

# Assessment Policy CiT, CEM en CME

## 1. Assessment Philosophy

The main philosophy behind the assessment policy of the BSc programme CiT and the MSc programmes CEM and CME is that the final qualifications, the educational programme and the assessment on the final qualifications form a coherent unit for each programme (see Figure 1). The final qualifications determine the learning goals of the courses, which together cover all final qualifications. For each course, the learning goals, teaching methods and course assessment form a coherent unit (see again Figure 1), meaning that the learning goals determine the teaching methods and that the assessment methods relate to the teaching methods and the learning goals. This ensures that the required knowledge and skills, as specified in the final qualifications, are properly assessed throughout the various courses.

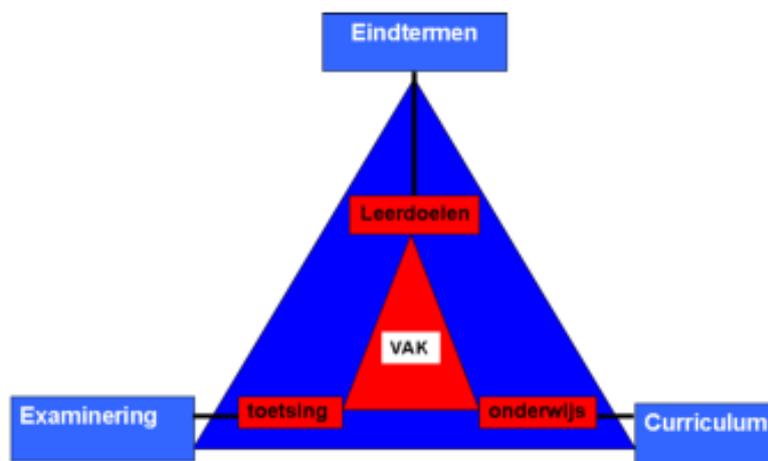


Figure 1: Didactic triangle

This philosophy behind our assessment policy is translated into concrete choices about assessments. As the final qualifications of the BSc programme CiT and the MSc programmes CEM and CME cover a variety of knowledge and skills, we need a variety of teaching and assessment methods. This is realised as follows: courses consisting of lectures, with particular knowledge-related learning goals, in general are assessed by written, or sometimes oral, examinations. Many courses include additional assignments to practice and assess specific learning goals. Examples of assignments are calculation assignments, computer assignments, essays, presentations, design assignments and project reports. Lab work assignments usually include a written report and students are often required to explain their solutions orally to the assessor.

An important aspect is the assessment of group work. It is important to assess whether each individual student meets the final qualifications of the programme including aspects of teamwork. Our final qualifications include these aspects, because they are crucial in the professional field of Civil Engineering. Therefore, some of the courses (particularly the design projects) are mainly assessed as groupwork.

We think it is important that there is intensive supervision in the projects, such that the staff has a clear picture of which groups experience problems in the teamwork. Moreover, the students have to reflect on the group process and the contributions of the individual students, at the end of many of the design projects, with the aim to increase their learning experience. These reflections are discussed with the teacher Design Projects (CiT) and/or responsible teacher (CiT/CEM) and can affect the mark of the individual students.

The ample individual assessments within the programmes, including the final thesis projects, ensure that we assess properly whether each individual student meets the final qualifications of the programme.

## 2. Safeguarding Assessment Quality

### 2.1 Introduction

Just like the safeguarding of the education quality of an education programme (i.e. courses) in general can be described by a PDCA-cycle, this can be done for safeguarding the quality of assessments within the programme. Via the different stages of the Deming cycle (Plan-Do-Check-Act, see figure 2) we describe the assessment system of the programmes. The system for safeguarding the quality of



Figuur 2 PDCA of Deming cyclus

BSc thesis projects and MSc thesis projects is described separately (paragraph 2.7 and 2.8).

### 2.2 Conditions

#### 2.2.1 Professionalization of teaching staff with respect to assessment

Each starting staff member has the obligation to obtain the University Teaching Qualification. Assessment is an important part of this qualification. Almost 60% of the teachers within the cluster Civil Engineering do have this qualification or is in the process of obtaining it. More than 40% of the teachers within the cluster Civil Engineering is eligible for the procedure for experienced teachers (> 5 years teaching experience, figures June 2012). The Examination Board will monitor the status with respect to UTQ on a yearly basis.

Existing knowledge of staff members with respect to learning goals and assessment quality was refreshed by an instruction sessions in aid of development of test plans. The website of the Examination Board will contain a section for staff members which includes information and rules with respect to assessment.

#### 2.2.2 Professionalization of members of the Examination Board with respect to new legislation and assessment

There is one Examination Board for the programmes CiT, CEM and CME. One of the members of the Examination Board is a staff member of another faculty (sc. EWI). All members of the Examination Board are themselves teacher in either or both CiT, CEM or CME (also the staff member of EWI who teaches the course Mathematics A) and fulfill the requirements of UTQ as described above. Next to this the Examination Board CiT/CEM/CME in recent years paid extra attention to assessment quality and safeguarding the quality of assessment also due to their new responsibilities which result from the changes in the WHW. This professionalization was done amongst others by a course for all Examination Boards of the faculty CTW.

#### 2.2.3 Appointment of Examiners

The appointment of Examiners is a responsibility of the Examination Boars (see section R2 of Teaching and Examination Regulations). In general the person responsible for teaching the unit of

study is also responsible for assessing the results. The personal policy of the departments will make sure that only qualified staff members can be Examiner. At this moment (June 2012) 33 out of 38 Examiners do have a degree which is at least one level higher than the level of the programme in which they teach their course. For the other 5 an exemption has been made based on their appointment (assistant/associate/full professor) and the qualifications that go with this appointment.

## **2.3 PLAN (preparation and development of a test)**

### *2.3.1 Test plan per course*

For each course in the BSc-programme CiT and the MSc-programmes CEM and CME a test plan was developed (by the teacher of the course) in which learning goals, assessment matrix and pass marks are described. Learning goals were described according to Blooms taxonomy<sup>1</sup> (knowledge, comprehension, application, analysis, synthesis and evaluation). For each learning goal it was tried to describe the relative contribution to the course. The assessment matrix contains a description of the way each learning goal is tested and how the assessment of the test is made up (for instance 'by using an answering model with points attached to each answer' in case of a written exam or 'by using a check list with criteria' in case of an oral presentation). The test plan is the basis for each exam for the course and should be renewed in case:

- a. A new responsible teacher (= Examiner) is appointed for the course
- b. The course was redesigned or the assessment of the course was redesigned
- c. The learning goals of the course were changed
- d. The Examination Board will ask for it (based on an evaluation of the course or in case of problems with the assessment which are reported (see also 2.3.2) )

### *2.3.2 Safeguarding the quality of test plans and exams*

All test plans will be checked by an assessment expert<sup>2</sup> and feedback will be given to both the programme management and the Examination Board.

Based on the test plans and the feedback of the assessment expert the programme management will check whether all final qualifications are sufficiently covered by the whole of (examination of) learning goals of courses. If necessary changes in courses and/or exams will be made.

Based on the feedback of the assessment expert and/or evaluation of courses the Examination Board will yearly invite some Examiners (+/- 3 BSc and +/- 3 MSc) to discuss the details of the test plan and the exam in relation to the organization and content of the course. Next to the test plan the following input can or will be used: course information, course material, exam, exam results, student evaluation. The Examination Board will mainly check:

- Transparency: are the questions formulated clearly and unambiguous?
- Validity: are the learning goals represented in a balanced way and at the appropriate level?

When there are signals that there are problems with an exam (for example based on complaints, remarkable results or a negative student evaluation) the programme management will report this to the Examination Board. The Examination Board in this case will ask for the test plan and the exam and will evaluate the particular exam for transparency and validity. If necessary the Examination Board will call for an expert to judge the (course specific) content of the exam (are the questions and expected answers correct?). The Examination Board will specify the necessary actions and will communicate these with the teacher and the programme management.

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<sup>1</sup> See for example: <http://taspd.edublogs.org/2007/04/23/revised-blooms-taxonomy/> (Anderson en Krathwohl, 2001)

<sup>2</sup> Usually the educational expert ("faculteitsonderwijskundige" FO) of the faculty. The FO has a background in Education Science and solid knowledge and expertise with respect to assessment and quality of assessment.

In many courses of the BSc-programme CiT and the MSc-programme CEM more than one staff member is involved. In these situations the exam most likely will be checked upfront on the aspects content, transparency and validity by all staff members involved. However, this is not a standard rule.

## **2.4 DO (execution of the exam)**

### *2.4.1 Information supply with respect to assessment methods and assessment (transparency)*

Via Osiris (student information system) and Blackboard (Electronic Learning Environment) information is given to the student on the learning goals, the assessment methods, assessment of exam(s) and pass marks. Osiris and Blackboard are coupled on the highest level but the teacher can add additional details in Blackboard if necessary.

Next to this the Examiner of the course is expected (see R4.7 of the Teaching and Examination Regulations) to provide representative example questions or example exams (including points) to students. This makes expectations clear to students and gives them the opportunity to exercise.

Finally, each (written) exam contains a start page that mentions at least assessment instructions and available time.

### *2.4.2 Exam sessions*

In R5, 6 and 7 of the Teaching and Examinations Regulations rules with respect to exam sessions are described as well as the procedures with respect to fraud and plagiarism.

### *2.4.3 Grading of exams*

Assessment takes place as described in the test plan (for instance with the help of model answers or a checklist with criteria). Grading is also described in the test plan as well as the pass marks. Grades should be given according to R9 of the Teaching and Examination Regulations.

### *2.4.4 Assessment and grading of design projects*

Within the BSc-programme CiT the design projects are merely assessed with grades per group following the test plan, usually with the help of checklists. For some of the projects a small part of the grade is individual based on individual assignments or the final grade can be obtained by handing in an individual assignment or assignments. These individual assignments focus on final qualifications concerning design, reflection and teamwork.

In all design projects in the BSc-programme in rare cases students will not finish the project because their contribution to the teamwork is fully inadequate. The procedure is briefly described in the document "Ontwerpprojecten Civiele Techniek, Handleiding teamwork en reflectie".

Also it might happen that individual students have to do an additional assignment or get a different grade than their team members due to their contribution to the teamwork. This is decided by the Examiner and the Teacher Design Projects.

In some cases students will finish/do design projects as an individual due to personal circumstances (implementation of Student Charter article B). The Examiner will make arrangements on behalf of the Examination Board.

## **2.5 CHECK (evaluation and analysis of the exam)**

### *2.5.1 Analysis of the exam results*

After the exam the Examiner will make an elementary analysis of the exam results<sup>3</sup>. This means the Examiner will look at the results keeping the following questions in mind:

- a. Is the exam as a whole made exceptional good or bad? (guide line: 60-80% pass)
- b. Is there a remarkable distribution of scores? (guide line: normal distribution)
- c. Are specific parts or questions of the exam made remarkably good or bad?

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<sup>3</sup>Our vision is that the Examiner is professional and has sufficient expertise both with respect to content and assessment to make an analysis of the results of the work delivered by the students.

- d. Are there any other remarkable issues with respect to the results?
- e. Do above points give way to adjustment of the grades or the exam?

The Examiner should consult an assessment expert, the programme management and/or the Examination Board in case major adjustments appear to be necessary.

### *2.5.2 Evaluation of assessment and grading*

Via the standard questionnaires students will also evaluate the quality of assessment. The following is asked for:

- a. Whether the assessment method(s) fit to the course content (5-point)
- b. Whether the level of the assessment fits to the course content (5-point)

Evaluation of the course (and assessment) by means of these questionnaires is done every year. The results will be given to the responsible teacher for feedback. Based on the results of the evaluation and the reaction of the teacher the programme coordinator will make a report for the quartile and send it to the educational committee. These reports will be discussed in this committee. In case the programme management and/or the education committee think it is necessary, the teacher is asked to make improvements to course and/or assessment. The programme director will make sure the improvement will actually be made. During the next evaluation it will be checked whether the improvement actually worked. In case of actions concerning assessment and grading the Examination Board will be involved as well.

### *2.5.3 Other aspects of quality control*

Next to the quality control by the Examiner himself and the student questionnaires, the student can contact the Examiner directly in case (s)he has doubts concerning the assessment and or grading. Due to the limited number of students and open door policy many students use this option (also facilitated via the Student Charter paragraph article 12 and R6a). In case the student does not want/dare to contact the Examiner directly or a conflict rises concerning assessment/grading students usually contact the student adviser. If mediation is not possible a formal complaint can be filed with the Examination Board. The website of the Examination Board describes the procedure in case of complaints.

## **2.6 ACT (improvement or adjustment of the assessment)**

### *2.6.1 Formulation and feedback of improvement*

Based on the results of 3 (CHECK) the responsible teacher will formulate all necessary and wanted improvements and the way to implement these. He will inform the education committee about this via the programme management (see 2.5.2). In case of major changes a new test plan will be made and send as well to the Examination Board (see 2.3.1).

### *2.6.2 Advice and support*

When the teacher wants advice or support to improve or optimize the assessment of his/her course, he can consult an assessment expert. The teacher can also contact the programme director or programme coordinator. There seem to be no (cultural) boundaries to do so.

When the teacher wants to do a formal course or training with respect to assessment and grading it is available at the OD ("onderwijskundige dienst"). The faculty will stimulate teachers who want to (further) professionalize their teaching/assessment skills.

## **2.7 Safeguarding quality assessment BSc-thesis project**

### *2.7.1 Background BSc-thesis project*

The BSc-thesis project is an individual project which is always carried out outside the University of Twente, at a company or public organisation within the professional field of Civil Engineering; either within or outside the Netherlands. We do not see the BSc-thesis project as the ultimate proof of all

the competences of the BSc-programme, but also as an important learning project in itself. During the project the student still acquires knowledge and competences and the student practices certain competences. Still, several of the final qualifications are addressed in the BSc-thesis project. Based on these considerations, the following learning goals have been specified for the BSc-thesis project. With the BSc-thesis project the student shows that:

- a) he/she can apply and integrate knowledge within a subfield of Civil Engineering (including aspects of management, modelling and/or design) independently and can broaden this knowledge or acquire new knowledge whenever needed.
- b) he/she can work systematically and methodically and can report adequately on the results.
- c) he/she has adequate communication skills and reflective capacities to operate in the professional field.

### *2.7.2 Responsibilities for supervision and assessment and requirements on examiners*

The mobility coordinator of the cluster Civil Engineering bears the final responsibility for the course 'BSc-thesis project'. The responsibility for the assessment of each individual project lies with the internal supervisor and the second examiner.

During the project, the student has an internal supervisor, who is a member of the scientific staff of the University of Twente and an external supervisor at the organisation where the project is carried out. The result of the BSc-thesis project is assessed by the internal supervisor and a second examiner. The second examiner is a member of the scientific staff of the University of Twente, from a different department than the internal supervisor. This creates a natural exchange amongst supervisors from different departments about the type of subjects and the level of the BSc-thesis projects. Moreover, it is a way to ensure that the BSc-thesis projects are assessed in the same way across the departments. At most one of the assessors can be a PhD-student (from second year onward). The external supervisor has an advisory role in the assessment of the BSc-thesis project.

### *2.7.3 Assessment of the BSc-thesis project*

The final grade for the BSc-thesis project consists for 30% of the grade for the project plan and for 70% of the grade for the final report. In addition, each student has to write a reflection report in which the student reflects on the expectations beforehand and the experienced reality concerning the external organisation, the BSc-thesis project and his/her own functioning. The reflection report has to be sufficient to finish the BSc-thesis project.

The draft of the project plan has to be approved by the internal supervisor, before the student can start with the project. The internal supervisor assesses the final project plan (based on the criteria in the 'Teacher-manual for supervising and assessing BSc-thesis projects') and marks it with a grade.

At the end of the project, the student submits the final report to the internal supervisor and the second examiner (and the external supervisor). The two examiners assess the project report based on the criteria as specified in the 'Teacher-manual for supervising and assessing BSc-thesis projects' (i.e. the content of the project, the report and the process of the project). Students can find these in the student manual and on the website. The manual also includes profiles for grading. The two examiners use these profiles to determine together the grade for the final result. Here, the internal (and possibly also the external) supervisor brings in input about the process of the BSc-thesis project. The internal supervisor fills in the grades for the project plan and for the final report on the assessment form, together with the final grade for the BSc-thesis project. In addition, the internal supervisor summarizes the conclusions of the examiners in terms of 'What went well?' and 'What could have been improved?' for each of the three assessment aspects. This assessment form is completed during the assessment meeting of the two examiners, immediately after the final meeting with the student. Together with the grades, this feedback is presented to the student, directly afterwards.

The reflection report is assessed by the mobility coordinator.

#### *2.7.4 Quality assurance of level and assessment of BSc-thesis projects by Examination Board*

In order to guarantee that the level of the BSc-theses projects is at least sufficient, the Examination Board evaluates some of the just-sufficient BSc-theses in more detail. To that end, the mobility coordinator often involves the Examination Board in the process of assessing a just-sufficient BSc-thesis project as a second opinion. This is to ensure that all BSc-thesis projects are indeed of sufficient level to justify the awarding of the BSc-diploma.

## **2.8 Safeguarding quality assessment MSc- thesis project**

### *2.8.1 Background MSc-thesis project*

The MSc-thesis project consists of two courses, i.e. the course 'Preparation MSc-thesis' (7.5 EC) and the course 'MSc-thesis' (30 EC). The MSc-thesis project is an individual project which can be carried out internally, or outside the University of Twente, at a company or public organisation within the professional field of Civil Engineering.

We do not see the MSc-thesis project as the ultimate proof of all the competences of the MSc-programme, but also as an important learning project, in which the student still acquires knowledge and competences and in which the student practices certain competences. Still, several of the final qualifications are addressed in the MSc-thesis project. The main objective of the course 'Preparation MSc-thesis' is to – independently<sup>4</sup> – produce a research or design plan for his/her MSc-thesis project, based on state-of-the-art scientific knowledge of the sub-field and acquire additional knowledge to prepare for the MSc-thesis project. The main objective of the MSc-thesis project is to – independently - carry out a large<sup>5</sup> individual research or design project in one of the sub-fields of Civil Engineering and Management, at a level that is representative for an MSc-programme, i.e. by applying state-of-the-art scientific knowledge of the sub-field.

Starting from these main objectives, learning goals for these two courses were derived directly from the final qualifications of the MSc-programme CEM. The two final sets of learning goals can be found in Bijlage 1. They have been communicated to the teachers and are included in the most recent Thesis Guide for students.

### *2.8.2. Responsibilities for supervision and assessment and requirements on examiners*

The graduation committee, who supervises the student during the MSc-thesis project and assesses the outcome of the MSc-thesis project, consists of at least two members of the scientific staff of the University of Twente. The final responsibility for the supervision and assessment lies with the chair of the committee, who should be a professor or an associate professor of the cluster Civil Engineering at the UT. One of the members of the committee is appointed as daily supervisor of the MSc-student. In almost all cases, the committee is extended with external members, particularly when the MSc-thesis project is carried out externally, but sometimes also for internal projects. As from September 2012 the Examination Board recommends graduation committees to always include an external supervisor in the committee. This recommendation will be included in the Thesis Guide of 2012. If the project is carried out externally the student will always have (at least) one daily supervisor from the external organisation. All members of the committee are involved in the supervision of the student during the entire graduation period. In the assessment of the MSc-thesis project the external members have an advisory role.

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<sup>4</sup> With 'independently' we mean: the student acts as the project leader for producing this research or design plan / for this individual project with guidance from his/her supervisors. The amount of guidance needed will be reflected in the grading of the course / project.

<sup>5</sup> With 'large' we mean one coherent project of 30 EC that requires about 21 full-time working weeks, i.e. about half a year of work. (The 30 EC includes finalizing the thesis and defending it in public, but not setting up a research or project plan, based on a scientific literature study, and acquiring additional required knowledge, since this is subject of the separate course 'preparation MSc-thesis'.)

### *2.8.3 Assessment of the course 'Preparation MSc-thesis'*

The course 'Preparation MSc-thesis' is a separate course with a separate grade. This course will always include a literature survey and a research or design plan based on this survey. In addition, some additional education may be included that the student needs, to carry out the MSc-thesis project successfully. The exact content of the course and the relative weight of the different components require approval of the chair of the graduation committee. The course 'Preparation MSc-thesis' is always carried out internally (also if the MSc-thesis project itself is carried out externally) to guarantee the academic level of the research or design plan and of the MSc-thesis project. At the end of the course, the chair of the graduation committee assesses the different components of the course and marks the course with a grade. The second supervisor of the MSc-thesis project may be involved in the supervision and assessment of the course 'Preparation MSc-thesis'. In fact, this is often the case.

### *2.8.4 Assessment of the course 'MSc-thesis'*

To complete the course MSc-thesis, the student has to write an MSc-thesis and has to present the thesis in public in a colloquium. Four weeks before the expected date of the colloquium, the student has to submit the final and complete draft of the report to all (internal and external) members of the committee. In a so-called 'green-light-meeting' with the student and all the committee members, the outcome of the project and the MSc-thesis is discussed in detail and the committee provides the student with feedback on the MSc-thesis project. At the end of the meeting, the committee decides whether the student gets 'green-light', meaning whether the level of the MSc-thesis project is (at least) sufficient to graduate and the student is allowed to hold the colloquium at the expected date. The student uses the feedback of the supervisors to draw up a final version of the thesis. During the public colloquium the student presents the results of the MSc-thesis project to the committee and others. After the presentation the committee and the public will pose questions to the student that he/she has to answer in public.

After the colloquium, the committee assesses the MSc-thesis project behind closed doors. The assessment is based on four main assessment aspects, i.e. i) content of the project, ii) the report, iii) the process of the project and iv) the presentation and defence. Students can find these criteria in the Thesis guide and on the website.

The assessment is carried out according to the protocol for the assessment of master theses, laid down in the document 'Assessment Master Theses'. This document is sent to the chair of the graduation committee before each colloquium. In addition to a description of the assessment aspects, this document includes profiles for grading. The examiners use these profiles to determine together the one final grade for the MSc-thesis project. Moreover, it includes an assessment form, on which the chair of the graduation committee summarizes the conclusions of the committee in terms of 'what went well?' and 'what could have been improved?' for each of the four assessment aspects, to ensure that all aspects are taken into consideration in the final grade and such that it is clear afterwards how the final grade has been determined. This assessment form is filled in during the assessment meeting of the graduation committee directly after the colloquium. Together with the grade, this feedback is presented to the student in public.

### *2.8.5 Quality assurance of level and assessment of MSc-theses by Examination Board*

In order to guarantee the level of the MSc-theses projects, the Examination Board evaluates some of the MSc-theses in more detail. To that end, they investigate two ends of the spectrum, i.e:

- i) excellent MSc-theses that are nominated yearly for the prize of best MSc-thesis of Civil Engineering at the University of Twente
- ii) just-sufficient MSc-theses that have been marked with a 6

The Examination Board forms the jury for the best MSc-thesis of Civil Engineering at the University of Twente. By evaluating the nominated theses and deciding on the winner of the prize, the Examination Board has good insight in the level of the theses that are considered as very good or excellent by the departments. This means that the Examination Board can judge whether these theses indeed deserve such a high grade.

By evaluating MSc-theses that have been marked with a 6 - and can therefore be considered as just sufficient - the Examination Board investigates whether these MSc-thesis are indeed of sufficient level to justify the awarding of the MSc-diploma. The Examination Board will advise departments to change their grading policy if they find reasons to do so.

The Examination Board monitors whether the assessment of MSc thesis projects does indeed take place according to protocol. To that end, yearly, each member of the Examination Board from one of the departments of Civil Engineering evaluates two MSc theses from the other Civil Engineering departments and attends the colloquiums and assessment meetings of these thesis projects. This means that at least six times per year (about 10% of the MSc projects), a thesis is evaluated and its colloquium and assessment meeting are attended by a member of the Examination Board who was not involved in that particular MSc thesis project. The results of these evaluations are discussed within the Examination Board.

## Appendix 1 Learning goals for Preparation MSc Thesis and MSc Thesis

### Learning outcomes of the course Preparation MSc Thesis

The main objective of the course Preparation MSc Thesis project is to produce a research or design plan – independently<sup>1)</sup> – for his or her MSc thesis project, based on state-of-the-art scientific knowledge of the subfield and acquire additional knowledge to prepare for the MSc thesis project. The MSc thesis project is a large<sup>2)</sup> individual research or design project in one of the subfields of Civil Engineering and Management.

- 1) By 'independently', we mean that the student acts as the project leader for producing this research or design plan with guidance from his or her supervisor(s). The level of guidance needed by the student will be reflected in the grading of the course.
- 2) By 'large', we mean one coherent project of 30 EC that requires about 21 fulltime working weeks, i.e. about half a year of work.

### *Learning outcomes with respect to content*

By producing the research or design plan the student has to show that:

- He or she is able to identify gaps in scientific knowledge within a subfield of Civil Engineering and Management, is able to assess research within a subfield of Civil Engineering and Management on its scientific merits, and is able to understand and incorporate the results of research into his or her own work.
- He or she is able to formulate a research or design problem and is able to produce a research or design plan, with sufficient focus, and such that it can be realized in the available time.
- He or she is able to acquire additional scientific knowledge independently.

### *Learning outcomes with respect to working process*

By producing the research or design plan, the student has to show that:

- He or she reflects upon his or her own work and uses relevant information to improve his or her capabilities.
- He or she has the attitude to strengthen his or her personal development and enhance his or her expertise.
- He or she is able to work independently.
- He or she is able to work systematically and methodically.
- He or she is able to finish the project in the time available.

### *Learning outcomes with respect to communication skills*

By writing the research or design plan, the student has to show that:

- He or she is skilled in properly documenting results of a scientific literature study.
- He or she is skilled in presenting a research or design plan in writing, including the underlying knowledge, choices and considerations.
- He or she is competent in scientific reasoning.
- He or she adheres to existing academic conventions, such as giving proper credit and referencing.

### **Learning outcomes MSc thesis project**

The main objective of the MSc thesis project is to carry out a large<sup>2)</sup> individual research or design project – independently<sup>1)</sup> – in one of the subfields of Civil Engineering and Management, at a level that is representative for an MSc programme, i.e. by applying state-of-the-art scientific knowledge of the subfield.

- 1) *By 'independently', we mean that the student acts as the project leader for this individual project with guidance from his or her supervisors. The level of guidance needed by the student will be reflected in the grading of the project.*
- 2) *By 'large', we mean one coherent project of 30 EC that requires about 21 fulltime working weeks, i.e. about half a year of work. (The 30 EC includes finalizing the thesis and defending it in public, but not setting up a research or project plan, based on a scientific literature study, and acquiring additional required knowledge, since this is the topic of the separate course Preparation MSc Thesis.)*

#### *Learning outcomes with respect to content*

By carrying out the MSc thesis project the student has to show that:

- He or she has expert knowledge on at least one of the subareas of Civil Engineering and Management, and is able to expand his or her expertise in the field of Civil Engineering and Management.
- He or she is able to position the (scientific research of the) own subfield in the scientific and societal context.
- He or she is able to identify gaps in scientific knowledge within a subfield of Civil Engineering and Management, is able to assess research within a subfield of Civil Engineering and Management on its scientific merit and is able to understand and incorporate the results of research into his or her own work.
- He or she is able to judge the value of information, makes effective use of this information for decisions and is able to evaluate these decisions.
- He or she is able to carry out his or her research or design plan, by applying an appropriate research or design methodology.
- He or she is able to judge whether available concepts, tools and techniques are satisfactory for the problem at hand, is able to apply the proper tools and techniques and able to generate his or her own assumptions, tools, theories, techniques or new ideas if these are not available.
- He or she is able to analyse and discuss the results, draw conclusions from the results and reflect on the results in the wider societal and scientific context.

#### *Learning outcomes with respect to working process*

By carrying out the MSc thesis project the student has to show that:

- He or she can reflect upon his or her own work and uses relevant information to improve his or her capabilities.
- He or she has the attitude to strengthen his or her personal development and enhance his or her expertise.
- He or she is able to work independently.
- He or she is able to work systematically and methodically.
- He or she is able to manage his or her own project as a project leader including proper communication with supervisors.
- He or she is able to finish the project in the available time.

#### *Learning outcomes with respect to written and oral communication skills*

By writing the MSc thesis report and presenting and defending the project in public, the student has to show that:

- He or she is skilled in properly documenting and presenting results of scientific and design work, including the underlying knowledge, choices and considerations, to colleagues and to a broader public.
- He or she is competent in scientific reasoning.
- He or she adheres to existing academic conventions, such as giving proper credit and referencing.