

Development goals and measures (UMV) 2017-20

DTU Civil Engineering

June 2016

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1. Academic profile and expected performance goals of the department

The mission of DTU CIVIL ENGINEERING is through research, education, innovation and research-based consultancy in the area of civil engineering, proactively to develop decision basis and technology in support of sustainable developments - for the benefit of society. It is our vision to be positioned among the world's 10 highest ranked civil engineering departments, to be excellent in research in a selected range of civil engineering disciplines, to be among the most attractive departments for students and a preferred provider of graduates, to be the favoured consulting partner to industry and public authorities nationally and internationally and finally to develop innovative new solutions and processes for the construction industry and building users.

The activities at DTU Civil Engineering are organised in sections:

- Section for Building Design, addressing: building technology, building materials, computer aided design, building information systems and fire safety.
- Section for Building Energy, addressing: building-energy technology, building services, and solar energy.
- Section for Structural Engineering addressing; design in steel, concrete and other materials, load processes and structural dynamics, monitoring and probabilistic methods, integral structural and material modelling and timber structures.
- Section for Geotechnics and Geology, addressing: rock mechanics, rock physics, geotechnics, geology and pavement engineering.
- Section for Indoor Climate and Building Physics, addressing: comfort and health in buildings, impact of indoor climate on productivity, efficient indoor air distribution, air cleaning, user/occupant behaviour and the future sustainable approaches to heating, ventilation and cooling of buildings, as well as hygrothermal building physics.
- Section for Arctic Technology and Sustainable Solutions, addressing: infrastructure construction and Arctic conditions, buildings and energy systems, Arctic environmental technology and planning, sustainability and infrastructure systems.

Furthermore, the department is the platform for three centres:

- ARTEK, Arctic Technology Centre, is a DTU centre initiated and operated in collaboration with the Greenland Self-Government with the main objective to provide professional Bachelor of Engineering educations in Greenland and to provide the platform for developing a University Centre for Arctic Technology.
- ICIEE, the International Centre for Indoor Environment and Energy, aims to identify and provide solutions to ensure healthy, comfortable and productive indoor environments with minimal energy consumption.
- Villum Centre for Advanced Structural and Material Testing is a cross-departmental collaboration at DTU bringing infrastructural lab facilities for large scale structural experiments to an international top level.

Finally, the department has defined four development areas that approach major societal challenges with interdisciplinarity and collaboration across the sections and centres in the department.

To realise the performance goals for 2017-2020, DTU Civil Engineering will strive to:

- Expand its position as one of Europe's leading civil engineering institutions.
- Be more outgoing and increase the communication towards society and thus be an active part in society and the construction sector.

- Increase external funding by seeking out new partners and thereby be more relevant for stakeholders and society.
- Transform its activities by intensified use of information technology and be present on a growing number of platforms.
- Increase the intake of students to meet societal needs (provided necessary funding is established).
- Increase the number of scientific personnel to ensure a creative scientific environment.
- Develop and expand its laboratory and research facilities to support frontier research.

2. Education and teaching

2.1 Education and teaching (BEng, BSc and MSc programmes)

DTU Civil Engineering educates engineers for the building sector in both Denmark and Greenland and strives to improve both the quality and the number of graduates, as the demand much exceeds the numbers produced.

Several new initiatives will be launched and tested at DTU Civil Engineering to enhance excellence and efficiency of teaching activities and increase the number graduates with a focus on these four areas:

1. Educate smarter
2. Functional bilingualism
3. Incorporating E-learning
4. Establishing new educations and teaching activities.

2.1.1. Educate smarter

The education and teaching development aim at creating an educational environment where both the students and the department can work smarter and achieve better results while using less resources. Specifically, the department will:

- Share educational activities with other universities (e.g. with Nordic Five Tech as in the Nordic Master in Cold Climate Engineering).
- Organize project families to train peer-review, peer-instruction, the ability to collaborate and communicate, and increase the R&D impact of the projects.
- Introduce the use of peer-review of reports and presentations in selected courses to improve communication skills and optimize the teaching resources.
- Use self-testing and brush-up E-lectures in the beginning of courses for the students to be taught at the proper level without repetition of previous teaching.

2.1.2 Functional bilingualism

The functional bilingualism (Danish and English) will be secured for the BEng and BSc students by introducing teaching activities in basic courses taught by English speaking personnel and establish both Danish and English vocabularies, and by establishing study plans which incorporate courses taught in English.

2.1.3 Incorporating E-learning

The department will innovate the teaching and learning by incorporating E-learning in relevant areas in cooperation with LearningLab to achieve the goals outlined in DTU's E-learning policy. After DTU has established a common E-learning platform cooperation with other departments will be increased to facilitate effective learning through use of E-learning. These activities will both facilitate the learning process, enable a

deeper learning and create a more efficient use of the resources thus transforming the educational environment by increased use of:

- blended E-learning techniques in more courses, preferably in combination with the flipped classroom or in combination with distance teaching (e.g. Arctic courses, educations shared with other universities, Massive Open Online Courses (MOOC), continued education).
- E-quizzes for self-testing at the beginning of a course in combination with “patches” or “brush-up video lectures” and exercises to increase the level while the weaker students still have an efficient way to catch up.
- E-quizzes, E-peer-review and E-grading activities to facilitate the work, to improve the student’s feedback. This will be combined with the traditional, individual exam to secure the individual testing, but this exam and the grading will to a larger extent use the digital possibilities.
- Increase the experimental possibilities for the students through instruction videos, either prepared by the staff or the students. This will both improve the learning and increase the capacity of the lab, which will result in improved access for the students.
- Involve the students in the development of E-learning materials (e.g. The Open and Intelligent Laboratory).
- Establish an annual seminar for best practise in teaching. Presenting experiences and documentations of the most effective means for teaching and learning, which also improve the quality of the learning.
- Develop a strategy and handbook for the use of E-learning possibilities.

These activities will be used as a part of the branding of DTU Civil Engineering, especially of the department's international and continued teaching activities. It is expected that the E-learning activities will be introduced in 30 % of the departments courses. Provided sufficient funding are obtained, the department will establish an E-learning support for the teachers in order to facilitate and optimize the E-learning activities with the goal of creating the optimal environment for independent and deep learning and upgrading of qualifications. The E-learning facilities will form a strong and efficient support for project based activities in especially cross-disciplinary problems. The E-learning facilities will also contribute to the reduction of the time it takes students to complete their studies as they efficiently support the students chances to catch up with delays and succeed at reexaminations.

2.1.4 New educations and teaching activities

The department aims at establishing or expanding several new education and teaching activities if a sufficient extra funding can be obtained (outlined in appendix E). The department will:

- Increase the number of BSc Civil Engineering students from 66 to 90 in annual uptake.
- Develop a contribution to the Innovation Pilot in the BEng Building and Infrastructure, either based on increased funding or by transfer of resources from other teaching activities. The department will maintain its involvement in the BEng Building and Infrastructure education, achieve the synergi effect and contribute to the development of the education.
- Establish the Danish Building Academy as a CDIO based, innovative learning activity in order to provide both an improved learning platform and a living lab.
- Develop a new international MSc education or educational line in Fire Safety. A new education will facilitate the recruiting for the education, whereas an educational line under the current MSc Civil Engineering would have a less clear profile.
- Develop a new study line in MSc Civil Engineering: Extreme Environment Engineering. The Nordic Master in Cold Climate Engineering will be promoted through this new study line.
- Develop a course in timber structures, either BSc or MSc, so it could be offered to all engineering students.

- Develop a new joint master in Mineral Resource Management in collaboration with Luleå University in the framework of ARTEK.
- Participate in development and implementation of a new BSc/Diploma education in Fishing Technology headed by DTU Aqua, based in Greenland in the framework of ARTEK.
- Outline detailed plans for the realization of educations at an Arctic Technical University Center in Sisimiut under the auspices of ARTEK along the lines of Vision 125.

2.2 PhD programme

The DTU Civil Engineering PhD School wants to offer a unique academic platform for PhD students, to graduate excellent PhD students and to be recognized as one of the best among peers.

According to the latest satisfaction survey, progress among the PhD students as well as stay abroad indicates some problems. A new PhD School management as of winter 2015/2016 will focus on these problems and facilitate an improved academic identity, and incitements for PhD students to value and produce high quality research publications, such as the DTU Civil Engineering PhD School Best Paper Award, will be maintained and developed further.

DTU Civil Engineering aims at increasing the number of PhD students through an increased number of industrial PhD students in cooperation with not only the industry, but also regions, cities, suppliers and ministries often as a part of the activities in the development areas. This will also enhance the innovation activities for PhD students and act as platforms for PhD courses.

The PhD development will be improved through cooperation with DTU university alliance partners.

2.3 Continuing education

In order to support engineering competencies in the construction industry and among practitioners, DTU Civil Engineering will slightly increase the activities in the field of continuing education in cooperation with the industry and other educational institutions. Specifically, the department will:

- Develop new, targeted educational activities in cooperation with the industry; e.g. dedicated training for the police on fire safety, for Singapore on Smart Cities.
- Increase the activities in cooperation with the industry at Byggecentrum and Dansk Beton og Konstruktionsinstitut (DKBI) and in our well-established and popular Master in Fire Safety introducing the use of E-learning and blended E-learning in an increasing number of activities.
- Secure and increase the quality of the educations through mandatory testing in each course.
- Investigate a possible ECTS allocation for courses in cooperation with DKBI and Aarhus University.
- Increase the number of students on the Flexible Master education.
- Develop continued education targeting Greenlandic/Arctic engineers.
- Assess needs and possibilities for upgrading refugee and emigrant engineers by a combination of Danish language courses and the Flexible Master system.

3. Research

Research Areas

The research at DTU Civil Engineering is based on a deep understanding of underlying physical phenomena combined with forefront experimental investigations and experience. The department is organised in six sections, three centres and four development areas. The centres are interdisciplinary and draw on research

resources from the sections. The research profile of DTU Civil Engineering is continuously adapted to ensure development of knowledge in the classic disciplines of civil engineering, identify novel means to provide innovative solutions to problems and to facilitate solutions to major societal challenges. Research activities may be identified in collaboration between researchers, external stakeholders and students.

The research activities within the department will include, but not limited to:

- Development, implementation and operation of innovative, easy operable, maintainable and efficient building services for lighting, heating, cooling and ventilation.
- Development of model predictive control and continuous commissioning for building services for optimized operation.
- Low temperature district heating systems for nearly zero energy buildings and existing buildings.
- Holistic renovation of existing buildings to improve indoor environment, energy performance, durability, environmental impact as well as life cycle economy.
- Solar energy systems including energy storage for the future energy systems.
- Interaction between construction management technologies and building design.
- Building Information Modeling (BIM).
- Fire safety and determination of design fire.
- Reviving research into wood and bio based materials.
- Porous construction materials (based on new lab facilities).
- Quantification of the value of monitoring building structures and infrastructure systems as a mean for improved design and assets management.
- Building physics; e.g. thermodynamics in the building envelope.
- Use of heating/cooling sources close to room temperature, transfer of surplus heat between rooms and flexibility in drawing energy from thermal and electrical grids.
- Development, implementation and operation of innovative easy operable, maintainable and efficient building services for lighting, heating, cooling and ventilation.
- Research on shale and clay, with special emphasis on fracturing, elastic properties and permeability.
- Development of pavement engineering, e.g. by use of recycled materials.
- Construction methods and technologies of bridges, tunnels and harbours.
- Systems for super-light building structures.
- Development of methods for classifying the structural capacity of existing structures.
- Development of new arch-sandwich structures for optimal design of bridges for permanent distributed dead load and concentrated movable loads.
- Numerical modelling of civil engineering structures.
- Reuse of construction and demolition waste as a renewable resource in building materials. A Center of Excellence is under development in this area.
- Testing of ashes as cement substitute in concrete for optimal resource efficiency.

In addition hereto, a number of inter-disciplinary research projects are conducted across the different sections. Most of these research areas are dealt with in the department centres, ARTEK and ICIEE, and will include, but not be confined to:

- ARTEK
 - Development of a research plan regarding Arctic Technology as outlined in Vision 125.
 - Development of technical solutions for foundations on permafrost.
 - New Arctic Building Practice and evaluation of small house building techniques in an Arctic environment.
- ICIEE

- Relationship between exposures in the indoor environment and human comfort, health and performance.
- Physiological and chemical reactions for prediction of the impact of indoor environment on building occupants and its control in energy efficient buildings.
- Application of BIG DATA, sensors and smart controls for improving health, comfort and performance of building occupants, linking the “sensing” building to “sensing” society.

Inter-disciplinary research in collaboration with other DTU departments (Smart Campus) on research areas outside the auspices of the centres will include, but not be confined to:

- Building systems as smart constituents within smart cities and intelligent energy systems.
- City climate including geographic information systems, wifi localisation and BIG data.
- Expansion of the collaboration between the sections at DTU Civil Engineering as well as other DTU departments in the area of numerical and computational analysis.

The department will revise and update its research strategy and based on a research evaluation, selected research areas will be prioritized in the future development of the department.

Research Collaboration

The department will emphasise on expansion of external collaboration with stakeholders in the construction industry, e.g. consortia partners in *INNO-Byg*, and strategical DTU partners, e.g. *Nordic Five Tech*. On the research area of Building Information Modelling (BIM) the department will complement its research by linking up with strong international partners.

The department will develop internal collaboration among other with the following DTU departments and centres:

- CERE on geotechnic and geophysics.
- GDSI on probabilistic based engineering methods and sustainability.
- Polar DTU on Arctic technology.
- Center for Oil and Gas on structural dynamics in offshore environment.
- DTU Electro on building acoustics for super-light structures.
- DTU Compute on smart buildings
- Life science institutes on bio-based construction materials.

Research Funding

The department will increase the external funding of research and innovation during the UMV period, and by including more VIP employees thereby release resources for strategic research investments and strengthen the critical core research areas. To ensure a strong future-oriented research profile of the department, we will conduct an analysis of the core research areas within civil engineering through user studies, benchmarking, etc.

Our senior researchers will increasingly be encouraged to take the lead in research programmes funded by the European Commission whereas our young researchers are encouraged to link up to research projects led by other institutions.

The department will focus on funding through the following concrete programmes and partners:

- Programmes under the auspices of EIT, including Horizon 2020 and Climate KIC
- Marie-Curie Programme for PostDocs and PhD students

- Innovationsfonden
- INNO+
- Private foundations

4. Scientific advice

The in-house competencies as well as developed techniques, methodologies and lab facilities of the department will be brought into play for the benefit of both private and public sector enterprises, nationally as well as internationally, not least through development of laboratory facilities on Campus Lyngby whereas The Villum Centre for Advanced Structural and Material Testing will substantially enter its operational phase.

The focus areas are closely linked to current major challenges for the built environment:

- New requirements on sustainability of the building sector with respect to environmental issues, resource consumption and re-use, economics, social and health issues.
- New requirements to the effectiveness and industrialization of the building sector..
- Upgrading and renovation of existing central elements in the aging built environment including the infrastructure.

Furthermore, the following areas are expected to potentially be central in national and international research-based consultancy activities in the UMV period: mould in renovated buildings, indoor climate implications of a society with circular economy, condition assessment, maintenance scheduling and remaining service life prediction of the existing infrastructure, estimation of load carrying capacity of existing structures, foundations and constructions in permafrost areas and finally performance specifications and quality assurance on scientific issues for the future large infrastructure projects. All will be major challenges, not only for the society but also for owners, consultants and contractors.

In Greenland – as envisioned in Vision 125 – the establishment of a new university centre for research and education related to Arctic technology is foreseen in collaboration between DTU and the Greenlandic authorities to be fully developed in the next 10 years – provided that the necessary funding can be obtained – thus creating a stronghold for research based consultancy in Greenland.

Finally, the ongoing construction and renovation activities at DTU Lyngby Campus should be mentioned as a possibility to establish building and infrastructure (road) monitoring activities which can strengthen the consultancy competences in the area of renovation, maintenance and facility management.

The department will:

- Prepare an analysis of the construction sector including mapping of needs for research-based consultancy services among stakeholders.
- Develop a business case for research-based consultancy services and strengthen administration by standard list prices for department staff and use of lab facilities
- Ensure impartiality and independency as a strong basis for trustworthy consultancy.
- Develop research-based consultancy services for major building and infrastructure owners.
- Increase participation in national and international standardization.
- Seek long term service agreements with selected stakeholders, e.g. public or semi-public organisations.
- Develop consultancy services based on lab testing facilities, e.g. with BAM (DE).

5. Innovation

DTU Civil Engineering strives to integrate innovation in all its activities including its core activities: education and research. The construction of buildings and infrastructure is seen as an innovation process in itself in order to create innovation in the construction industry.

At the same time, the department wishes to promote patenting and creation of start-ups with the department's research activities as a starting point. The department strongly encourages its researchers to engage in innovation activities and thus make use of individual networks and expertise in the department's innovation activities. The department has compiled the following four strategic goals for innovation in the UMV period:

- Improving the innovation environments
- Facilitating student innovation and entrepreneurship
- Strengthening and increasing innovation cooperation
- Increasing commercialization of innovation.

Improving the innovation environments

To obtain the goal of improving the innovation environment, the department will:

- Carry out planning and building of new facilities: Villum Centre for Advanced Structural and Material Testing and the new laboratory buildings 128 and 129.
- Obtain funding for a new building 130 as a new innovation and research environment for civil engineering materials, e.g. biomaterials, ZeroWaste materials and concrete.
- Increase the capacity of student workshops in buildings 117 and 127 and the department's laboratories by combining "The open and intelligent laboratory"-concept (blended E-learning and access 24/7) with an upgrade and expansion of the concrete laboratory in building 119 provided necessary funding is obtained.
- Create and run a living lab by developing the Campus Village provided necessary funding is obtained. This leads to new innovation possibilities as the dormitory will be both a living lab with a big data option as well as provide a platform for cross-disciplinary innovation and research in cooperation with the building industry.

Facilitating student innovation and entrepreneurship

The department will strengthen the innovation in all bachelor educations where the department contributes: BSc Civil Engineering, BSc Architectural Engineering, BEng Architectural Engineering, BEng Arctic Technology and BEng Building and Civil Engineering. The department will actively participate in these activities and use these as a starting point for further cooperation with the external partners. To obtain this goal, the department will:

- Increase the number of student projects in collaboration with external partners in order to encourage innovation and learning, e.g. by using Project Family concept.
- Make innovation and entrepreneurship part of the courses 11691 and 11996 "Project Work" for BSc students.
- Create innovation and entrepreneurship activities for BEng students as part of their mandatory semester in practice and later as a part of the Innovation Pilot course.
- Develop the concept of innovation immersion or research immersion in the 3 week period in August. Students may develop and experiment more freely in this period, where lab capacity is available and the

students are not following other courses. The results of these activities are used for new concepts, project ideas or even the development of SRP-activities or other recruiting activities.

- Participate in Science Camps (e.g. Sorø Science Camp) and Innovation Camps.

Strengthening and increase innovation cooperation

The department wishes to strengthen the inter-disciplinary research in order to increase the innovation cooperation with other DTU departments as well as the industry. To obtain this goal, the department will:

- Strengthen the innovation cooperation through the interdisciplinary development areas, Danish Building Academy/Campus Village and selected project areas (e.g. SmartCities).
- Increase the cooperation with external partners (e.g. Krüger, Saint Gobain, Velux, Danish Industry member, The Capital Region of Denmark, Lyngby, Ballerup and Albertslund, Grundejernes Investeringsfond).
- Increase cooperation with other DTU departments and international universities.
- Refine the department's Innovation Day by inviting more external participants, selected persons from other DTU departments and representative students.

Increasing commercialization of innovation

To obtain this goal, the department will:

- Develop patents in cooperation with AIS, but with an early evaluation of the marked potential in order to minimize unnecessary costs.
- Increase the number of PoC grants and funding from the relevant industry to mature the technologies; e.g. sewage waste treatment and phosphor retrieval, superlight structures, strengthening methods for structures.

6. Partnerships

The partnerships of DTU Civil Engineering are a fundamental platform in order to reach the department's goals at both a strategic and operational level. Our identification and engagement with partners take basis in a strategic consideration of how partnering best support activities related to our core activities on research, education, innovation and research-based consultancy.

Important present DTU Civil Engineering partners include: Nordic Five Tech alliance universities, Harvard, Stanford, the buildingSMART consortium, the INNObyg consortium, DONG A/S, COWI A/S, Alectia A/S, NIRAS A/S, the Greenland Self-Government.

Important future partners include: Climate KIC, INNO+, Femern Belt, members of the Danish Building Academy, Raw Materials KIC, GDSI, BAM, La Sapienza, LTH, KTH, TU Delft, Aalto, HUST (China), Universities/companies in BRIC-countries and other emerging economies.

In the UMV period, the department will strengthen partnerships with:

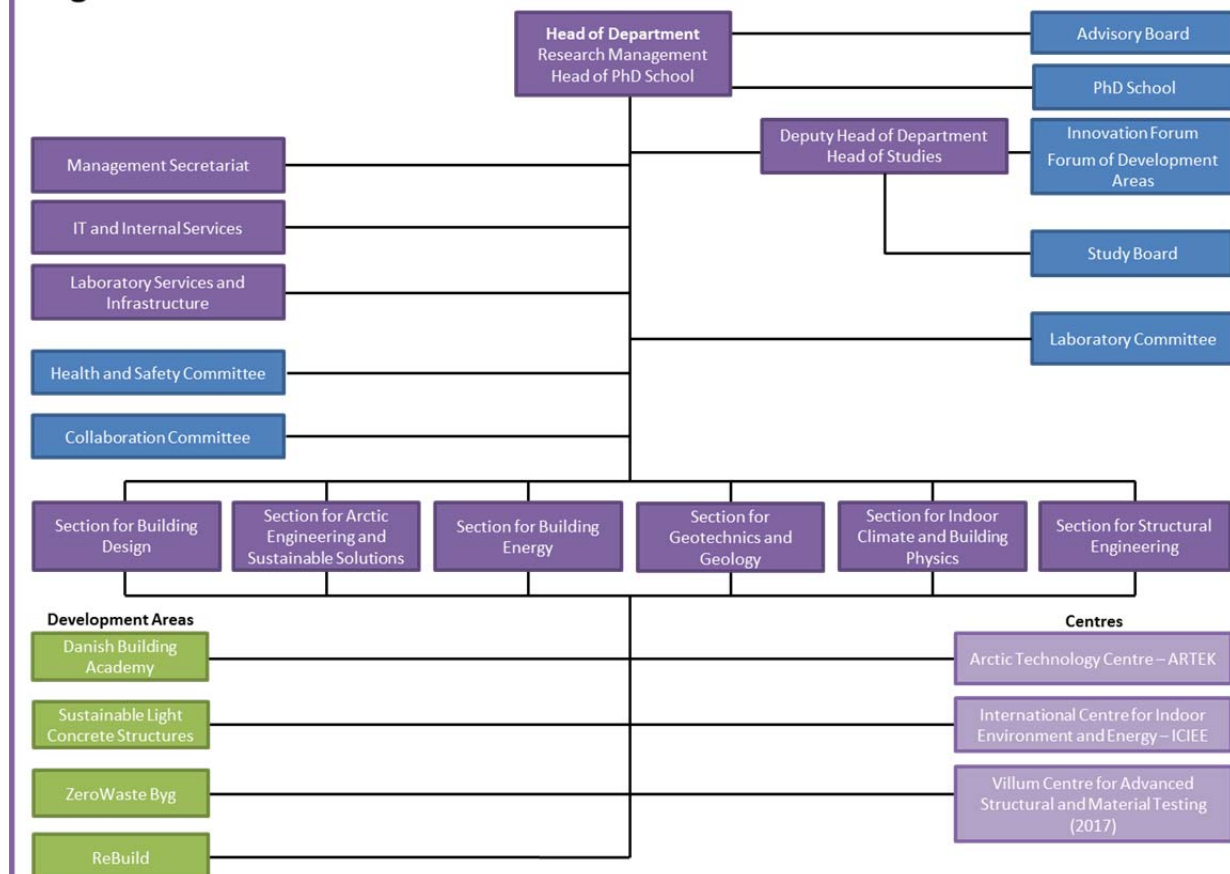
- Leading technical universities in Europe for mutual sharing of lab facilities and experiences on testing activities; e.g. within large scale structural testing.
- Technical universities in Arctic and Nordic countries for collaboration on research and combined educations, e.g. through UArctic and Nordic Five Tech.
- Leading organisations in the Scandinavian Construction Industry.

7. Human resources

7.1 Organisation

DTU Civil Engineering is organized into six sections, three research centres and a central support comprising a management secretariat, IT and building services and laboratory services, as shown in the figure below.

Organisation



DTU Civil Engineering wants to develop an organisation that supports the key processes that lead to successful delivery of our strategic goals. The overall aim for the administration is to support the scientists and research groups in the best possible way and to ensure that the department's scientists have the best terms and conditions enabling them to do excellent research.

As contribution to this, the department wants to strengthen the administrative resources, competencies and working culture enabling them to offer a range of specialized support across the department within the areas such as project support, administrative support, laboratory support, management and communication. A high standard and precision in fundraising will be given special attention.

7.2 Leader and leadership development

DTU Civil Engineering applies to the DTU Leadership Role and will like to see the management development as an integral part of the activities at strategic and operational levels. We aim for a clear understanding of individual roles and responsibilities in the overall functionality of the department.

All members of the management team are expected to participate actively in the strategic development of the department, in the day-to-day management activities and to develop as leaders; e.g. through the DTU Leadership program. Seminars in the leader group on leadership, strategy and awareness on culture will take place.

Management of ARTEK will be reviewed and developed.

7.3 Employee development

Development of the employees at DTU Civil Engineering is a focus point in the daily operation but also at a strategic level. The process is rooted in the annual personal development talks conducted between the individual employees and their immediate manager. The annual development talks is a crucial leadership tool to recognize, set up goals and be clear on expectations. As stated in the DTU competence strategy, the aim is a clear link between the strategic goals at the department and the individual employee competence development, in order to develop the highest potential possible.

Job satisfaction surveys from earlier years have shown that there is an important job to do when it comes to improving the job satisfaction at the department. After the last survey, a number of areas have been identified that need attention. Work related stress, recognition, communicating the department's strategy and goals, as well as a more appreciative collaboration between scientific and administrative staff. These areas will be looked in to and acted upon. The analysis and action plan is developed in close collaboration with the local Collaboration Committee.

In order to obtain these goals, the department will:

- Arrange an annual DTU Civil Engineering educational seminar, presenting best practice “from teachers to teachers”.
- Maintain a strong focus on continuous development of our lecturers – primarily via Learning Lab, e-learning and by integrating our young faculty members as PhD supervisors.
- Pay special and continuous attention to the administrative staff towards obtaining an optimal organizational structure, enhanced efficiency in processes, clear collaboration structures, preparation of job and task descriptions and high quality knowledge sharing.
- Work on a transparent and open administrative organization where the individual's tasks and responsibilities are clear to the individual, the colleagues and the management.
- Start a process among the management and the Collaboration Committee securing cohesion between strategic goals and competence development.

7.4 Attracting and recruiting

Developing and recruiting talent is crucial for increasing expertise in DTU Civil Engineering's scientific field. The department will focus on the recruitment process and on recruiting the right people with the right talent and the right diversity for the right functions. When recruiting TAP we generally involve a personal test (PAPI). Focus will also be on improving our offers in terms of start-up conditions and support, especially in the beginning of the employment of new international faculty.

In order to further help develop the potentials and talents of the department, we will have a constant focus on possible professorships in relation to the strategic initiatives. All new positions shall bring the department to an even higher level of expertise within several scientific areas. We will also have a focus on strengthening the department's core competencies in order to recruit highly qualified staff through our strong international profile and international networks. In the UMV period, we will establish 3 professorships in strategic selected

research areas, e.g. architectural engineering, fire safety, rehabilitation of buildings, building information modelling or civil engineering materials. Furthermore, we will investigate national and international funding mechanisms that can support the department in attracting and developing talented researchers.

Finally, we will explore possibilities of attracting top professionals among practitioners for teaching activities in part-time industrial professorships.

7.5 HR key figures

DTU Civil Engineering wants to obtain and maintain a scientific sound balance for the activities for each individual VIP; e.g. between education and research. In general, the educational part of VIP activities is high. At the same time, the department wants to maintain a critical mass in the research groups in order to ensure scientific quality and development.

In the UMV period, a slight increase in permanently employed research staff is expected reflecting the expected growth in teaching activities, external funded projects as well as the research-based consultancy venture. The number of PhD students is expected to be stable in the UMV period.

8. Material resources

8.1 IT

The department wants to make an solid IT platform available for daily work as well as transition and digitalisation of professional activities, e.g. e-learning and knowledge sharing.

A virtual desktop infrastructure project in the B-databar is being carried out within the framework of the central computerlab committee. This will have a big impact for teachers as the use of IT in many different learning environments will be possible, use of multiple client platforms can be utilized and access a VDI environment regardless of geographical location made possible.

Computers have become a central component in all experimental activities, making it dependent on a both secure and flexible IT environment where security threats (virus, ransomware, hackers etc.) not should result in compromised data and loss of valuable experimental knowledge. A more secure infrastructure in the lab environments will be planned, established and adjusted as a focus area of the departmental IT security committee.

Internet at Campus Sisimiut will be updated to the highest possible standard, provided the necessary funding can be obtained.

Enhancement of knowledge sharing will be planned and implemented by means of common data structure, knowledge sharing systems and a 'sharing culture'.

8.2 Laboratory equipment/scientific infrastructure

Experimental facilities of high quality is key for a long range of the activities of the department. It is thus our strategy to maintain and further develop these at high or highest international level. The funding requirement for this is significant and should be reflected in both the base funding and external research funding.

At present many of the departments facilities are worn down and obsolete, and in certain areas the standard is below lowest international standard. Upgrading will take place through the following strategic efforts: (i) focusing of the departments experimental capabilities, (ii) upgrading of machines and tools in workshops, (iii) upgrading of focus areas through combined external and internal funding and (iv) identification of needs for maintenance and renewal and establishment of mechanisms for providing such funding for each of the laboratory units in the department. An example of such a unit where the approach is implemented is DTU Structural Lab established in collaboration with DTU Mechanical Engineering.

The ongoing realization of the Villum Centre for Advanced Structural and Material Testing (B119A) forms a focal point in the coming years, and the center is expected to open officially in 2017 and thereby establish mechanical testing facilities at highest international standard, supporting research and forming the basis for international laboratory networking activities.

The DTU funding allocated for new laboratory buildings allows for establishment of completely new lab infrastructure supporting geology and geotechnical engineering (B129) and ARTEK research (B128) - these laboratory facilities are expected to open officially in 2017/2018. Further more, the DTU funding allocated for laboratory buildings will form the basis for a dedicated effort to rise external funding for a complete upgrade of the department's lab facilities for civil engineering materials (B130).

Facilities for experimental pavement engineering for use in both education and research activities are highly needed in consequence of the ongoing capacity building within geotechnical engineering. The department will plan and seek funding for establishment of such facilities; possibly to be included in a refurbished Building B119 and/or a new Building B130.

It is envisaged to establish a boundary-layer wind tunnel to perform studies on individual buildings and on the urban built environment at acceptable geometric scale. The available and future facilities at DTU Mechanical Engineering and DTU Wind Energy are not suitable for this type of simulation, and the use of commercial wind tunnels comes with heavy time restrictions. The wind tunnel will be the main working instrument for research in structural loading and dynamic response as well as for research on urban microclimate. Furthermore, the facility will provide verification data for numerical simulation using computational fluid dynamics.

The indoor climate lab facilities including climate chambers in building 412 are worn and require a major renovation. At the same time the current placement far from the main premises of DTU Civil Engineering is a barrier for a better integration of the Section for Indoor Environment and Building Physics in the department. Hence, the department will seek to attract funding to build new research facilities near building 118/119 and relocate the section into the 1st quadrant. The funding comprises both external funding of lab facilities and DTU funding for a new building.

With the help of a new financial laboratory structure, the need for allocation of funds for laboratory use, maintenance and upgrading will be clarified and made transparent. To further support the use and maintenance of the equipment in the various laboratory units a unique database system will be launched. The preparatory work on this has been ongoing for some time. The work is currently ongoing in collaboration with the central IT Department AIT and the system is planned to be finished and launched during the UMF period.

During the UMF period, safety in workshops will be structured and enhanced in parallel with the increase in capacity and facilities.

8.3 Premises

The renovation plan for DTU Civil Engineerings premises in the 1st quadrant consists of the following elements: The new building 127 (completed), renovation of the office space in buildings 118 and 119 (completed), renovation and upgrade of 117, extension of 118 with af building 128 (in the design stage) and a connection building between 118 and 119 with af building 129 (in the design stage), the Villum Centre for Advanced Structural and Material Testing in building 119 (under construction), the renovation of building 116 (planning stage) and finally a facelift of the out-door areas. This undertaking is expected to give the built environment in 1st quadrant a major upgrade both functionally, environmentally and visually. The plan is effectuated in close dialog between CAS and the department – a process which will be ongoing in a large part of the UMV period.

However, the plan does not foresee a general upgrade of the workshop facilities in building 119 and the previously envisioned relocation of Indoor Climate staff from building 402, which is unfortunate. Those issues will be addressed during the first years of the UMV period.

- Relocation of Indoor Climate staff to Building 118/119 (condensation)
- New building in 1st quadrant for indoor climate laboratories
- New building B130 for civil engineering material laboratories

In 2015, an application for external funding of premises for a Technical University Center in Sisimiut was rejected. Significant improvement of physical environment (offices) at Sisimiut Campus are urgent needed and Artek will seek an intermediate solution in collaboration with Greenlandic Self-Rule and Municipality of Qeqqata before reapplying for funding to revised campus premises later on in the UMV period.

9. Communication

The overall strategic external communication objective for DTU Civil Engineering is to:

- Disseminate knowledge of the activities within research, education and innovation.
- Be known by authorities, players in the construction industry, external collaboration partners, decision makers and the general public for excellent research, education, innovation and research based consultancy services.
- Be known for pro-active and innovative approach to address future societal challenges.

In the first year of the UMV period, the department will develop an in-depth communication strategy to support these objectives from various perspectives, e.g. increased transparency, peer-to-peer benchmarking of communication patterns, selection of media types/channels and a proactive attitude towards news and press releases. The strategy will include the use of social media for dissemination, storytelling and networking.

10. Process and employee involvement

This UMV has been written through a participatory process involving all organisational units and associated staff. The process was initiated in February 2016 in the management group of the department followed by discussions within the individual organisational units and at staff meetings. All staff members have had the

opportunity to contribute to this UMV. In the final phase, the UMV report has been reviewed within the department management group and subsequently commented by the Local Collaboration Committee.