	0	**8**
	Total	**6**	**7**	**5**	**5**	**0**	**23**
GRADUATED							
≤ 4 years [1]	NR	0	1	0	0	0	**1**
	%	0%	14%	0%	0%	0%	**4%**
≤ 5 years [1]	NR	0	2	1	1	0	**4**
	%	0%	29%	20%	20%	0%	**17%**
≤ 6 years [1]	NR	1	2	2	2	0	
	%	17%	29%	40%	40%	0%	
≤ 7 years [1]	NR	1	2	3	2	0	
	%	17%	29%	60%	40%	0%	
Total Graduated	NR	**3**	**3**	**3**	**2**	**0**	
	%	**50%**	**43%**	**60%**	**40%**	**0%**	
Not yet finished	NR	2	1	0	0	0	**3**
	%	33%	14%	0%	0%	0%	**13%**
Discontinued	NR	1	3	2	3	0	**9**
	%	17%	43%	40%	60%	0%	**39%**

[1] In the case of the started PhD's in a given year the lead time was considered and cumulatively drawn over the years. A PhD who graduated in "≤ 4 years", is therefore again included in "≤ 5 years", in "≤ 6 years" and in "≤ 7 years". The table "Total Graduated" shows the total number of PhDs candidates that successfully completed there studies.

3 – **Urbanism research strands**

Our research can be categorised into four research strands. One that is largely intradisciplinary, and that hence addresses specific challenges that relate to each discipline, the other three are based on how they relate to design: ‘research on design’, ‘research through design’ and ‘research for design’. These are explained below.

‘Disciplinary research’

Disciplinary depth and breadth

Urbanism as a multidisciplinary approach can only exist by the grace of each constituent discipline playing a key role in theoretical and conceptual debates within their disciplines and being at the forefront of methodological innovation in their own specific field. Therefore, each of the six disciplines puts substantial research effort into intra-disciplinary research challenges in order to develop the theoretical foundations of their discipline. Often, these also have a more methodological nature and relate to the adoption of new technologies. Examples range from increasing citizen engagement in planning through new digital tools, experimenting with Virtual Reality and Augmented Reality to proof urban designs, the development and testing of new algorithms and data-structures for 3D reconstruction and 3D modelling, employing longitudinal large micro datasets, digital landscape architectures or the extraction of geographical information from digitised texts.

‘Research on design’

People - plans interactions

Urbanism in Delft has a history going back almost 75 years. Our research and education today are strongly rooted in this history, and as such our traditions define who we are and how we position ourselves. Partly as a consequence of this, substantial research effort is put into understanding the evolution of design and planning, not just in Delft, but also in the Netherlands and at the European scale. Planning discourses, design narratives, spatial visions and the evolution of planning and design frameworks are explored in order to understand how human and societal needs have been and are understood and framed, and ultimately translated into plans for spatial interventions conditioned by institutional, political and cultural contexts. Hence, part of this type of research in Delft often has a historical nature, given its focus on the evolutionary dimension. However, the use of digital participatory platforms by governments and citizens to co-produce changes in the built environment on the basis of crowd-sourced site knowledge, needs and preferences also fits into this research strand.

‘Research through design’

Plans - places interactions

Considering that research is a creative process producing something that did not previously exist, our analysis in this strand is focused on the outcome of that process in order to get at underlying principles and ideas. As such, the built environment is a container of design knowledge, as expressed by its design principles and typologies, and can serve as a basis for future design. The design process itself is used as a vehicle to gain appropriate understanding of the challenges in context, to frame spatial problems visually, to explore possibilities and to generate solutions; a process in which the designer uses heuristics that may consist of examples, patterns, analogies, shape grammars or typologies to support the spatial decision process, and in particular visual representations - sketches, drawings, maps, models - are crucial for visual thinking and communication. In sum, we use design as a vehicle to understand challenges, make spatial problems visual and spatial, to explore possibilities and to generate solutions. In addition, our research within this strand focuses on the effective and efficient implementation of designs and plans, and how the institutional and local contexts may hamper or foster this process.

‘Research for design’

People - place interactions

The recent addition of Urban Studies and what is now Urban Data Science (previously Geomatics) as disciplines within Urbanism has meant that Urbanism has also significantly expanded its capacity to do ‘research for design’. This research strand focuses, first of all, on capturing the built environment in (3D) models, typologies, concepts and statistics on spatial structures. This is the prerequisite for evaluating different streetscapes, neighbourhood compositions, urban forms and metropolitan and territorial spatial structures. The benchmark against which the built environment is evaluated is provided by the needs’ framework - better built environments allow a better satisfaction of human and societal needs. Explanations of these interactions generally focus on the behaviour of people to satisfy their needs, for which the built environment, in interaction with the social environment, provides constraints and opportunities. This interaction between people and places is explored through a variety of ways, including (3D) urban modelling, advanced statistical analysis as well as qualitative research methods. Part of this research strand is also about how people actively shape their built environment, which often leads to informal urbanisation and what has been referred to as DIY Urbanism - interventions and transformations of the built environment without the (formal) approval of government or other authorities. Obviously, these are expressions of the (sometimes unsatisfactory) addressing of human needs.

4 – **Vision**

Challenges

The way Urbanism and our research is organised presents two important challenges:

Coming full circle

While many of the Urbanism disciplines cover at least two out of the three research and design strands (in addition to their own disciplinary strand), we feel that Urbanism research would profit from more systematically including the 'third dimension' to come full circle. For instance, it is important that those exploring the interaction between people and places pay more attention to the design, planning and engineering implications - not just as the concluding part of research, but more as a point for departure. Likewise, research on the interaction between people (needs) and plans (design, planning and engineering) could take into account the actual transformation of the built environment more systematically – so, not just the process, but also the outcome. Finally, our research on the interaction between plans and places is challenged to incorporate in a more systematic way human and societal needs as an evaluation framework in the research-through-design process.

From multidisciplinarity to transdisciplinarity

The way Urbanism is organised has many benefits for practicing the different disciplines involved because it naturally provides the internal cohesion and critical mass required for disciplinary dialogues on theory, methods and tools leading to innovations that take these disciplines further, while also significantly adding to the external visibility and recognisability of the Urbanism department. However, the organisational structure also carries the danger of having less cross-disciplinary dialogue, which comes, perhaps, less naturally. On a deeper level, innovation could be achieved not just from a multidisciplinary approach to the interactions between people, places and plans, but from an interdisciplinary way of working on joint projects, and (preferably) working in a transdisciplinary way to allow for an more integrated and holistic perspective on such interactions.

Strategy recommendations research assessment 2016

In addition, the previous external committee of peers doing the 2016 research assessment made several strategy recommendations after reviewing the faculty research programmes over the period 2010-2015. Following the assessment protocol of the Association of Universities in the Netherlands (VSNU), they scored on a four-point scale ranging from 1 (world leading/excellent) to 4. Both the Urbanism research programme and the Urban and Regional Studies research programme (of which the majority of research activity is now part of the Urbanism department) were valued 1 on 'research quality' as well as 'relevance to society' and 2 ('very good') on viability. The review panel issued the following recommendations:

1. Reconsider the research themes, and try to streamline/consolidate them. This would help to prioritise efforts to get more grants and to communicate priorities and interests to the outside world of sponsors as well as students. It would also help identify gaps and new areas of research that could be filled by the new individual faculty to be hired;
2. Continue to explore ways to engage the University in hiring women for chair positions;
3. Continue training and redirecting middle-level staff in new and existing areas of research, along with developing new mechanisms and structure to guide doctoral student work;
4. Continue to be proactive. The committee entirely supports the stated goal to strengthen research management, because a sustainable research programme requires both forward thinking leadership in grant capture and consistent monitoring and tutoring in existing research development. The programme should consider adding the goal of fostering creative thinking with regard to directions for future research. This should be doable, because it appears that, in spite of the programme size and the complexity of the research areas, the programme governance is able to take place in an apparently seamless way (it uses regularly scheduled research programme meetings and, among other things, coordinates research within the Faculty Research Council).

With respect to the Urban and Regional Studies (URS) research programme, these were the recommendations:

1. Stronger research collaboration between the different URS staff members;
2. More crossovers between URS sub-disciplines to create new and important synergies. Collaboration already exists at the level of teaching; joint research collaboration could be equally worthwhile;
3. A potential weakness (threat) is the limited number of PhD candidates in relation to the number of permanent staff. Putting emphasis on targeting larger research project proposals will lead to an increase in the number of pre-doc positions. This issue is also linked to giving postdocs more opportunities to stay (longer) in academia;
4. In relation to other programmes, URS has only a limited number of academic staff in the rank of professor. The committee would therefore recommend to increase the number of professor positions.

Objectives

Given the challenges and strategy recommendations outlined above, and our mission to advance our understanding of the interaction between the built environment and the satisfaction of human and societal needs, and of how design, planning and engineering interventions in this built environment can better satisfy those needs, we hereby define a number of concrete objectives for our research:

From a substantive point of view:

1. To obtain an increased understanding of the interactions between human and societal needs (people), the built environment (places) and how we can intervene in this built environment (plans) in a way that satisfies human and societal needs better.
2. To move from multidisciplinary working to a holistic transdisciplinary approach to understand the interactions between people, places and plans, and as such, further develop the theoretical and methodological foundations of Urbanism and the Delft approach to it.
3. To practice the constituent disciplines of Urbanism to the highest academic standards, and to be innovative in our disciplines.

From an organisational point of view:

4. To further develop an efficient and impactful Urbanism PhD programme;
5. To build stronger interconnections between the research programme and masters' and post-masters' education, making effective use of the high-quality student body;
6. To provide a cohesive, diverse and inclusive community where all members of Urbanism can excel.

From a knowledge utilisation point of view:

7. To introduce the principles of open science more clearly in our research routines.
8. To have a societal impact - making a difference in the real world.

5 – **Strategy**

Each objective translates into a specific strategy:

1. A better understanding of the interactions between people-places-plans
2. From multidisciplinarity to transdisciplinarity
3. Disciplinary breadth and depth fostering disciplinary innovation
4. An efficient and impactful Urbanism PhD programme
5. Better connecting urbanism research and education
6. A cohesive, diverse and inclusive Urbanism community
7. Moving towards open science
8. Making a difference in society

A better understanding of the interactions between people-places-plans (objective 1)

Creating room for innovation

How we are funded is vitally important for the development of our research. We are slowly moving in the direction of a situation in which tenured staff will be funded completely, meaning less dependence on bringing in grant funding. This obviously does not mean that bringing in research grants is of less importance – on the contrary, this is how we fund PhD and postdoc projects, maintain and develop our academic and professional networks, as well as how we have a societal impact. However, it does mean that we can be more selective in the type of grant that we aim for. The funding of choice is:

1. long-term - thus enabling the hiring of PhDs and postdocs;
2. preferably derives from well-established bodies (among which the ERC, or the Netherlands Organisation for Scientific Research);
3. involves high-profile partners of choice to maintain and strengthen our network and innovative capacity;
4. provides plenty of room for substantial innovation in our field;
5. allows us to make a real impact on society.

Being more fully funded also implies that we are less dependent on projects, and can further develop our curiosity-driven research, which will likely boost our innovation. This should also fuel our desire to concentrate on the highest quality academic dissemination.

As stated in the first challenge, and keeping the Urbanism Triangle in mind, we need to do more to ‘come full circle’. The definition of this Urbanism Triangle has been an important step in creating this awareness, it also allows to identify gaps in our research (e.g. particular needs may have been somewhat overlooked). An important, and perhaps also very ambitious part of our strategy, is also the development of an Urbanism handbook, in which we bring together the knowledge of the department and partners.

Very important for this objective is the identification and strengthening of relations with key local and international strategic research partners and networks that allow us obtain a better understanding of our research objects. The Urbanism research programme has many partners in civil society, government, the profession and industry across the Netherlands. We also have many international links, including in all EU member-states, other European countries and in Latin America and Asia, especially China. We list here only the most significant partners in recent years. We start with local collaborations within a number of university and faculty research programmes and initiatives, and move on to national and international collaborations. While we provide an overview of the major research collaborations with other institutes, it must be noted that there are also many personal research collaborations.

TU Delft 'Deltas, Infrastructures & Mobility Initiative'

The TU Delft-wide 'Deltas, Infrastructures & Mobility Initiative' (DIMI) is developing integral solutions for urgent societal problems related to vital infrastructure for water safety and smart mobility, which are intrinsic to the natural and built environment. An integral approach, in which different disciplines cooperate, provides the best guarantee for finding these solutions. The contribution from Urbanism concentrates on the theme 'Delta of the Future'.

Website: https://www.tudelft.nl/en/infrastructures/

TU Delft 'Global Initiative' and Faculty Projects and Initiatives

The faculty has the ambition to become a centre of excellence in sustainable urban development in the Global South. This is inserted in a larger strategy by TU Delft to become a centre of reference in key areas of sustainable development (water and sanitation, sustainable mobility, energy transition, mass housing, spatial planning) and a lead-partnership between the faculty and UN-Habitat and the World Urban Campaign. The faculty and the university are also committed to promoting the Sustainable Development Goals (2015) and the New Urban Agenda (2016) and the indicators, tools and methods to implement them. Research contributions from Urbanism focus on the following three topics:

- comparative study of planning frameworks, tools and cultures, governance structures and the dynamics of spatial form;
- analyses of the interactions between spatial planning, political structures, democratisation processes and the built environment;
- analyses of planning practices, tools and frameworks for sustainable urban development, such as the New Urban Agenda and the Sustainable Development Goals and their application in planning and design practice.

Websites: https://www.tudelft.nl/global/; https://www.tudelft.nl/en/architecture-and-the-built-environment/about-the-faculty/about-the-faculty/africa/

Faculty Programme Design & History

The faculty research programme Design & History explores a wide range of knowledge and instruments relating to the origins, restoration, conservation, revitalisation and transformation of built heritage. Led by Prof. dr. ing. Carola Hein (department of Architecture), the faculty program Design & History connects various research groups and themes in the realm of architecture, building technology, urbanism and landscape architectural design and merges these in a unique and innovative joint venture. Since 2013, members of the Design & History group participate in the LDE collaboration between Leiden University, Erasmus University and TU Delft in the Centre for Global Heritage Development (www.globalheritage.nl). Group members also work closely with the OSK (Onderzoekschool Kunstgeschiedenis), the Dutch Postgraduate School for Art History created by various universities and museums. Research contributions from Urbanism to the programme focus in particular on the following topics:

- The meaning of place and place identity, in particular the tangible and intangible essence of (large scale) heritage landscapes, like estates

or suburban, defence, water and industrial landscapes as well as historic inner cities.
— The role of place identity and heritage in planning and design.

Website: https://www.tudelft.nl/en/architecture-and-the-built-environment/research/research-at-bk-bouwkunde/design-history/

Amsterdam Institute for Advanced Metropolitan Solutions (AMS)

The AMS Institute is an Amsterdam based joint initiative by TU Delft, MIT Boston and Wageningen UR in which Urbanism has a central role. The Institute was initiated by the Municipality of Amsterdam and is located in the city. AMS is an ambitious scientific institute where science, education, government, business partners and societal organisations are working together to create solutions for the complex challenges of metropolitan regions. AMS uses Amsterdam as a living lab with test beds to understand the flows and characteristics of the urban environment. Arjan van Timmeren acts as scientific director of AMS.

Website: https://www.ams-institute.org

Branchevereniging voor Ondernemers in het Groen (National Association for Greenspace Professionals in the Netherlands (VHG)

The Association VHG has generously supported a research fellow in Urbanism to embed urban forestry more strongly within research and education. The fellowship is based in the Landscape Architecture section but with strong links across the programme and faculty. The priorities for research are urban forestry in urban landscape design, the contribution to urban climate mitigation and adaptation, infrastructure and the link to urban ecology.

Website: https://www.vhg.org

International Forum on Urbanism (IFOU)

TU Delft is a founding member of IFOU which is an active network of universities, research institutes and knowledge centres collaborating in the field of urbanism. IFOU aims to initiate and realise international comparative research in the fields of urban design, planning and management of metropolitan areas and regions; to support the international dissemination of knowledge; to organise international exchange programmes; and to facilitate the dialogue between the academic world, professional organisations, and politicians, not least through its regular conference programme.

Website: http://ifou.org/wp/

South China University of Technology (SCUT)

TU Delft has established an Urban Systems and Environment Joint Research Centre (USE) with SCUT in 2012. Urbanism plays a central role in cooperation with the Faculty of Civil Engineering and Geosciences. Over six years, USE has involved more than 40 staff, engaged many dual and joint PhD candidates, made more than 20 combined external funding proposals and organised eight joint conferences. Current work is focused on a UK/China/NL (NWO) project on Adaptive Urban Transformations (AUT) in the Pearl River Delta.

Website: https://www.tudelft.nl/jrc/

Van Eesteren-Fluck & Van Lohuizen Foundation (Efl)

The Foundation has jointly created the Van Eesteren Professor with TU Delft to work on regional design and planning. From 2013 Professor Frits Palmboom took up this position and worked with staff and external partners on the IJsselmeer region in the Netherlands. In 2019 a new professor will be appointed to deepen this work with particular attention to the Amsterdam-Brussels-Cologne region and other international cases.

Vogelbescherming Nederland (Birdlife Netherlands)

Urbanism has established a strong partnership with the Vogelbescherming Nederland which has generously sponsored a research fellow to work towards the establishment of a centre of excellence in urban ecology. The research relates strongly to the urban landscape compositions and systems component of the Urbanism research programme. The emphasis is on urban ecological principles for sustainable urban landscapes and potential synergies between water, energy, nutrients and greening in urban metabolism and circular systems.

Website: https://www.vogelbescherming.nl/over-ons/organisatie/birdlife-international

European Policies Research Centre - Delft (EPRC-Delft)

The European Policies Research Centre operates through two distinct entities. It was founded in 1987 at the University of Strathclyde in Glasgow, Scotland (EPRC Glasgow), and until June 2017 it operated exclusively as a research institute in the School of Government and Public Policy in the Faculty of Humanities and Social Sciences at the University of Strathclyde. EPRC Glasgow has specialised in regional and industrial development in Europe for almost 40 years. The research portfolio of EPRC Glasgow spans the countries of Western, Central and Eastern Europe, involving research at European, national and regional scales. In July 2017, a new entity was founded - European Policies Research Centre Delft (EPRC Delft) working from the Department of Urbanism at TU Delft. EPRC Delft is a non-profit foundation (stichting) registered in the Netherlands under Dutch law. It has been established to conduct comparative policy research and knowledge exchange relating to EU Cohesion policy and other EU policies. EPRC Delft is managed by Professor John Bachtler and Professor Fiona Wishlade and staffed by secondees from EPRC Glasgow, but it has its own supervisory board and operates independently of the University of Strathclyde. EPRC Delft cooperates with TU Delft BK Faculty staff members, in particular those from the department of Urbanism, including the recent EU H2020 project COHESIFY: Understanding the Impact of EU Cohesion Policy on European Identification.

Website: http://www.eprc-strath.eu/iqnet/supportPages/delft.html

From multidisciplinarity to transdisciplinarity (objective 2)

Cross-cutting themes

We aim to obtain a more holistic approach to the system of interactions between ‘people’, ‘places’ and ‘plans’, also in particular by bringing the Urbanism disciplines together. Important to achieving this was the reframing of our shared mission and the development of the Urbanism Triangle. People from different disciplines often easily find each other, partly as a result of the cohesive community that we are, but also often driven by joint work on projects, or in bidding for these projects. Traditionally, Urbanism also identifies a number of cross-cutting themes that transcend the boundaries of individual disciplines. Following the advice of the previous research assessment, we reduced this number. Three such cross-cutting themes remain, each mobilising knowledge and skills from across the department of Urbanism and led by staff members from different disciplines.

Innovation networks

Currently, we are debating how such cross-cutting themes can be better facilitated at the department level. Also, there is the question whether such rather heavily institutionalised themes should be complemented, or perhaps substituted by a larger number of more flexible networks between disciplines that allow the addressing of a larger number of research foci where we see potential for innovation; once this innovative potential has been judged, these could be terminated or brought further, providing, for instance, the starting point for a larger project application.

Metropolitan regions and landscapes

Urbanisation takes place nowadays in complex metropolitan settings which are formed by networks of urban settlements of various sizes. They are held together by intricate infrastructural webs with a morphology characterised by a varied patchwork of landscapes. The scale of metropolitan regions in most cases does not match the scales and perimeters of administrative divisions creating a particular complexity in terms of effective and legitimate public policy. This theme is led by the question of how can we gain operative force in territorial transformation processes while establishing local identity and tangible regional relationships through connecting ecological and social processes, and urban and architectural form? We therefore seek to understand spatial structures from a design and governance perspective that employs and develops knowledge of spatial design and planning. The main research topics include regional design methods and principles for sustainable urban landscape development; assessment of the evaluation of urban and landscape structures to provide insights for spatial design and planning at multiple scales; assessing the performance of regional design and regional design tools in various institutional settings in different countries and regions. A dedicated position sponsored by the Van Eesteren-Fluck & Van Lohuizen (EFL) Foundation and AMS has been created to address these themes.

Delta urbanism

Delta Urbanism focuses on new approaches in the design and planning of urbanised deltas as critical and highly dynamic territories that face extreme challenges from competing claims and interests. A balance must be found between on-going urbanisation, port-development, agriculture, environmental and ecological qualities, flood-defence systems and fresh-water supply. Addressing these competing claims requires new relationships be forged between design, engineering, science and governance. Therefore, urbanism collaborates closely with the TU Delft Faculties of Civil Engineering and Technology, Policy and Management, the Erasmus University Rotterdam, Wageningen University & Research and the Dutch Water Institute Deltares, as well as with several private engineering and design firms in the Netherlands. Major research topics include ways to define a sustainable relationship between urbanisation, economy, environmental quality and safety in delta areas; the development of interdisciplinary and integrative approaches of design, engineering, science and governance in deltas; guidance on the development of a balance between planned, designed and engineered interventions in the system of the delta, on the one hand, and a freedom for self-organisation of natural and societal processes, on the other; investigating possibilities to combine water safety and carbon mitigation strategies with urban design, landscape design and spatial planning, aiming to improve spatial forms and structures in urban and metropolitan delta regions. The theme investigates these topics in the Dutch Delta and numerous delta areas in other parts of the world. Special sensitivity is placed on the qualities of places, the systemic understanding of structures, subjects, and flows, and change over time.

Urban modelling

Design and planning of cities are becoming ever more challenging due to growing demands for energy transition, climate change, improvement of liveability and the reduction of inequality, health- and mobility issues. Automated solutions offer potential to address these challenges. Smarter digital tools and methods can provide real-time feedback on design and planning proposals. A requirement is the availability of suitable models for simulation and computation and to link real-time urban data to its digital counterpart. A main challenge for this theme is to develop urban modelling that can both serve design and planning and simulate the past, present and future. Although the potential of urban models is known, in practice tools for the design, evaluation and communication of design and planning proposals are hardly used, partly because they are time consuming and lack detail. A key objective within the urban modelling theme is to integrate user requirements from the urban design and planning professions and couple it with in-depth knowledge of the technical aspects of modelling tools. Main research topics include therefore: adaptable geometries for 3D city models; the development of simulations for a variety of functions, including mobility, climate, sun/shadow projections, heat, precipitation, wind, noise, pollution, etc.; visualisations using VR and AR technology to provide insight into the implications of designs to the designers themselves, but also to other stakeholders such as inhabitants to improve citizen engagement.

Disciplinary breadth and depth fostering disciplinary innovation (objective 3)

Innovation through staff and networks

Urbanism as a multidisciplinary approach can only exist by the grace of each constituting discipline playing a key role in theoretical and conceptual debates within their disciplines and being at the forefront of methodological innovation in their own specific field. Therefore, Urbanism also leaves much room for the individual, constituting disciplines to develop strategies that enhance the disciplinary breadth and depth of their discipline, and concentrate their resources in a way that advances disciplinary innovation and that allows for getting the best out of their staff. This includes giving individual researchers the autonomy they need to develop into independent, innovative research leaders (Principal Investigators) and to pursue their own ambitions. Through the appraisal process we will ensure that all relevant staff are competent in research supervision, publication and writing funding proposals.

All our disciplines are very active in setting the right conditions for innovation: organising workshops and events on novel themes, engaging in collaborations that provides novel perspectives and insights, bringing in key researchers as guests to the department, or as speakers, developing research networks with partner institutes, giving room to explore their staff's innovative ideas, etc. The possibility to do more curiosity-driven research is also an important element – albeit, it is a freedom that comes with responsibilities.

An efficient and impactful Urbanism PhD programme (objective 4)

Graduate School

The introduction of the Faculty-wide A+BE Graduate school has strongly contributed to streamlining the PhD process, to better organising doctoral education, to a closer supervision and mentoring of PhD students, and to a more structured selection of PhD candidates. Over the years, we have seen a steady inflow of new PhD students, while the number of PhD defences is picking up. Yet, there still is a concern about the time it takes to complete the PhD trajectory, as many PhD students take more time than the expected 4 years; reasons for this vary from person to person.

Types of PhD students

Being a PhD student at Urbanism comes in many varieties. Currently, most are self-funded/or bring their own funding, mostly holding a grant from an international or national science funder. They are given 'hospitality' in the department. Some are employed as contributors to large research projects that have been acquired, and develop this contract work into a PhD thesis. Several of them are also (often tenured) teaching staff at the Faculty, for whom doing a PhD research is part of their career development trajectory. There are also external PhD students, who combine a job in practice with part-time (and generally free time) PhD thesis writing. Others, and this is perhaps most ideal, managed to get an official PhD positions made possible through grants by, for instance, the Netherlands Organisation for Scientific Research or the European Research Council; these positions are always advertised and we tend to get a high number of applications. Whatever the source of funding, we tend to treat PhD students not as students, but as colleagues, and they generally work in close co-operation with their supervisors towards a successful completion of their thesis.

Entry

Opportunities for PhD research in Urbanism are generally advertised on the department and faculty websites – as a 'call for PhD candidates'.

We have limited supervision capacity and much demand so we provide information on various topics to help potential candidates in their applications. Self-funded PhD candidates must write proposals in response to the topics on which we have capacity to supervise, and applications must demonstrate competence to undertake research in the topic, preferably including success in academic publications. We may provisionally accept candidates subject to them securing funding. We may be able to advise on this but the primary responsibility for finding funding rests with the candidate. In any case, in recent years we have introduced more rigorous selection for this type of PhD student, in order to align the research more with departmental interests, accompanied with more adequate monitoring of performance and supervision, in cooperation with the Graduate School. PhDs will also present more to external peers outside their supervisory team, for which we will create a ‘flagship event’ to which all PhD candidates contribute in addition to the public ‘go, no-go’ review in year one.

TABLE 5.1 PhD projects finalised period 2016-2018 (first promotor situated in in Urbanism (includes incorporated OTB PhD theses)

NAME	TITLE PHD	DEFENCE
Jorge Lopes Gil	Urban modality: Modelling and evaluating the sustainable mobility of urban areas in the city-region	23/02/2016
Ken Arroyo Ohori	Higher-dimensional modelling of geographic information	06/04/2016
Jaume Masip-Tresserra	Polycentricity, Performance and Planning; Concepts, Evidence and Policy in Barcelona, Catalonia	25/04/2016
Azadeh Arjomand Kermani	Developing a framework for qualitative Evaluation of Urban Interventions in Iranian historical cores	24/06/2016
Inge Bobbink	De landschapsarchitectuur van het Polder-boezemsysteem: structuur en vorm van waterstelsel, waterpatroon en waterwerk in het Nederlands laagland	11/10/2016
Peter van Veelen	Adaptive planning for resilient coastal waterfronts: Linking flood risk reduction with urban development in Rotterdam and New York City	25/11/2016
Filip Biljecki	Level of detail in 3D city models	01/05/2017
Terrence Curry	Form follows feeling: The acquisition of design expertise and the function of aesthesis in the design process	03/07/2017
Kim Zweerink	Ruimtelijke transformaties van de steden in het Randstadgebied (12de-20ste eeuw): Een vergelijkende analyse van de stadsplattegronden	26/09/2017
Rūta Ubarevičienė	Socio-spatial change in Lithuania. Depopulation and increasing spatial inequalities	29/09/2017
Ravi Peeters	Geographical point cloud modelling with the 3D medial axis transform	14/03/2018
Gabriela Rendon	Cities for or against citizens? Socio-spatial restructuring of low-income neighborhoods and the paradox of citizen participation.	10/04/2018
René van der Velde	Transformation in Composition: Ecdysis of Landscape Architecture through the brownfield park project 1975-2015	12/06/2018
Sharon Wohl	Complex Adaptive Systems & Urban Morphogenesis: Analyzing and designing urban fabric informed by CAS dynamics	13/06/2018
Xin Li	Residents' Perceptions of Impending Forced Relocation in Urban China: A case study of state-led urban redevelopment in Shenyang	15/06/2018
MaartenJan Hoekstra	Stedebouwkundig(e) ontwerpen in woorden: Honderd jaar stedebouwkundige begrippen	21/06/2018
Yuting Tai	Changing Values on Water in Delta Cities	11/09/2018
Merle Zwiers	Trajectories of neighborhood change.	14/09/2018
Nico Tillie	Synergetic Urban Landscape Planning in Rotterdam: Liveable Low-Carbon Cities	28/09/2018
Veronica Zagare	Towards a method of participatory planning in an emerging metropolitan delta in the context of climate change: the case of lower Paraná Delta, Argentina	17/10/2018
Nurul Azlan	Seditious Spaces: Protest in Post-Colonial Malaysia	29/10/2018
Linda van den Brink	Geospatial data on the Web	04/12/2018
Cai Jiaxiu	Design with forms as well as patterns	17/12/2018
Claudiu Forgaci	Integrated Urban River Corridors: Spatial design for social-ecological resilience in Bucharest and beyond	20/12/2018

Better connecting urbanism research and education (objective 5)

For many practices in society, there is a strong need for academically trained professionals and evidence-informed ways of working. The academic profile of our Urbanism alumni is truly shaped during the masters' phase of the five study programmes, which the department leads: MSc track Urbanism, MSc track Landscape Architecture, MSc Geomatics, MSc Metropolitan Analysis, Design & Engineering (MADE) and the European post-graduate Master in Urbanism (EMU). Our graduates are the young urbanism professionals and the urbanism leaders of the future.

The connection and interdependence of scientific research and higher education forms the core of the university, but this relation is not self-evident, nor easily realised. The added value of intertwining research and education for students is clear: students get the most up-to-date knowledge in their field of study, they develop their research skills, and perhaps most importantly, they develop their critical, academic attitude. But teaching can be very inspiring for research staff as well: young people take a fresh look at your work and your presentations as researcher, and they can directly or indirectly contribute to your research work.
In Urbanism we aim for a strong link between research and education, and we have several ways of achieving this. Here we elaborate on some best practices:

1 Several (graduation) studios are embedded in research projects: researchers teach in courses and studios, students are involved in running research projects, or students develop their project within the theme of the research project. Three examples:
   - Graduation studio Transitional Territories is strongly embedded in the 'Delta Urbanism' cross-cutting theme.
   - MSc2 Urbanism Research & Design studio: Spatial Strategies for the Global Metropolis focuses on regional design and planning, vision and strategy making, and the circular economy, and is embedded in the REPAiR research programme. We won this research project, in part, because of the promised integration of our education into it. It also showed that incorporating the concept of the circular economy in an integrative manner in urban design and planning courses is challenging because of its metabolic and complex nature, but in the end the students were provided with a situated and even transdisciplinary learning environment. Stakeholders appreciated the eco-innovative solutions developed by the students.
   - The Landscape Architecture graduation studio is strongly embedded in the LA section's research programme.
2 The MSc Honours Program Master (HPM) Architecture and the Built Environment is another strategy to strengthen the links between education and research. Selected honours students will set up and carry out their own research linked to one of the current research projects in Urbanism, under the personal guidance of experienced researchers and senior staff members. Research topics are offered by senior staff members and cover the entire breadth of the Urbanism research programme.
3 Within the masters' track of Urbanism we stimulate graduation students to write scientific journal articles during and after graduation, and it is possible to graduate by submitting a journal article instead of a final report as the final MSc graduation product. We offer selected research- and academic-writing-oriented students additional workshops on writing scientific papers. We are exploring if this model is feasible for all MSc programmes, and seeking ways to stimulate joint paper writing by graduates and mentors.
4 We do research on urbanism education. Since 2018, the A&BE faculty has launched academic research into its educational innovations focusing on 'Teaching design', 'Academic skills', 'Multi-, inter- and transdisciplinary education', 'Online/blended education' and 'Curriculum revision and educational leadership'. The Urbanism department contributes to all themes of this research programme with several education innovation projects in our (post-) masters' curriculums, and via our strong involvement in the bachelors of Bouwkunde. Here we list a number of projects and events:

Igor Pessoa, Roberto Rocco - the Comenius Teaching Fellowship project Bridging DOCS (€50,000 financed by NWO/NRO) aims to integrate TU Delft Urbanism masters' students with students from existing TU Delft online courses. This integration will start with the development of a platform connecting the students from the master course 'Methodology for Urbanism' with participants of the 'Rethink the City' MOOC.

Reinout Kleinhans - the TU Delft Teaching Fellowship project Crossing the Proverbial Gap Between Research-Based Education and Societal Impact (€50,000 sponsored by TU Delft) aims to explore and strengthen community engagement through (design) education. Students are enabled to conduct research and design which truly connects to and engages (members of) local communities in the context of regular bachelors'/ masters' courses.

Remon Rooij - the project Study Stress in Design Education (€50,000 sponsored by the 4TU Centre for Engineering Education) aims to explore, implement and evaluate measures to reduce unnecessary student stress in architecture and built environment design education. The project is executed in co-operation with the faculty of Industrial Design Engineering.

Kristel Aalbers, Inge Bobbink (involved as MSc coordinators) - the project Pedagogies for MSc AUBS Studio Teaching (€40,000 sponsored by the 4TU Centre for Engineering Education and led by Roberto Cavallo) aims to describe, compare and evaluate the different pedagogies of our MSc design studio education. The project is executed in co-operation with the faculty of Industrial Design Engineering.

Roberto Rocco, Marcin Dabrowski - the Values for Urbanism Handbook (€7,000 sponsored by the TUD Values for Design platform) will discuss how to teach and study values connected to the role of urban planners and designers in society: democracy, nature and role of the State, rule of law, democracy, participation, governance and ethical values of planning and design for people.

MaartenJan Hoekstra, Remon Rooij (members of the editorial board)- the book Academic Skills for Architects / Academische Vaardigheden voor Bouwkundigen (€10,000 sponsored by the 4TU Centre for Engineering Education) aims to systematically describe the academic skills that are taught in the bachelors' Bouwkunde curriculum. It will also become the benchmark for our international body of incoming students. The book focuses in particular on the relation between design and scientific research, and their relevant academic skills.

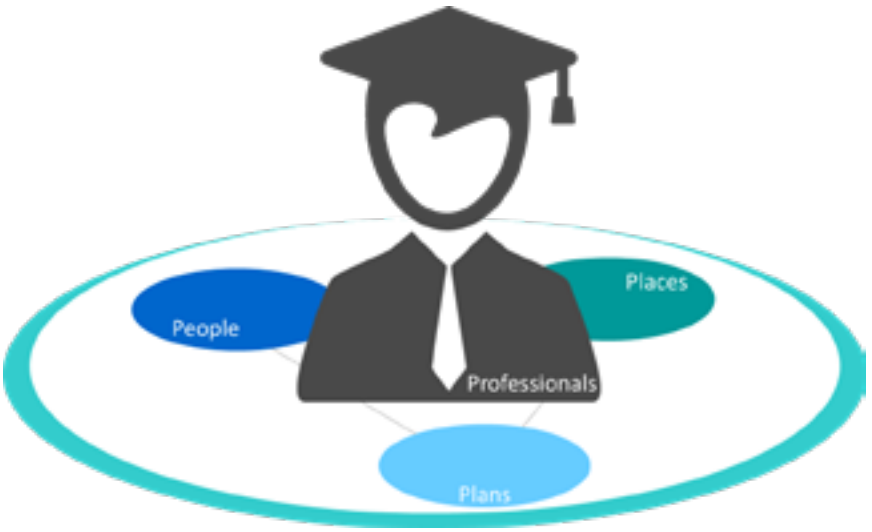

FIG. 5.1 Connecting urbanism research and education

A cohesive, diverse and inclusive Urbanism community (objective 6)

Diversity

We strongly adhere to the core values of Delft University of Technology: Diversity, Integrity, Respect, Engagement, Courage and Trust (DIRECT). The Urbanism department has become very international over the years. Imagine, for instance, that we had 38 international students in our BK master in 2003, and 370 (the majority) in 2017. Currently, we have 27 different nationalities in Urbanism. But internationalisation is just part of the story that brings us to diversity. Women's empowerment, globalisation, the rise of countries in the Global South, normalisation of LGBT+ persons, increasing diversity in Dutch society at large with increasing immigration, and de-colonisation of academic studies; these and other societal, cultural and economic trends mean that our working environment is now incredibly rich and diverse. And we absolutely need to draw from a wider pool of talent and knowledge in order to face our shared mission. Diversity entails a multiplicity of worldviews and knowledge. This means that knowledge does not come from one single perspective, but is produced from a multitude of perspectives and experiences. Diverse cultural perspectives can inspire creativity and drive innovation. Diverse perspectives are also a great opportunity for personal growth. It is all about understanding the richness and the variety of the human experience. But we are aware of challenges too, and many of these challenges are 'invisible' to those who don't experience them. It is easy to overlook other people's subjective experiences and to normalise behaviours that exclude certain groups.

Frontrunner

In 2018, Urbanism organised a very well-attended internal workshop on inclusiveness and diversity, in which we realised that inclusiveness is not a given. In the interactive workshop, we were challenged to be open about the challenges and opportunities of diversity. We discussed issues such as the gender gap, micro-aggressions, stereotypes (negative and positive), language, feelings of isolation or lack of respect. It was felt that being open and active during the workshop helped raise the awareness of staff and prompted the department to face these challenges and seize the opportunities offered by diversity more decisively. To take the remarks of our staff further, we aim to deepen the subject of diversity and inclusiveness in order to create a safe and positive environment for all, academic and non-academic staff and students alike.

FIG. 5.2 Diversity report

Following the TU Delft Strategic Framework (2018-2024), Urbanism will be the first department to operationalise the University's ambitions on diversity and inclusiveness in a departmental workshop. A course 'Managing Undesirable Behavior' has been developed by TU Delft, together with the training office Schouten & Nelissen and, given our track-record, Urbanism is the first department where it will be tested and further developed. In this course, we will learn to signal undesirable behavior and to deal with it effectively. Moreover, we will discuss how to lead by good example, since we are all leaders at various times in our careers. We aim to embrace diversity as an asset, and to value our staff for all their individual talents and qualities, but also for what makes them unique and different. We seek to know how to stimulate all to use their distinctive

qualities and needs and to make our department richer. If we can make this approach work, other departments will certainly follow our example.

Cohesion

While we often design ‘interaction environments’, we try to practice what we preach inside our department, and at the faculty scale, too, in order to foster cohesiveness. We stimulate interaction between staff members through frequent gatherings - e.g. workshops, invited guest lectures, lunch seminars, etc., through diverse and variable mentoring teams for masters’ thesis supervision, through sharing responsibility for the education and research more generally, as well as through our seating plan. As a department we have yearly outings, parties and we celebrate successes together.

Moving towards open science (objective 7)

The European Commission defines open science as a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools. The idea captures a systemic change to the way science and research have been carried out for the last fifty years: shifting from the standard practices of publishing research results in scientific publications towards sharing and using all available knowledge at an earlier stage in the research process.

The aim of open science is that others can collaborate and contribute, where research data, lab notes and other research processes are freely available, under the terms of FAIR (findable, accessible, interoperable and reusable) that enable reuse, redistribution and reproduction of the research and its underlying data and methods.

Moving towards open science has important implications for how we conduct and organise our research, in particular when it comes to data management, while it is obvious that open science also means open access publication. the Urban Data Science section has an especially long history in open science. Open datasets are published at https://3d.bk.tudelft.nl/opendata/ and their software is made available on Github (https://github.com/tudelft3d/). Other sections are following in their footsteps - albeit still slowly. For instance, several data papers describing the creation of new datasets have been submitted in addition to storing the data. TU Delft as whole is supporting this, and it is expected that we will implement these new standards soon on a wider basis. We are moving to a situation in which all our data will be made available via the TU Delft repository (repository.tudelft.nl), or via the 4TU repository or via DANS-Easy. Through TU Delft repositories, such as Pure, all our publications can be accessed, and we hardly see the need to publish in journals that place our work behind a paywall. This is also due to the excellent negotiations by all Dutch universities with publishing houses, which have led to agreements that allow researchers at Dutch universities to publish open access in most journals.

Making a difference in society (objective 8)

Our mission implies societal impact

Much Urbanism research is driven by the deeply felt need of our research staff and students to 'make a difference' in society: to improve people's lives, as well as the sustainability and livability of our environment. Contributing to a better satisfaction of the 15 human needs stated in our mission is what drives us. Our mission is to provide the basic conditions for human existence (focusing on sustenance, shelter, health, safety, security), to allow humans to relate to others and their environment (focusing on interaction environments, social cohesion, ecological health, the ability to make sense of the world and one's role in it, to create environments that are beautiful, that provide comfort and that people can relate to) and to create an environment that allows humans to grow (focusing on a sense of belonging, fair treatment and equal opportunities, opportunities to be heard and to affect this environment).

Outreach, capacity building and stakeholder engagement

To obtain this societal impact, we try to change levels of understanding, knowledge and attitudes of all relevant stakeholders, including citizens to empower them, and many outreach activities are aimed at exactly that. We contribute to professional magazines, to news and other media targeted at larger audiences, we actively contribute to policy debates, for instance through organising or participating in numerous workshops, conferences and other events where relevant stakeholders meet. Also particularly relevant is online learning, and we have developed several online courses that are open to all. As Urbanism, we address many relevant scales - from redesigning streets and public spaces, to neighbourhood development, debates on urban and metropolitan development, involvement in provincial or national policy debates in many countries across the globe, and even regional development and planning issues at the European scale are a focus of our attention. We also actively participated in the discussion on the UN Global Development Goals. Communication, capacity building and stakeholder engagement are keywords in our work.

Future-oriented intervention is at the core of urbanism

But there is more. At the core of Urbanism is the design and planning of actual spatial interventions in our built environment that makes the fulfillment of this mission possible. Hence, we make instrumental use of research information to actually develop those interventions which have a direct impact on our environment, and our research is partly focused on implementing those interventions in the most efficient and effective way. The very focus of what we do therefore is to intervene - we consider Urbanism to be an action- and future-oriented activity.

6 – **SWOT analysis**

Strengths

- A distinct Delft approach to Urbanism;
- Deep experience and capability in international research collaboration;
- Well-established collaboration between academics and practitioners;
- Critical mass of research staff willing to collaborate across disciplines;
- Successful transition towards more academic publication, while maintaining a prominent position in professional and popular publication;
- Stable portfolio of major externally funded research projects.

Weaknesses

- Gender balance;
- Lack of clarity about research of truly international excellence;
- Not all staff experienced yet in peer-reviewed publication and writing research proposals;
- Continuing, if reducing, backlog of PhD candidates;
- Dependence on PhD students bringing a grant, and limited opportunities to select PhD students on the basis of competition;
- Few opportunities for staff progression in TU Delft and possible loss of younger capable researchers;
- Underutilisation of possibilities to involve students in research.

Opportunities

- Global trends in urbanisation demand knowledge and expertise in urbanism;
- Potential for developing underpinning cross-cutting theory on urbanism;
- Continuing research calls at national, EU and global levels on urbanisation;
- Wide network of national and international partners that bring opportunities to urbanism;
- Strong strategic alliances in the Netherlands and internationally;
- Collaboration with other departments and faculties;
- More time for curiosity-driven research;
- Continuing demand from high-quality applicants for master's and doctoral studies (+ some capacity to supervise them).

Threats

- Reduction of funding sources, dependence on limited co-funding and increasing competition for funds;
- Potential for fragmentation of overall programme and direction if disciplinary research strands are not sufficiently complemented with transdisciplinary research;
- Possible fragmentation of effort as researchers pursue limited funding sources;
- Difficulty of recruiting senior staff in urbanism.

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7 – **Research projects Urbanism**

Comparative Analysis of Territorial Governance and Spatial Planning Systems in Europe

Acronym
COMPASS

Funder | Programme [grant number]
ESPON EGTC | *Comparative Analysis of Territorial Governance and Spatial Planning Systems in Europe* [EE/SO1/009/2016]

Overall budget
€ 869.700

Grant amount
Total: € 869.700
TU Delft: € 193.600

Role TU Delft
Lead partner

Duration
06-2016 >05-2018

TU Delft researchers
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Project partners
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Nordregio, Sweden
Politecnico di Torino, Italy
Polish Academy of Sciences, Poland
Spatial Foresight, Luxembourg
University College Dublin, Ireland
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Members of the COMPASS consortium

In the late 1990s the European Commission published the 'EU Compendium on Spatial Planning Systems and Policies' which covered the 15 EU member states at that time. Since then, the EU has expanded to 28 member states and there have been significant developments in pan-European territorial and cohesion policies. Territorial governance and spatial planning systems have evolved to become one of the key components of integrated cross-sectoral development strategies and policy delivery mechanisms among ESPON member and partner states. The COMPASS project addressed the following policy questions:

1. What changes in territorial governance and spatial planning systems and policies can be observed across Europe over the past 15 years? Can these changes be attributed to the influence of macro-level EU directives and policies?
2. What are best-practices for cross-fertilisation of spatial and territorial development policies with EU Cohesion Policy?
3. How can national/regional spatial and territorial development policy perspectives be better reflected in Cohesion Policy and other policies at the EU scale?

Further information
https://www.espon.eu/planning-systems

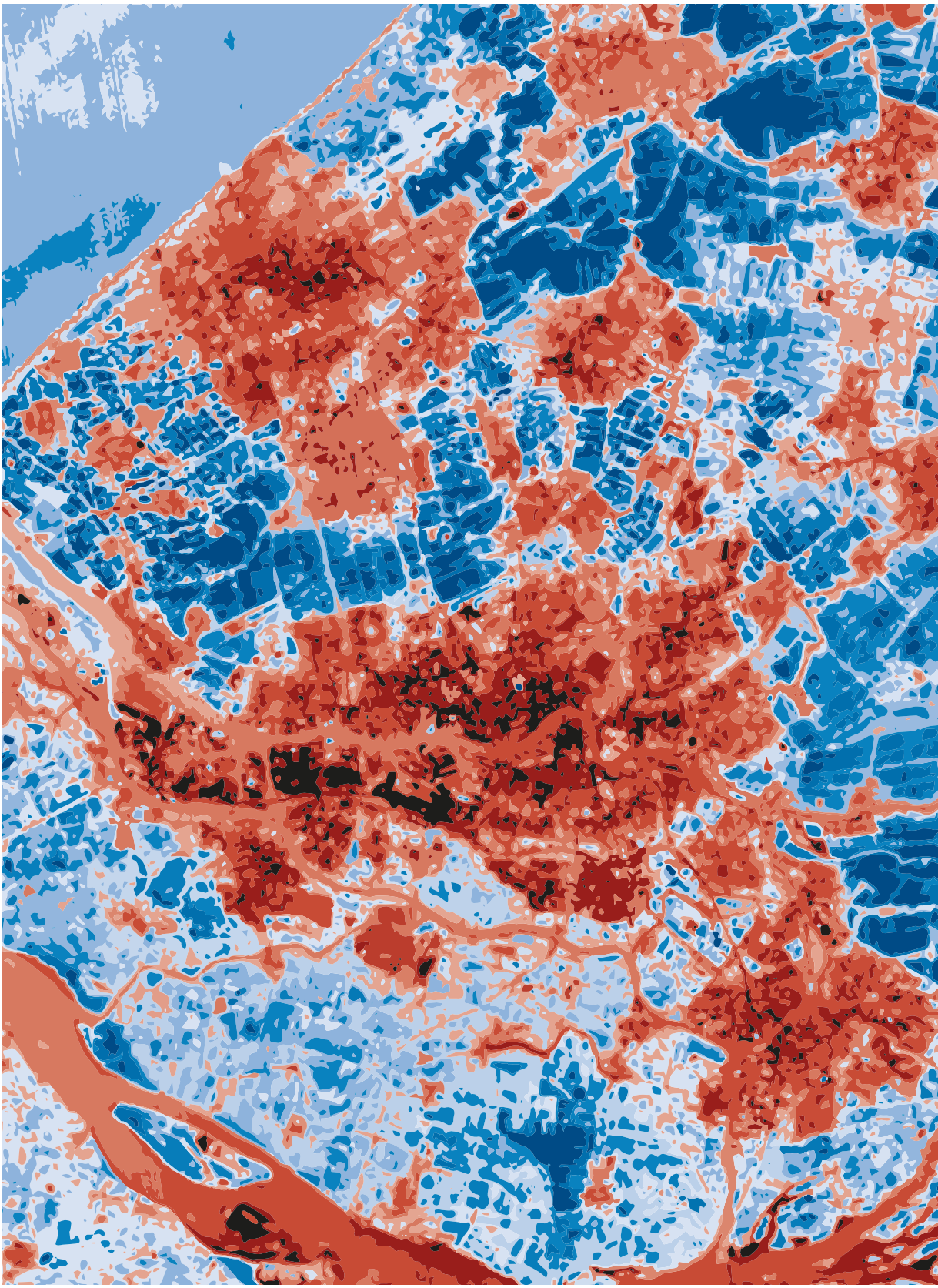

FIG. 1.1 The night time surface urban heat island in The Hague compared to other cities in the metropolitan region Rotterdam-The Hague. Each color step represents one degree Celsius. Blue is cooler and red is warmer, while black represents the highest noctural surface temperature. The map displays an average based on three nights: 12-09-2016, 26-05-2017, 18-06-2017. Landsat 8 was used.

The Hague heat (Haagse hitte)

mapping The Hague's urban heat island

Acronym
Haagse Hitte

Funder | Programme [grant number]
City of The Hague
TU Delft Climate Institute

Overall budget
€ 57.500

Grant amount
Total: € 57.500

Role TU Delft
Principle investigator

Duration
07-2015 > 12-2019

TU Delft researchers
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Ir. Alexander Wandl
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In recent years, various studies have been carried out into the heat island effect in the Netherlands. A study by TNO set the tone for the city of The Hague. The Hague would have the strongest heat island effect of any Dutch city. This perception has given rise to a social and political concern that formed the starting point for this research project by TU Delft into the urban heat island effect in The Hague, made possible by the municipality of The Hague.

With remote sensing methods, we determined the heat island (surface temperature) and the surface energy balance. With crowd sensing, the temperature in the immediate vicinity of more than 200 homes was monitored (gardens and balconies). Indoor temperature measurements of over 12.000 homes were obtained as well, provided by Quby. We mapped social and spatial factors based on satellite images, GIS and 3D models. Using that data as a starting point, the relationships between heat island/surface energy balance on the one hand and social/spatial factors on the other hand were determined. Multivariate regression analysis was used to determine the social and spatial characteristics that influence the development of the heat island and the increased mortality among the elderly during heat waves. The research ultimately resulted in two heat maps, an atlas with underlying data, and a set of adaptation measures for the built environment that make the city of The Hague and its inhabitants more resilient to the effects of heat. Overview maps show where which measures apply. A simple timeline underlines that the heat of The Hague requires a long-term policy.

On the basis of detailed and recent satellite images, we concluded that The Hague's heat island effect is considerable, but not more serious than in the rest of the metropolitan region. During the day, the surface area of the heat island in The Hague is less fragmented than that of Rotterdam, but not more so. The nocturnal heat island surface is under the influence of the North Sea. In spring the sea is cooler at night than the city's surface, in autumn the proportions are reversed. The crowd sensing measurements show that the temperature in the immediate vicinity of homes can easily exceed 30 degrees Celsius in summer.

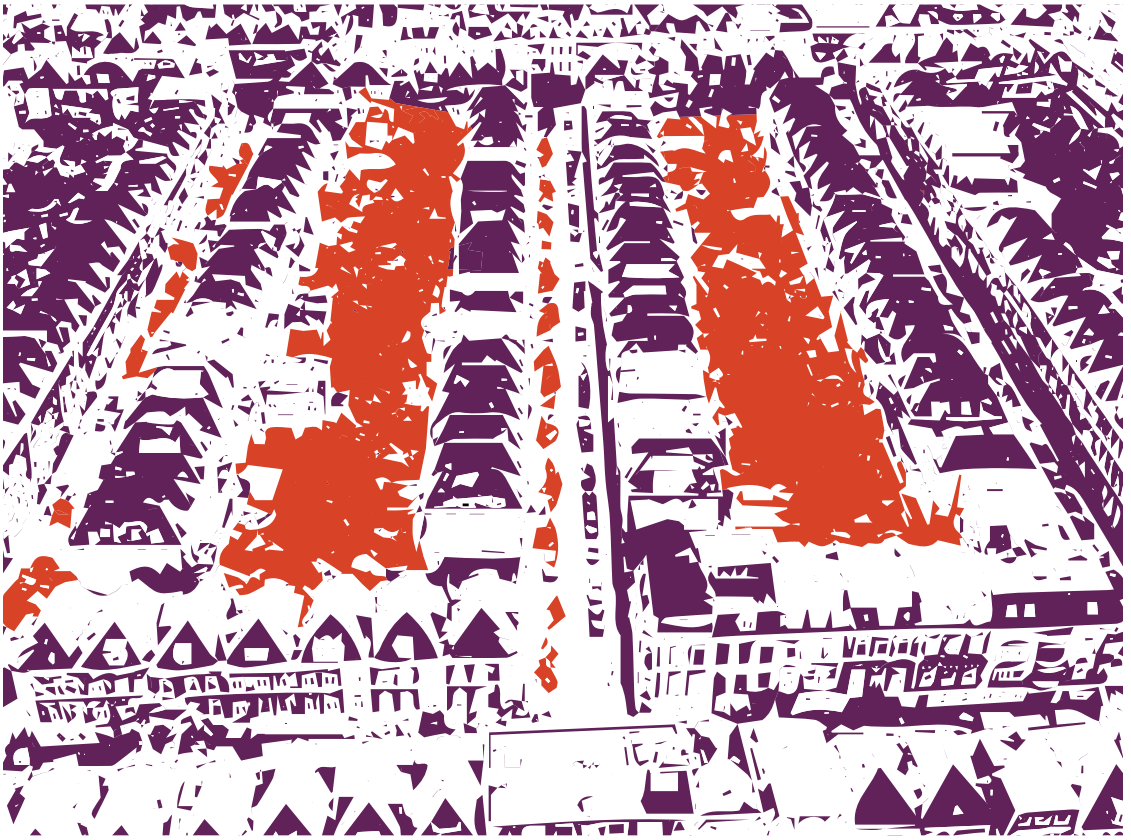

Image: City streets have little space to add green while (private) courtyards provide much more opportunity for greening. TU Delft.

There is a strong correlation between the heatisland effect (QH + QS) and the use of space in The Hague. The degree of hardening, the lack of reflection of sunlight (albedo), the absence of green and surface water, shadow and sky-view, building volume and the distance to the sea are factors that together determine the heat island in the summer. The heat-island effect in a winter situation has not been considered.

In view of the unrest surrounding the current heat island effect, KNMI's climate forecasts, the considerable densification challenge facing the city, the expected ageing population and the above-average mortality during heat waves, there is indeed sufficient reason to tackle the problem in a policy-based manner. The study has identified especially three actions aimed at curbing the heat-island effect:

- Phasing out bitumen roofs;
- Greening of courtyards;
- Monitoring home overheating.

These actions require a long policy breath that extends over decades. The heat maps can be used to set priority areas. The Heat Map 'Ruimte' shows the clusters of spatial characteristics that strengthen the urban heat island: hardscape; vegetation; albedo; sky view; surface water; building volume.

The heat map health shows in a similar way the factors associated with the excessive mortality that occurred during heat waves: number of people over 75 per hectare; age of the buildings; sensible and ground heat flux.

Further information
https://books.bk.tudelft.nl/index.php/press/catalog/book/isbn.978946366003

Beyond Agglomerations

Mapping Externality Fields and Network Externalities

Acronym
DISPERSAL

Funder | Programme [grant number]
NWO - Netherlands Organisation for Scientific research| *VIDI grant Vernieuwingsimpuls/ Innovational Research Scheme* [452-14-004]

Overall budget
€ 906.898

Grant amount
Total: € 800.000
TU Delft: € 800.000

Role TU Delft
Host institution (personal grant)

Duration
11-2015 > 11-2020

TU Delft researchers
Dr. Evert Meijers [lead]
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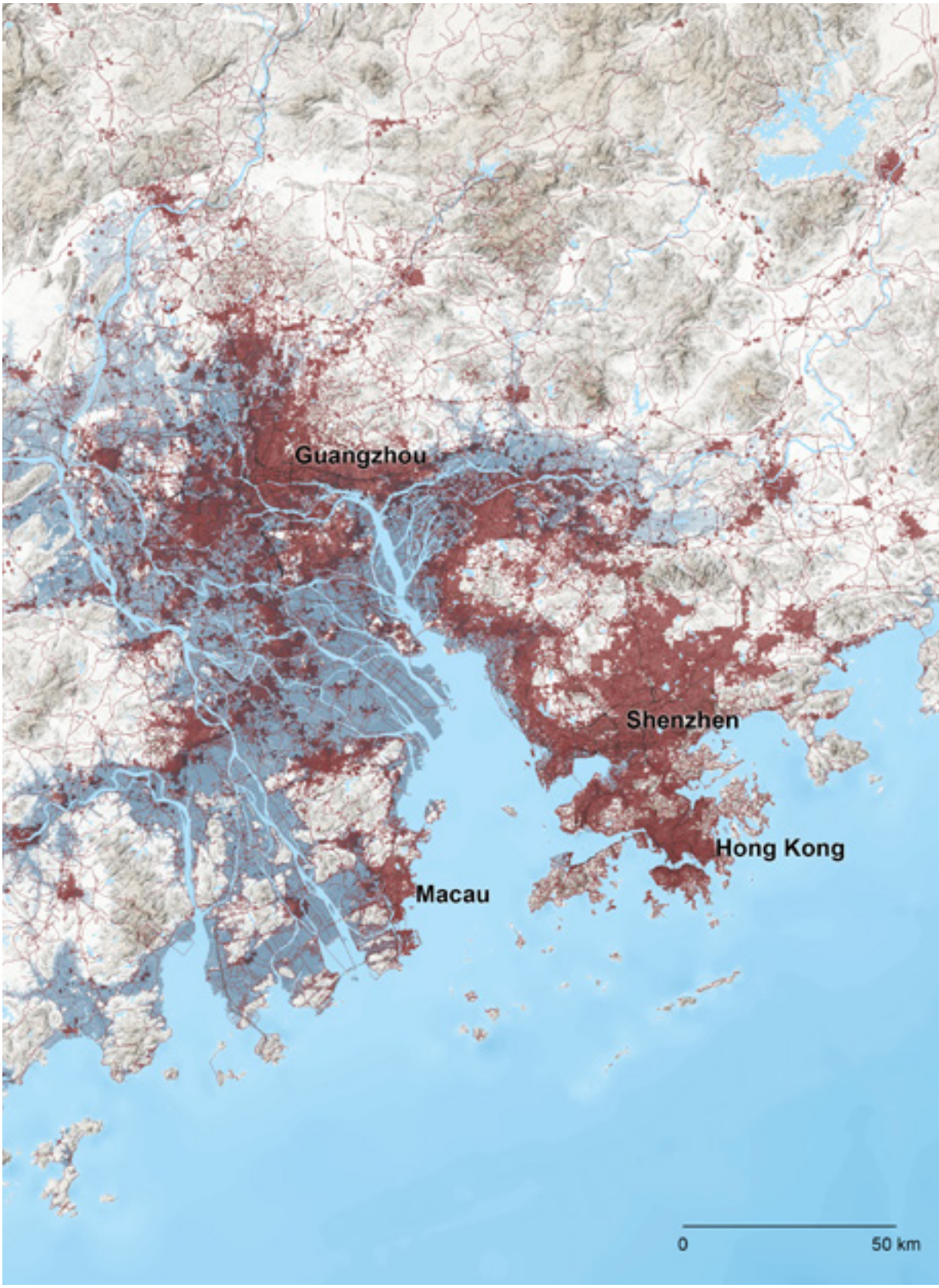
The research was funded through a VIDI grant (452-14-004) provided by the Netherlands Organisation for Scientific Research (NWO).

Citation network of publications, labelled according to the schools of thought in urban systems research (Peris et al., 2018).

Small and medium-sized European cities are performing increasingly well, even though conventional agglomeration theory suggests that the agglomeration benefits of large cities are the primary economic drivers in the world, steering urban and economic growth towards the largest cities and metropoles.

To solve this discrepancy between theory and reality, this project aims to challenge and recast the geographical foundations of agglomeration theory. This project explores the hypothesis that small and medium-sized cities are able to 'borrow size' through being proximate to other cities and/ or through being connected in networks with other cities. This means that urbanisation economies are not confined to individual agglomerations –as is the long-standing and unquestioned assumption. Rather, they transform spatially into 'urban externality fields' and/or 'urban network externalities'. The project focuses particularly on the role of ICT in this transformation and on new ways of measuring networks of cities.



Map: Steffen Nijhuis, TU Delft

Adaptive Urban Transformation

Territorial governance, spatial strategy and urban landscape dynamics in the Pearl River Delta

Acronym
AUT

Funder | Programme [grant number]
National Natural Science Foundation of China [NSFC] | Joint Research Projects: Sustainable Deltas [ALWSD.2016.013]
Netherlands Organisation for Scientific Research [NWO] | Joint Research Projects: Sustainable Deltas [ALWSD.2016.013]
Engineering and Physical Sciences Research Council [EPSRC]| Joint Research Projects: Sustainable Deltas [ALWSD.2016.013]

Overall budget
€ 1.000.000

Grant amount
Total: € 1.000.000
TU Delft part: € 350.000

Role TU Delft
Lead partner

Duration
02-2018 > 02-2022

TU Delft researchers
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This project concerns planning and management for more resilient urban deltas, and in particular, adaptation of the dynamics of urban deltas to address increasing flood risk. The project evaluates innovative territorial governance as an approach to create spatial strategies that may unlock the adaptation options, especially by integrating urban planning and water management, and engaging with stakeholders.

The overall aim of the research is to develop an integrative and multiscale design and planning approach for adaptive urban transformation in fast urbanizing deltas. It uses the Pearl River Delta as a case study. The project will combine work in the China, the Netherlands and the UK: (1) to develop a portfolio of integrated adaptation measures based on an assessment of ecological capacity and life cycles of buildings, urban districts and regions; (2) identify potential in territorial governance structures for more integrated approaches and adaptation measures; and (3), develop and test innovative 3D visualisation techniques that facilitate participatory, multi-stakeholder planning approaches.

For the first time, established and regular urban transformation processes will be used as opportunities to adapt systems in urbanized deltas at relatively low costs. Furthermore, the research will identify institutional, cultural and financial innovations that are needed in territorial governance to steer the development of urban and rural areas towards more resilient futures.

This research provides a unique approach that integrates research in urban landscape systems, territorial governance and visualisation techniques that will help to achieve more integrated and resilient deltas.

Photo: Guangyuan Xie, SCUT

The research builds upon established partnerships between the TU Delft and SCUT, and is complemented with the UoS. In 2013 TU Delft and SCUT founded a joint research centre on Urban Systems and Environment (USE). USE provides a platform for research projects on the challenges of city planning and management in contexts of high urbanization as in north-west Europe and Pearl River Delta. TU Delft is specialized in future strategies for sustainable development of urban deltas in response to new (climate) conditions, and renowned for combining science, technology and design. SCUT has taken the lead in academic research and engineering practice of large public buildings and urban planning and design in various regions in China. SCUT has strong ties with (local) governmental stakeholders, important for practical applications in real time projects, and to safeguard the societal relevance of the research. SCUT also hosts the prestigious State Key Laboratory of Subtropical Architecture Science in China approved by the State Ministry of Science and Technology, providing infrastructure and capacity needed for successful research projects. The team is augmented with UoS. The UoS has a long track record and experience in collaborative research on an international level, and is world leading in developing innovative approaches and tools for stakeholder involvement and 3D landscape visualization. The team represents a mix of scientific partners that have ample experience in the theory and practice of transdisciplinary projects focused on integral planning and design of urban deltas, including the development and application of tools.

Keywords
Resilient urban planning and management; Territorial governance; Adaptive urban transformation; Spatial strategy; Stakeholder involvement; 3D Visualisation

Further information
www.adaptiveurbantransformation.com

SPACERGY

Space-Energy Patterns for Smart Energy Infrastructures, Community Reciprocities & Related Governance

Acronym
SPACERGY

Funder | Programme [grant number]
EU | *JPI Urban Europe*

Overall budget
€ 1.108.624

Grant amount
Total: € 1.108.624
TU Delft: € 248.211

Role TU Delft
Lead partner

Duration
04-2016 > 08-2019

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Daniela Maiullari

Project partners
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ETH Zurich, Switzerland
AMS Institute, The Netherlands
Municipality of Zurich, Switzerland
Municipality of Almere, The Netherlands
Municipality of Bergen, Norway
The Public Road Administration of Norway, Norway

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URBAN EUROPE

SPACERGY builds upon the need of planning authorities to develop new models to implement energy transition strategies in the urban environment, departing from the exploitation or reciprocity between spatial potential and energy systems. Based on urban morphology and energy use modeling, SPACERGY develops new tools and guidelines necessary to advance the implementation of energy efficient urban districts. The toolsets are tested in three urban areas under development in the cities of Zurich, Almere, and Bergen, acting as living laboratories for real-time research and action in collaboration with local stakeholders. The results of this research project support planners and decision makers to facilitate the transition of their communities to more efficient, livable and thus prosperous urban environments.

Further information
www.jpi-urbaneurope.eu/spacergy

All images: Toulouse 2011 (photos taken by Maarten van Ham)

DEPRIVEDHOODS

Socio-Spatial Inequality, Deprived Neighbourhoods, and Neighbourhood Effects

Acronym
DEPRIVEDHOODS

Funder | Programme [grant number]
EU | *FP/2007-2013 - European Research Council grant (ERC Consolidator Grant) under the European Union's Seventh Framework Programme* [615159]

Overall budget
€ 1.996.506

Grant amount
Total: € 1.996.506
TU Delft: € 1.996.506

Role TU Delft
Project partner

Duration
08-2014 > 07-2019

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The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013) / ERC Grant Agreement n. 615159 (ERC Consolidator Grant DEPRIVEDHOODS, Socio-spatial inequality, deprived neighbourhoods, and neighbourhood effects).

The objective of the DEPRIVEDHOODS project was to come to a better understanding of the relationship between socio-economic inequality, poverty and neighbourhoods. The spatial concentration of poverty within cities is of great concern to national governments, partly based on a belief in neighbourhood effects: the idea that living in deprived neighbourhoods has an additional negative effect on residents' life chances over and above the effect of their own characteristics. This belief has contributed to the development of area-based policies designed to introduce a more 'favourable' socio-economic mix in deprived neighbourhoods. Despite the persistent belief in neighbourhood effects, there is surprisingly little evidence that living in deprived neighbourhoods really affects individual lives. There is little consensus on the importance of neighbourhood effects, the underlying causal mechanisms, the conditions under which they are important and the most effective policy responses. The DEPRIVEDHOODS project has studied simultaneously neighbourhood sorting over the life course, neighbourhood change, and neighbourhood effects, within one theoretical and analytical framework. The highlights of the DEPRIVEDHOODS project are summarized below.

The first highlight is the book Socio-Economic Segregation in European Capital Cities (Routledge in 2016), which offers a systematic and representative account of the spatial dimension of rising inequalities and socio-economic segregation in Amsterdam, Athens, Budapest, London, Milan, Madrid, Oslo, Prague, Riga, Stockholm, Tallinn, Vienna and Vilnius. Comparing data for the years 2001 & 2011 segregation was linked to four underlying universal structural factors: social inequalities, global city status, welfare regimes and housing systems. The book showed that socio-economic segregation is increasing in European cities. The poor and rich are increasingly living in different parts of the same city. These increasing levels of segregation are related to increasing levels of inequality. The book received ample attention from the international press and national governments.






The second highlight is the development of the vicious circles of segregation framework (published by the OECD). The multi-level conceptual model of segregation includes three conceptual levels – individuals and households, generations, and urban regions. Different socio-economic groups sort into different types of neighbourhoods, workplaces, schools, and leisure sites, leading to patterns of segregation at the urban level. Also exposure to different socio-economic contexts affects individual outcomes, leading to sorting processes into domains. This vicious circle of sorting and contextual effects leads to higher levels of segregation.

The third highlight is the development of a multiscale approach to measuring spatial context and exposure to others. Using individual-level register data for the full population of the Netherlands and a very detailed multiscalar framework of bespoke neighbourhoods at 101 spatial scales, we measured the share of ethnic minorities and people with a low income for the whole country. We created individual cumulative distance profiles of exposure, mapped exposure surfaces, and applied entropy as a measure of scalar variation to compare potential exposure to others in different locations both within and between cities.

The fourth highlight was the development of a longitudinal approach to measuring neighbourhood context over the life course. Sequence analysis was used to simultaneously capture duration, timing, and sequencing of exposure to neighbourhood (dis)advantage. The results showed important variation in neighbourhood histories between groups, which were relevant for understanding individual outcomes later in life.

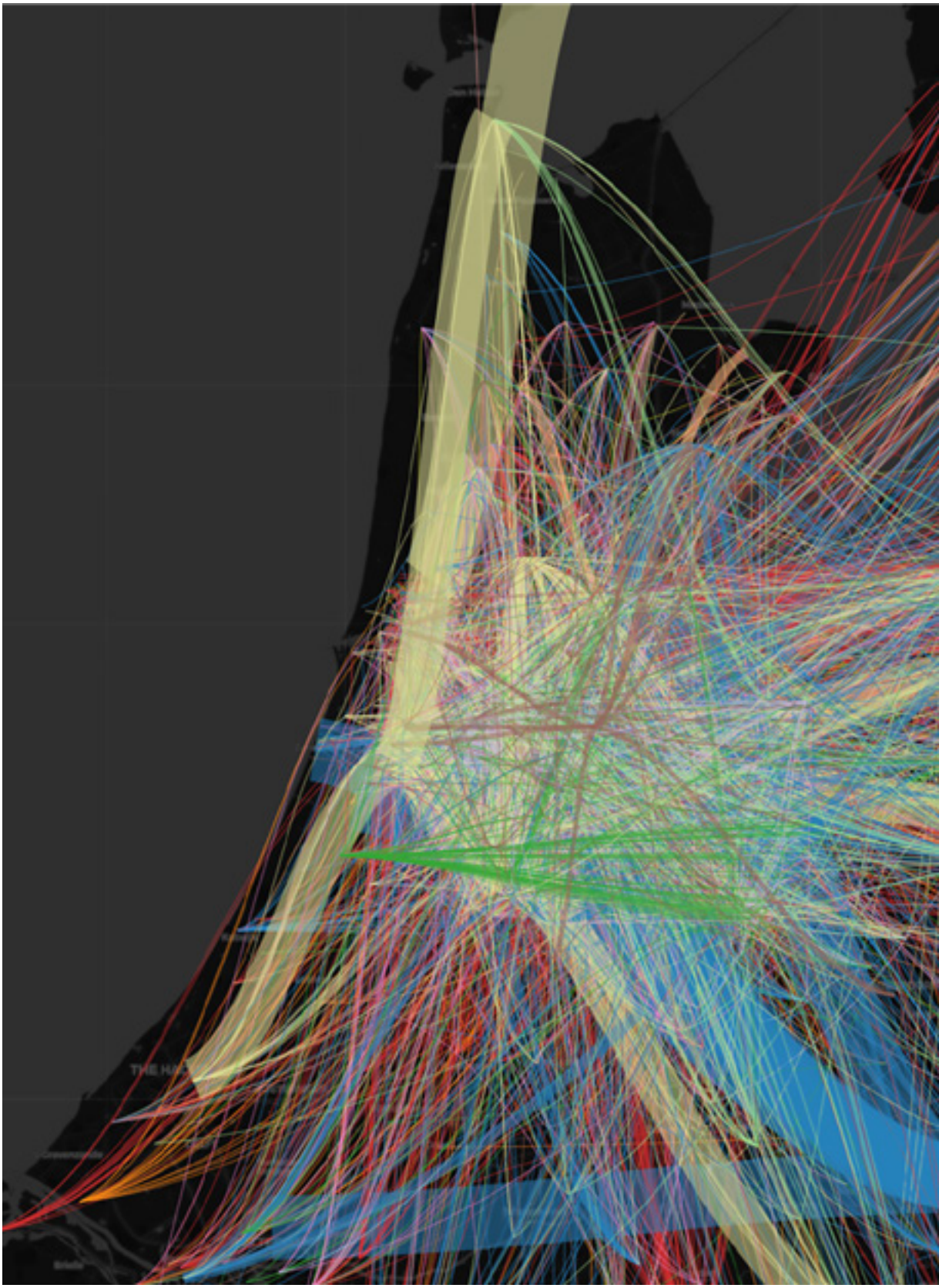
The fifth highlight was the use of a sibling design to explore the impact of neighbourhood histories and childhood family context on income from work. Using data from Swedish population registers, we showed that the neighbourhood effect on income from both childhood and adult neighbourhood experiences, is biased upwards by the influence of the childhood family context.

The sixth highlight is the incorporation of neighbourhood choice in a model of neighbourhood effects. The non-random selection of people into neighbourhoods is a major challenge in the neighbourhood effects literature which biases outcomes of models of neighbourhood effects. We improved an approach to overcome such bias by explicitly modelling neighbourhood choice and deriving correction components for models of neighbourhood effects.

The seventh was an international comparison (Sweden, the Netherlands, UK, Estonia) of the relationship between socio-economic segregation in neighbourhoods and socio-spatial mobility. The combination of high levels of income inequalities and high levels of spatial segregation tend to lead to a vicious circle of segregation for low-income groups, where it is difficult to undertake upward socio-spatial mobility.

The project has used unique geo-referenced longitudinal data from Sweden, United Kingdom, Estonia, and The Netherlands. DEPRIVEDHOODS has resulted in 53 academic peer reviewed journal articles to date, 4 completed 4 phd theses, 3 published books and 9 published book chapters. The project has received a lot of media attention from major newspapers in Europe and beyond.

Further information
www.deprivedhoods.eu



A stylised AS-MFA of the construction and demolition waste flows generated in the Amsterdam Metropolitain Area. (Source: REPAiR TUD team)

REPAiR-REsource Management in Peri-urban Areas

Going Beyond Urban Metabolism

Acronym
REPAiR

Funder | Programme [grant number]
EU | *H2020-EU.3.5.4. - Enabling the transition towards a green economy and society through eco-innovation* [688920]

Overall budget
€ 5.089.636

Grant amount
Total: € 5.089.636
TU Delft: € 1.200.000

Role TU Delft
Lead partner

Duration
09-2016 > 09-2020

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HafenCity Universität Hamburg [HCU], D
Institute for Regional Studies, [RKI], H
Institute of Geography and Spatial Organization - Polish Academy of Sciences [IGiPZ], PL
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Geo-Col GIS and Collaborative Planning [Geo-Col], NL
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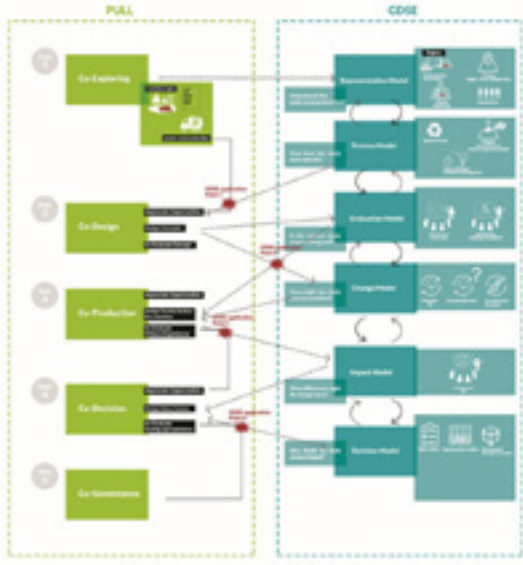
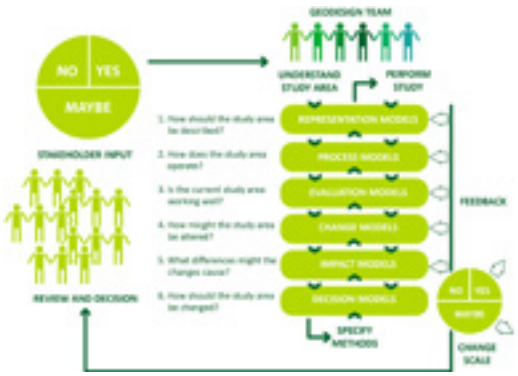
The core objective of REPAiR is to provide local and regional authorities with an innovative transdisciplinary open source geodesign decision support environment (GDSE) developed and implemented in living labs in six metropolitan areas in Europe: Amsterdam, Naples, Hamburg Ghent, Pécs, Łódź. The GDSE allows creating integrated, place-based eco-innovative spatial development strategies aiming at a quantitative reduction of waste flows in the strategic interface of peri-urban areas. These strategies will promote the use of waste as a resource, thus support the on-going initiatives of the European Commission towards establishing a strong circular economy.

The key challenge for REPAiR is to integrate models and methods from, among others, the environmental sciences, geographic sciences and economic sciences with design and spatial planning methods, both on a software and process level.The integrated models and methods enable local and regional stakeholders to use the geodesign decision support environment (GDSE) within a workshop setting to develop fast and reliable alternatives for spatial sustainable development strategies.



Geodesign meets Living Lab. The Methododlogy applied to the use of the GDSE in the six REPAiR peri-urban living labs. (Source: REPAiR UNINA team)



TOP: Stakholders and researchs during the co-creationprocess of the Amsterdam peri-urban living lab. (Source: REPAiR TUD team)
BOTTOM: The Research Approach of REPAiR based on Steinitz's geodesign framework. (Source: Libera Amenta)

The main objective of REPAiR is to demonstrate the feasibility and validity of the GDSE as a tool for enhancing waste and resource management. To successfully develop, test and implement the GDSE, the following project objectives have been defined:

1. To provide decision-makers with comparative assessments of different integrated spatial resource management strategies by combining forecasting methods, strategy conceptualisations and an integrated assessment of economic, environmental and social sustainability in a collaborative decision support environment.
2. To develop an understanding of the characteristics, mechanisms and dynamics of European resource management systems by analysing the relations between waste flows, environmental and spatial quality, allocation and governance in six peri-urban areas using life cycle thinking.
3. To better interpret the link between metabolic flows and urban processes, by extending the assessment of urban metabolism to include urban driver concepts and urban patterns, as well as environmental and spatial quality, and co-benefits.
4. To improve the knowledge and reliability of waste-related data by activity based spatial material flow analyses.
5. To implement living labs in peri-urban areas across Europe to develop, test, implement and assess place-specific eco-innovative solutions for resource management to improve environmental and spatial quality and quality of life.
6. To understand decision making structures and processes in the case study areas with regard to interests and priorities of different stakeholders to add transparency to the decision-making process.
7. To develop a framework for transferring (a) the key modules of the GDSE itself; and, (b) the solutions and change models that it will produce across differentiated peri-urban areas.
8. To disseminate and ensure the further uptake of the project's insights on aspects of resource management and GDSE development by including local and regional planning authorities, NGOs, public and private waste management companies, and future urban planners in the project. Moreover, open dissemination of insights, tools and technologies is provided across Europe, establishing the foundation for knowledge-based consultancy services that support local implementation of policies and spatial investments aimed at developing a circular economy.

First results

The first phase of the project was dedicated to understanding, the territory, people, waste management status quo, circular economy state and visions as well as the different governance landscapes of, predominantly, the two main pilot cases, Naples and Amsterdam. The first phase resulted in the definition of the system boundaries, the selection of the resource scopes for the case studies, the first assessment of data availability and the list of key priorities in the pilot cases. In parallel the organisation of the peri-urban living labs (PULLs), the project webpage, the dissemination plan and the data management plan were established.

Moreover, methods, for the six models have been developed. These were, among others, an integrated socio-spatial and physiological analyses, which includes an activity-based spatial materials flow analysis in order to understand and represent the extended urban metabolism of the case study areas. A framework for a multi-size (micro, meso, macro), multi-geo-scale (processes located at different geographical scales) and multidisciplinary (social, economic, or environmentally oriented) impact assessment, as well as methods for decision making during the process of the PULLs. Furthermore, methods to co-create eco-innovative solutions have been developed. Regarding the latter, a first set has been developed. This allowed to start working on methods for knowledge transfer of such eco-innovative solutions. In close collaboration the technical development of the GDSE was started.

Progress beyond the state of the art

The progress beyond state of the art during the first period of the project was predominantly related to the development of analytical methods, as well as the technical development of the GDSE.

- REPAiR developed the first geodesign software that includes flows, other than traffic and water. In order to do so, modules for data entry and visualisation that include waste and resource flows had to be developed.
- To further extend the concept of urban metabolism and make it applicable to support development of place based eco-innovative solutions, REPAiR developed an activity-based material flow analysis (AS-MFA), which follows the so called ‘network model of urban metabolism’ and includes, activities and value chains.
- REPAiR explored, through interviews, questionnaires and the co-exploration phase of the PULLs the roles of governance settings and territorial and socio-cultural characteristics of different (peri-) urban areas. Next, these were taken as factors, which constrain or support the capacity to devise place-tailored solutions to promote the use of waste as a resource.
- The AS-MFA was applied in an integrated socio-spatial analysis together with further developed understanding and mapping of wastescapes to define the so called ‘enabling contexts’, which are locations or subsystems within the area of interest that are specifically suitable for developing and implementing eco-innovative solutions.
- In order to be to be able to assess eco-innovative solutions a sustainability framework was developed, that is holistic and comprehensive in the sense that it covers social, economic and environmental aspects, and considers local to global impacts, based on a life cycle perspective.
- The REPAiR project was used as a pilot to test a better integration of research and design education in two Urbanism Master courses: (1) MSc course “Spatial Strategies for the Global Metropolis”, an obligatory annual course of the MSc Urbanism programme that integrated CE in 2017 and 2018, each with about 75 students; (2) MSc course “Geodesign for a Circular Economy in Urban Regions”, an elective course open to students of different MSc programmes that ran in 2017 and 2018, each with about 15 students form the Architecture, Urbansim and Industrial Ecology tracks.

Illustration of the flows of food waste, which are generated within the Amsterdam Metropolitan Area. (Source: REPAiR TUD team)

A selection of related publications with BK contributions

Amenta L, van Timmeren A. (2018) Beyond Wastescapes: Towards Circular Landscapes. Addressing the Spatial Dimension of Circularity through the Regeneration of Wastescapes. Sustainability, 10(12):4740. https://doi.org/10.3390/su10124740 REPAiR 2018_01

van der Leer, J., van Timmeren, A., Wandl, A. (2018) Social-Ecological-Technical systems in urban planning for a circular economy: an opportunity for horizontal integration, Architectural Science Review, 61:5, 298-304, DOI: 10.1080/00038628.2018.1505598

Taelman, S. E., Tonini, D., Wandl, A., Dewulf, J. (2018) A Holistic Sustainability Framework for Waste Management in European Cities: Concept Development. Sustainability 10, no. 7: 2184. https://doi.org/10.3390/su10072184 REPAiR 2018_07

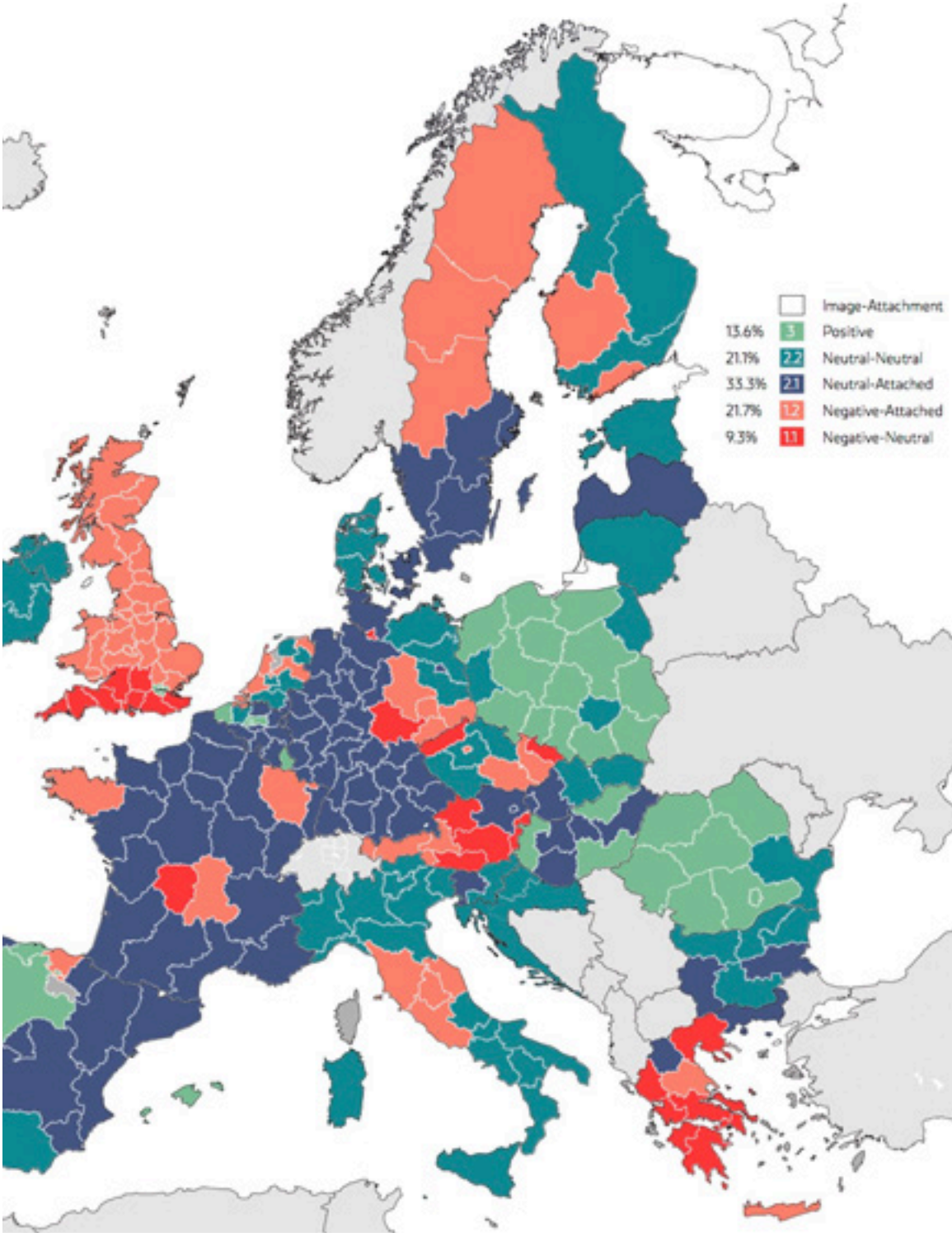
Remøy,H. Wandl, A. Ceric, D. van Timmeren, A. (2109) Facilitating Circular Economy in Urban Planning Urban Planning 4 (3), 1-4, http://dx.doi.org/10.17645/up.v4i3.2484

Wandl, A., Balz, V., Qu, L., Furlan, C., Arciniegas, G., & Hackauf, U. (2019). The Circular Economy Concept in Design Education: Enhancing Understanding and Innovation by Means of Situated Learning. Urban Planning, 4(3), 63-75. doi:http://dx.doi.org/10.17645/up.v4i3.2147

Further information

http://h2020repair.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 688920.



EU identification typology map

The Impact of Cohesion Policy on EU Identification

Acronym
COHESIFY

Funder | Programme [grant number]
EU | *H2020-EU.3.6 – Societal Challenges: Europe In A Changing World – Inclusive, Innovative And Reflective Societies* [693427]

Overall budget
€ 2.446.300

Grant amount
Total: € 2.446.300
TU Delft: € 242.500

Role TU Delft
Project partner

Duration
02-2016 > 04-2018

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University of Warsaw, Poland
Cyprus University of Technology, Cyprus
Central European University, Hungary
Delft University of Technology, The Netherlands
Trinity College Dublin, Ireland
University of Mannheim, Germany
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The paradox of EU Cohesion Policy

A major new study to understand whether and how EU Cohesion policy influences the European identity of citizens across the EU (called COHESIFY) was launched on 3-4 March 2016. Led by Professor John Bachtler and Dr Carlos Mendez of the European Policies Research Centre (EPRC), and involving colleagues from EPRC and the wider School of Government & Public Policy at the University of Strathclyde, the €2.4 million study is funded by the Horizon 2020 programme of research excellence from the European Commission. Against stiff competition from 28 other consortia across Europe, the winning EPRC-led consortium comprises 8 universities and 2 SMEs from 10 EU Member States with complementary disciplinary backgrounds and applied and creative expertise in communication, branding and citizen engagement. COHESIFY will focus on four inter-related issues:

1. how European identity and perceptions of the EU and Cohesion policy vary at national, regional and local levels;
2. the impact of Cohesion policy on citizens' perceptions of the policy and identification with the EU;
3. whether and how Cohesion policy communication strategies affect perception and identification; and
4. what is needed to make Cohesion policy more effective in terms of people's perceptions of the policy and the EU more generally.

Members of the COHESIFY consortium

The study will employ an innovative mixed-methods design including an original and representative survey of citizens in a sample of EU regions, quantitative and qualitative analysis of EU-wide data and of programme implementation and communication strategies in a sample of regions, framing and sentiment analysis of online and offline media and focus groups with citizens.

The structure of COHESIFY is designed around six work packages. Beyond project management (WP1), the research will begin with a contextual mapping of EU territorial challenges, attitudes and identities (WP2). The implementation and communication of EU Cohesion policy are then examined in WP3 and WP4 respectively, feeding into the core questions on citizens' perceptions of Cohesion policy and the impact on citizens' attitudes to the EU, drawing conclusions together along with recommendations for enhancing communication. The final work package (WP6) will disseminate and communicate the research outputs with a strategy.

Apart from advancing the scientific state-of-the-art on the relationship between Cohesion policy, perceptions on the EU and European identity, COHESIFY will deliver creative communication practice to disseminate its results through awareness-raising and outreach activities targeting policymakers, stakeholders and the public at large. In addition, the project will produce two sets of resources: a unique body of original, EU-wide comparative data that will be made available through open access arrangements to other researchers and policymakers for analysis and benchmarking; and an innovative online learning platform to collect data and share ideas among policy makers, stakeholders and academics on Cohesion policy communication.

Further information
https://www.cohesify.eu

Recycling point in Siracusa

Urban Strategies for Waste Management in Tourist Cities

Acronym
URBAN WASTE

Funder | Programme [grant number]
EU | *H2020-EU.3.5.4 – Enabling the transition towards a green economy and society through eco-innovation* [690452]

Overall budget
€ 4.248.782

Grant amount
Total: € 4.248.782
TU Delft: € 175.820

Role TU Delft
Project partner

Duration
06-2016 > 05-2019

TU Delft researchers
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Dr. Erik Louw
Dr. Arie Romein

Project partners
Gobierno de Canarias, Spain [lead]
Association des Cites et des Regions pour le Recyclage et la Gestion Durable des Ressources, Belgium
Aarhus Universitet, Denmark
Ayuntamiento de Santander, Spain
Universitaet fuer Bodenkultur Wien, Austria
Kobenhavns Kommune, Denmark
Cabildo Insular de Tenerife, Spain
Anaptixiaki Anonimi Etairia Diachirisis Aporrimaton Anotilikis Makedonias-Thrakis Ae - Diaamath, Greece
Kobenhavns Universitet, Denmark
Comune di Siracusa, Italy
Observatoire Regional des Dechets d'Ile de France, France
Bioazul, Spain
Sveriges Lantbruksuniversitet, Sweden
Dunea Doo za Regionalni Razvoj i Poslovne Usluge, Croatia
Consulta Europa Projects and Innovation, Spain
Agence Observat Amenage Habitat Reunion, France
Camara Municipal de Lisboa, Portugal
Universidad de las Palmas De Gran Canaria, Spain
Ambiente Italia s.r.l., Italy
Asociacion Hotelera y Extrahotelera de Tenerife La Palma La Gomera y El Hierro, Spain
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Publicising the URBAN WASTE project in Siracusa

Cities with large visitor numbers face a number of challenges related to waste prevention and management. The URBAN WASTE project develops strategies aimed at reducing the amount of municipal waste production and supporting the re-use, recycle, collection and disposal of waste in tourist cities. The URBAN WASTE project adopts and applies the urban metabolism approach to support a transition to a new model of waste management in which waste is considered as resource. The project includes an analysis of urban metabolism in 11 pilot urban areas. The cities and regions participating in the project are Florence, Nice, Lisbon, Syracuse, Copenhagen, Kavala, Santander, Nicosia, Ponta Delgada, Dubrovnik-Neretva county, and Tenerife.

A participatory process is used to develop and implement a mutual learning action plan. The plan is implemented in the pilot cities and the results are monitored and disseminated to help facilitate the transfer and adaptation of the plan to other cases.

Further information
https://www.urban-waste.eu

3D visualization for VR, scenario Zonnepark at Eye-Level, ©2019
TU Delft, Urbanism / VR Zone

Urban Design for Improving Health in Groningen

Acronym
UDIHiG

Funder | Programme [grant number]
ZonMW : The Netherlands Organization for Health Research and Development | *Space for Health: bundling knowledge for an environment-oriented approach* [531001322]

Overall budget
Phase 1 € 149.983 (+ 35.245 co-funding)
Phase 2 € 398.550 (+ 84.598 co-funding)

Grant amount
TU Delft part Phase 1 € 30.000
TU Delft part Phase 2 € 65.000

Role TU Delft
Project partner

Duration
Phase 1 09-2018 > 09-2019
Phase 2 09-2019 > 09-2021

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Wijkraad Paddepoel
GGD Groningen [GGD]
Platform Gras [GRAS]
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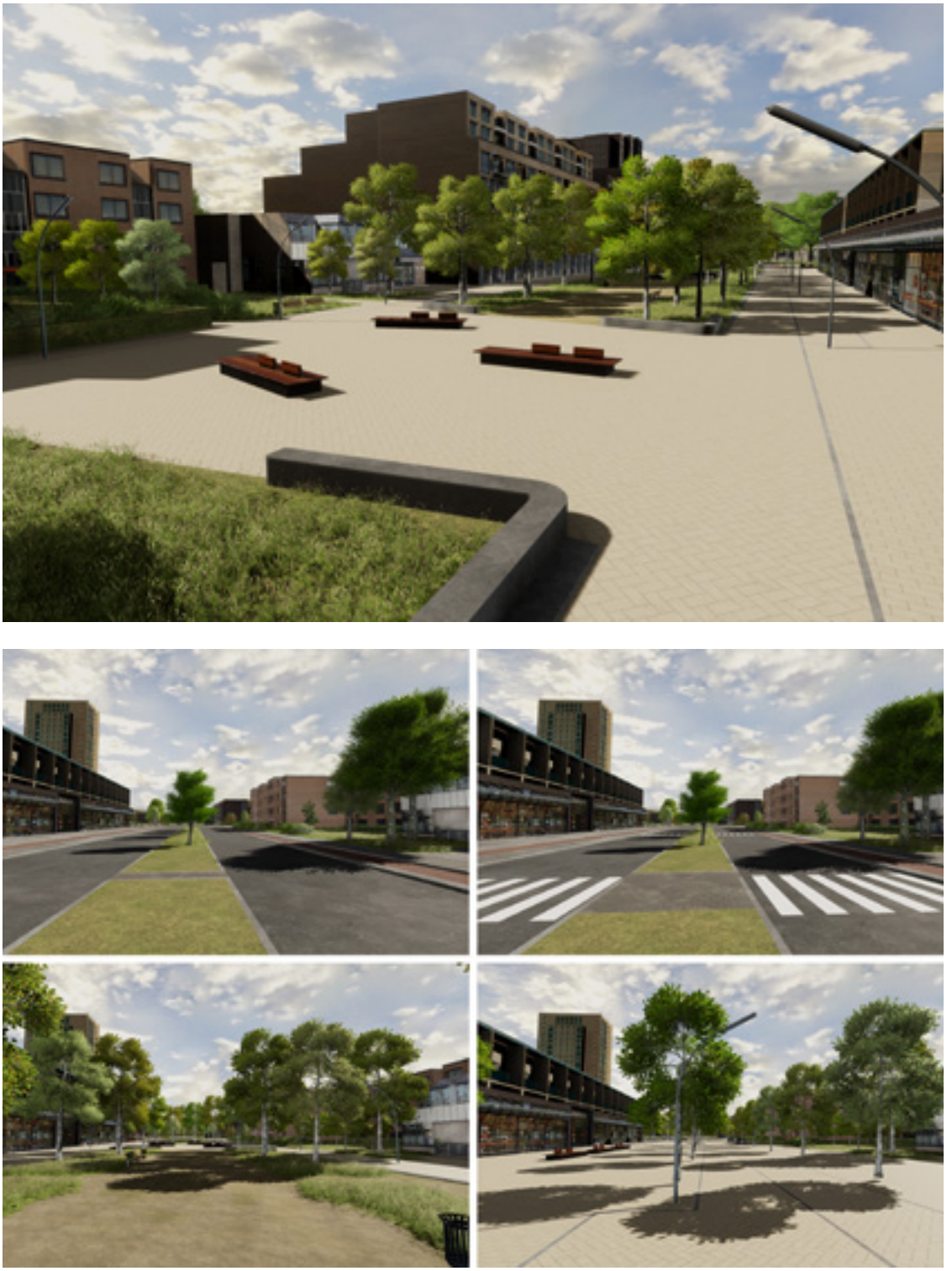
3D visualization for VR, scenario Zonnepark from Birds-Eye view, ©2019 TU Delft, Urbanism / VR Zone

People's living environment impacts public health. On average, health levels in neighbourhoods that were built during the years of the post-war reconstruction (1950-1970) lag behind those of other parts of the city. Until recently, this has been explained mainly in terms of their physical qualities (particulate matter, noise), or in terms of the characteristics of the population (lower social status and migrants being more dominant). The effects of the urban layout on the lifestyles of the residents of such neighbourhoods are as yet understudied. There is no doubt, however, that their urban layout promotes unhealthy lifestyles by promoting car dependency; larger distances to facilities, barriers for pedestrians and cyclists caused by main roads cutting through them, etc. Related to that greenery is underused because it is experienced as unsafe. Redesigning the urban lay-out can help to remove negative qualities and foster healthier lifestyles – hence the name of the project: Urban Design for Improving Health in Groningen (UDIHiG).

Phase 1 revolved around a pilot project that, amongst other things, developed and consolidated the consortium that with only minor adjustments will execute the so-called research agenda. Phase 2 expands the scope of the research carried out during phase 1. Key to UDIHiG is a multidisciplinary approach that generates optimum synergy between scientific fields of different characteristics – the health sciences, the design disciplines, change management with a focus on co-creation – in order to develop a methodology that optimizes the involvement of the residents.



TOP: 3D visualization for VR, scenario Zonnepark at Eye-level, ©2019 TU Delft, Urbanism / VR Zone
BOTTOM: 3D visualization for VR, scenarios Zonnelaan from Eye-level perspective, ©2019 TU Delft, Urbanism / VR Zone

Their involvement allows us to integrate their views in the brief for urban interventions and assess the impact of these interventions on lifestyles and health outcomes. Of particular importance is the involvement of urban planners; they introduce intervention techniques from a field that, although health motives played a determining role in its evolution, developed outside the scope of the health sciences; incorporating this domain is in line with the WHO's 'health in all policies' initiative. The urban interventions are designed by the city architect – a guarantee of a professional level as well as of the ambition to integrate the findings of the project in future planning projects ofthe city.

Phase 2 increases the scope of Phase 1 by

- focusing on the entire neighbourhood (the pilot focused on the shopping centre) *addressing a wider range of issues that relate lifestyles to the urban layout: access to greenery, the availability of social hubs, etc. (the pilot concentrated on walkability and cyclability)
- targeting all categories of the residents, addressing the full diversity of people living in Paddepoel (the pilot addressed only the elderly)
- refining the assessment process of health effects of urban interventions
- expanding the diagnostic analysis of the neighbourhood
- developing a analysis and intervention model that makes the results of this project applicable in similar neighbourhoods.

Phase 2 envisages five Working Packages (WP's) which address the following sub-objectives:

1. To optimise diagnostics of urban neighbourhood health and urban environment with regard to the impact of the urban environment on health behaviours and health outcomes (WP1). This will entail spatial analysis of Paddepoel and its use, of demographic data, and of health data;
2. To develop interventions to improve health behaviours by means of a redesign and adaptation of the urban environment (WP2). This will entail a healthy cities literature review, selection of sites, formulation of a design brief, urban design proposals, and their 'translation' in Virtual Reality, and realization of proposed interventions;
3. To enhance participation of residents and other local stakeholders in the analysis of the urban environment and co-create intervention with them by use of virtual reality tools and others innovative methods (WP3). This will entail involvement of the residents in all stages of the project; assessment via Virtual Reality of the urban interventions, and via questionnaires of their expected impact on lifestyles;
4. To disseminate findings to various stakeholders including in particular residents, urban developers, and health professionals who aim to improve health in similarly designed post-war neighbourhoods, this will entail the production of manuals and scientific papers and dissemination to various target groups (WP4);
5. In addition, UDIHiG will have a WP on management (WP5).

By scaling up to the basic level of the neighbourhood, UDIHiG addresses the scale that has been identified as the most important for urban public health policies. Our ambition is to underpin the by now generally acknowledged relationship between the urban and public health with hard data derived from a scientifically valid evaluation of lifestyle changes of the residents that increase their health status, thus providing solid ground for health oriented urban interventions.

Manufacturing needs specific architectural and urban spatial conditions

Cities of Making

Resources for activating new urban industry through technology, spatial design and transition governance

Acronym
CoM

Funder | Programme [grant number]
JPI Urban Europe | *ERA_NET Cofund Smart Urban Futures*

Overall budget
€ 1.042.250

Grant amount
Total: € 958.742
TU Delft: € 254.206

Role TU Delft
Project partner

Duration
03-2017 > 01-2020

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Dr. Victor Munoz Sanz

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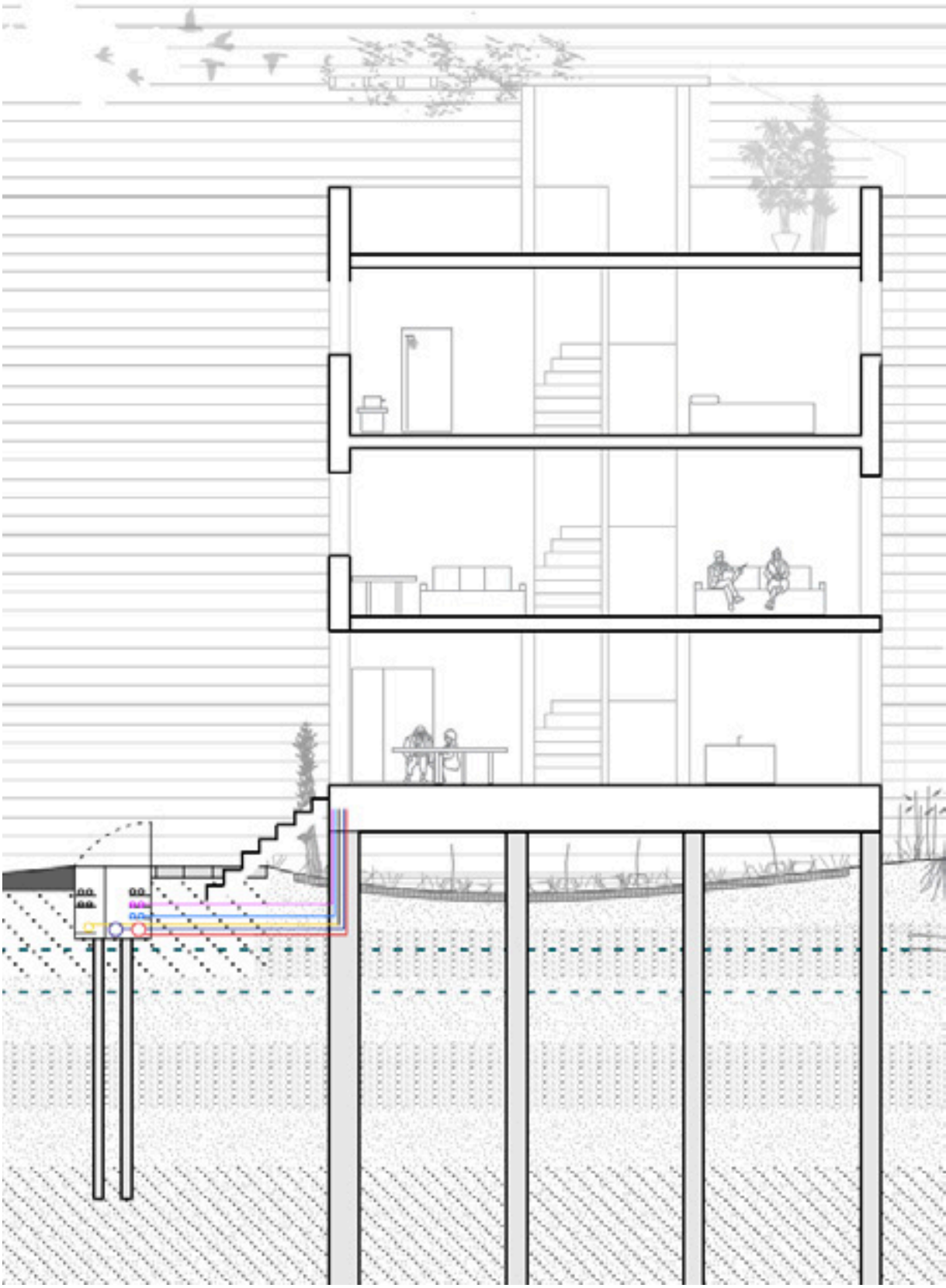
Co-creation is key for integrating a diversity of urban activities and needs

Cities of Making (CoM) explores the future of urban based manufacturing in European cities in terms of technology, resources, place and application. Following years of decline and offshoring, European cities are being confronted by a range of issues simultaneously: firstly, manufacturing jobs have shifted quickly to services and have created large gaps in the employment market, concepts such as circular economy are being taken seriously by cities and finally new technology is emerging allowing industry to be quieter and more discrete. This may offer a raft of potential benefits, including jobs for sociodemographic groups most affected by unemployment, innovation, more efficient use of materials and urban resilience. Urban centres play an important role in nurturing new forms of green urban manufacturing, based on a clean, knowledge- and labour-intensive manufacturing sector.Over the past 2.5 years, Cities of Making has investigated the role of urban production in European cities in the 21st century, in particular the aspects of place, people and locally available resources. Based on experience from the city regions Rotterdam, London and Brussels - each with a distinct industrial heritage - the key ingredients that support a resilient and innovative industrial base have been determined in a combination of strategic and action research. The multi-disciplinary team integrated the key findings of this research and developed a co-creation urban development tool.

Further information
https://citiesofmaking.com



Technical profile shows the city as construction through the combination of sections and plans on several scales.

Intelligent SUBsurface Quality

Intelligent use of subsurface infrastructure for surface quality

Funders
DIMI Delta Research Initiative Mobility and Infrastructure [€ 88.855]
Municipality Rotterdam [€ 7.500]
Municipality Leiden [€ 32.000]
Municipality Zaandam [€ 5.000]

Overall budget
€ 133.355

Grant amount
Total: € 133.355
TU Delft: € 133.355

Role TU Delft
Lead partner

Duration
01-2016 > 12-2019

TU Delft researchers
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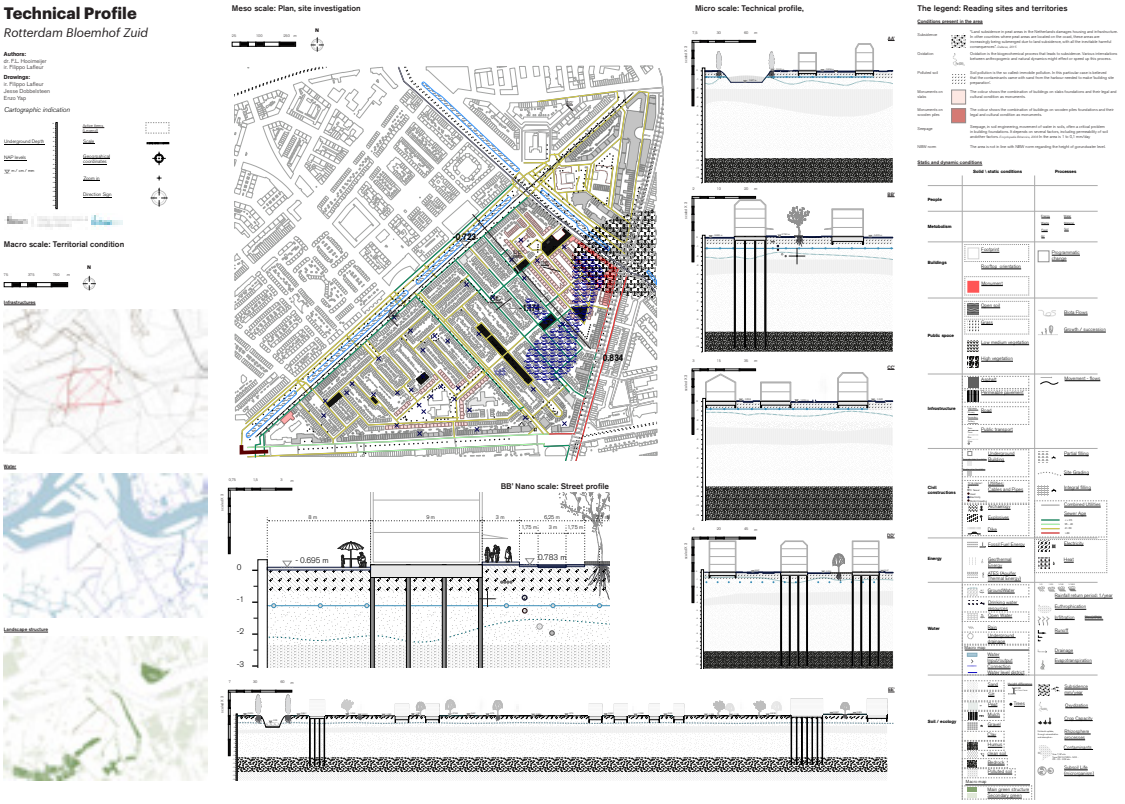
The subsurface is a technical space, the "engine room of the city," that incorporates the vital functions of water and energy supply, communication systems, sewers and drainage. Natural systems too – crucial for stable, dry, cool and nature inclusive cities – are also largely dependent on the quality of the subsoil. The subsurface is critical in an era of climate and demographic changes, the energy transition and economic uncertainty and constraints. However, due to the domain's current segregation and a weak urban design and planning connection, crucial design potential, benefits and innovations, remain unexploited.

This project developed knowledge brokerage tools and design principles to enable understanding and design of the surface and subsurface as one united space. Knowledge brokerage tools are Technical Profile, Technical Projection and Provocative Design, all which enable the inclusion of subsurface data into the design process.

Design principles were developed from the perspective of healthy soils and circularity. The condition of urban soils is crucial to liveability and to the successful achievement of necessary climate and energy actions. In exploring the urban design process spatial strategies responding to global trends were tested on three typical Dutch urban typologies – neighbourhoods created in the 90s, 70s and 50s in connection with the highway. This highway zone can be activated through changing patterns of mobility and new technologies to enhance urban resilience, quality and liveability on a larger scale. New technologies for example for wastewater treatment and renewable energy production on the highway utilizing wind and sun inform new urban designs and programs for development. In this study we chose the topics of (waste) water, energy and new program and in relation to electric cars and automated driving also the cleaning of the 'old' car use around the highway should be part of the development. For each urban typology the main characteristics and potentials are defined in relation to the topics of (waste)water, energy, remediation and new program.



Design of public space and architectural connection when accepting subsidence, a more moisture space and indigenous ecosystem.

As a next step, these designs where re-considered with the intention to introduce concepts of circularity and healthy soil. In the developed design principles, all materials coming from buildings and changes in the public space were re-used within the design parameter. The current degraded and pollution conditions of urban soils were remediated by four concepts that produced fundamentally different design of urban patterns and also leads to a fundamentally different maintenance of urban public space, as well as a different way of dealing with subsidence. This will be less constructed and will anticipate the dynamics of the soil and the performance of the ecological systems of the original landscape more. In other words, ecosystem participation.

Next to the design principles the research produced a six-step design approach aimed at integrating challenges of climate change, energy transition, new mobility while at the same time reduce and re-use of materials and using healthy soil as central perspective. This combination is done by integrating the material flow analysis in the design process which functions as an assessment (material flow design assessment) to evaluate and to improve the designs.

Output

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Further information

https://www.tudelft.nl/infrastructures/onderzoek/special-projects/ondergrondse-infrastructuur/

Amsterdam

Urban Modelling in Higher Dimensions

Embedding Generalisation of 3D Data in a 4D Model

Acronym
UMnD

Funder | Programme [grant number]
European Union | *H2020-EU.1.1. - EXCELLENT SCIENCE - European Research Council (ERC)* [677312]

Overall budget
€ 1.800.000

Grant amount
Total: € 1.498.148
TU Delft: € 1.498.148
Additional from AMS: € 240.000

Role TU Delft
Lead partner

Duration
09-2016 > 03-2022

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Prof.dr. Jantien Stoter [lead]
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Stelios Vitalis [PhD candidate]
Dr. Ken Arroyo Ohori [Postdoc]
Dr. Ravi Peters [Postdoc]
Balázs Dukai [scientific developer]

Project partners
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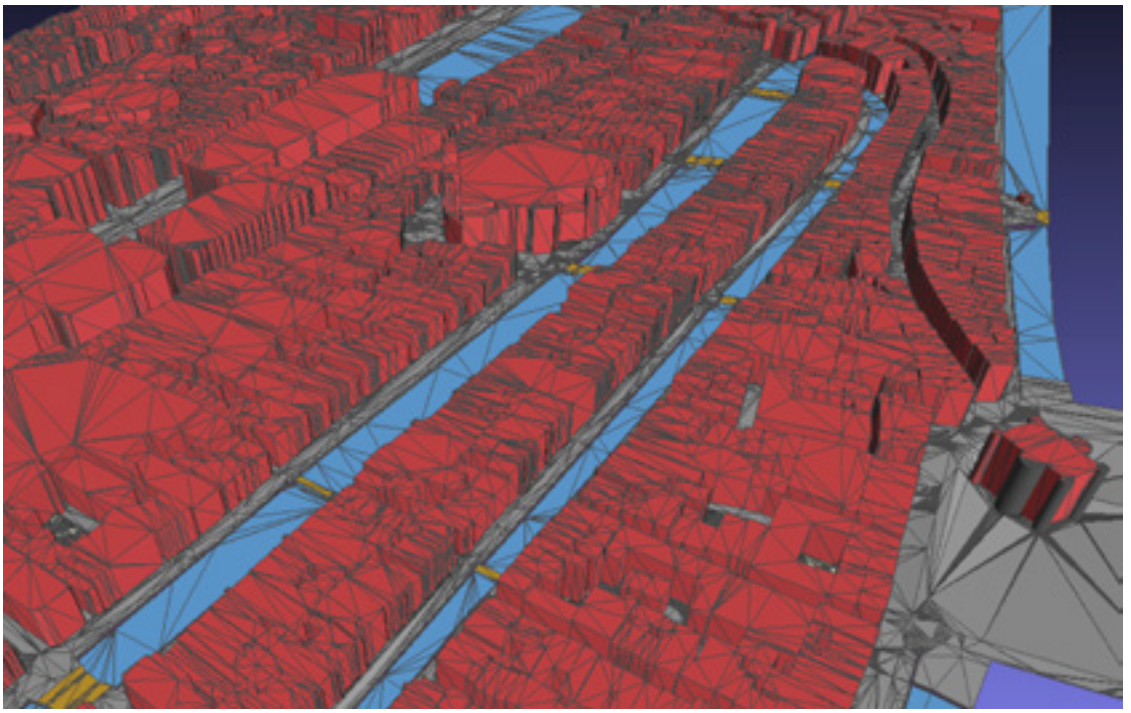
3D geographic information about urban objects (buildings, roads) is needed to monitor and control processes within modern urban areas (noise, flooding, energy demand-supply). However, each specific process requires 3D data with its own specific semantic and geometric Level of Detail (LoD), and current approaches require enormous manual efforts to collect general-purpose 3D data and to transform it to make it suitable for a specific application.

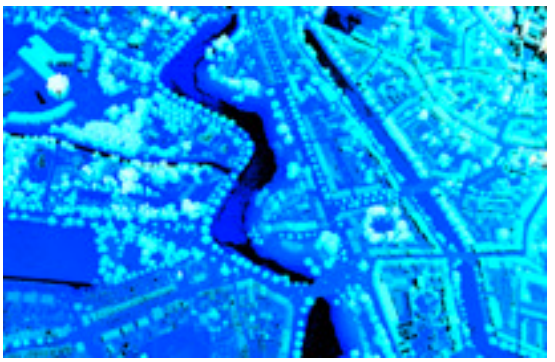
In this project, we are developing a fundamental solution for providing 3D data at application specific LoDs. For this, we use an innovative method that goes far beyond the state-of-the-art by introducing higher dimensional (nD) mathematical models, which will enable us to enforce consistency by modelling the LoDs as an extra dimension to the 3D spatial dimensions in an integrated 3D+LoD (4D) model.

We have defined three key research lines for the project: (i) a groundbreaking extension of 2D cartographic generalisation solutions to 3D, enabling us to automatically derive application-specific coarse 3D data from fine 3D data; (ii) embedding multiple 3D city models at different levels of detail into a single 4D model; and (iii) “slicing” operations that extract custom 3D cross-sections of the 4D model. By combining the results of these three lines of research, we aim to generate error-free 3D data at application specific LoDs.

Our 4D approach opens a new horizon for modelling parametrisable aspects of urban environments, which may establish new modelling paradigms in the future.

In addition to these three research lines, in collaboration with our AMS partner, we further develop the prototypes of this research into solutions that generate countrywide 3D data that can directly be used in urban applications such as noise simulation, simulation of air pollution and other urban flow simulations such as for heat and wind.





TOP: Amsterdam
LEFT: LOD-Composite
RIGHT: Middelburg

For this purpose, an additional research position is funded by AMS. This postdoc is applying the 4D model to urban applications to solve the issues of large cities as Amsterdam. To be able to develop a solution that meets the requirements of urban researchers and practitioners, the 3D data requirements of these urban applications need to be studied and the solutions should be developed accordingly. The postdoc studies the requirements and helps to translate these requirements into 3D+LoD implementations so that the urban researchers can be served by ready-to-use and up-to-date 3D data at different LoDs.

And vice versa, by applying the 4D model to use cases, he evaluates the 4D model of the ERC project and based on this evaluation it can be further improved. This will make 3D data readily available and support advances in the urban applications. For this part we work with external partners who will implement the solutions to be developed.

Further information
https://3d.bk.tudelft.nl/projects/umnd/

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