Advisory report
Limited Framework Programme Assessment

Master Spatial Engineering

University of Twente

Contents of the report

1. Executive summary

In this executive summary, the panel presents the considerations which led to the assessment of the quality of the master programme (MSc) of Spatial Engineering of the University of Twente. The programme was assessed according to the standards of the NVAO Assessment Framework for the higher education accreditation system of the Netherlands (version September 2018)[1].

Standard 1 - Intended learning outcomes

The profile of the master programme of Spatial Engineering has rapidly grown into a mature unique profile with distinctive characteristics. The programme's intended learning outcomes (PILOs) reflect master level and are relevant for the (international) work field. The panel especially appreciates that the programme demonstrably involves the professional advisory board in the evaluation of the intended learning outcomes and that the international perspective is clearly of paramount importance. Suggestions for further improvement include finetuning one of the PILOs and continuing the dialogue on the programme's name.

The panel concludes that the programme meets the criteria of standard 1.

Standard 2 - Teaching-learning environment

The 7 programme's intended learning outcomes (PILOs) have been adequately translated into 55 "sub-ILOs". Many of those (12 out of 55) are linked to internationalisation and are called intended international and intercultural learning outcomes (iiiLOs). Each sub-ILO, including each iiiLO, is linked to one or more study units in the curriculum. Together with the programme's educational concept, based on CBL and PLE, and combined with great attention to personal development, this enables students to achieve the PILOs. This applies to both current and new curriculum. Students starting in September 2023 will follow the new curriculum. Changes in the new curriculum are based on evaluations and feedback of stakeholders and reflect a strong quality culture.
There are no indications that the programme's study load is too high. The programme attracts mainly international students, and the panel considers this to be a strength. At the same time, the panel thinks it would be possible to attract more Dutch students by focusing on "selling" the programme's USPs.
Students are guided by enthusiastic and inspiring teachers, and teachers and students alike share a vibrant pioneering mentality.
Facilities and services provided by the faculty and the programme are of very good quality and tailored to the needs of both Dutch and non-Dutch students. Every single student will be able to benefit from this wide variety of what is on offer. The panel advises to formalise communication agreements and restructure the programme information on canvas with the assistance of direct stakeholders (students) to make it more user-friendly and easily accessible.

The panel concludes that the programme meets the criteria of standard 2.

[1] The programme was also assessed according to the criteria of the CeQuInt Assessment Framework. The results are documented in a separate report.

Standard 3 - Assessment

The programme has a clear vision on assessment, in line with the vision on education and adequate for assessing the achieved level.
The programme has a variety of assessment methods in place. Assessment methods are transparently communicated (Education and Examination Regulations, study guide), verifiable (recordings) and reliable (multiple eyes). The panel was especially enthusiastic about the combination of the personal development portfolio and the oral assessments to assess outcomes of challenge-based learning. According to the panel, the measuring of student's integration and mediation skills could be made more explicit in the rubric of the thesis and the internship report.
The Examination Board functions well and focuses on its most important task: safeguarding assessment quality in general and the assessment quality of the theses and internships in particular. The Examination Board has a well-working thesis carrousel in place. The panel advises to introduce an internship report carrousel as well.

The panel concludes that the programme meets the criteria of standard 3.

Standard 4 - Achieved learning outcomes

The theses and internship reports were relevant for the field and of master level (one internship report with the narrowest of margins). Students are demonstrably trained in working independently on finding mitigation and adaptation strategies for wicked problems during their research projects and their internships. Sometimes the integration of two (or three) fields of expertise could be more explicit to do justice to the specific characteristics of the programme.
Alumni find their way to the job market or academia quite easily and the international orientation of the programme is clearly reflected in their careers. The panel advises to keep close track of alumni and their careers and to intensify the relationship with them to receive extra input on strategic level, next to the input provided by the professional advisory board.

The panel concludes that the programme meets the criteria of standard 4.

Frankfurt, Germany,
3 July 2023,

Dr. P.A. Magiera
(panel chair)

Drs. B.E. Roemers
(panel secretary)

2. Programme administrative information

Name programme in CROHO:	Master Spatial Engineering
Orientation, level programme:	Academic Master (MSc)
Number of credits:	120 EC (2 years)
Specialisations:	n/a
Location:	Enschede
Mode of study:	Full-time
Language of instruction	English
Registration in CROHO:	60962
Expiry date initial accreditation:	30 March 2024
Latest submission date advisory report:	31 October 2023
Name of institution:	University of Twente
File number NVAO:	PA-1421
Status of institution:	Government-funded
Institution's quality assurance:	Positive outcome, valid until 2 May 2026

3. Assessment per standard

3.1 Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings and considerations

Introduction

In 2016 the master programme of Spatial Engineering successfully completed the public funding trajectory (CDHO) and in 2017 the initial accreditation trajectory (NVAO). Since 2018 the Faculty of Geo-information Science and Earth Observation (ITC)[2] of the University of Twente offers the master programme of Spatial Engineering (M-SE). This programme is unique in the Netherlands. Therefore, the programme is assessed individually (instead of being clustered with other programmes in a visitation group).

Profile and name

The programme describes a spatial engineer as "someone who uses spatial data, technology, and planning to address stakeholder needs that result from the big problems that society is facing. They work on things like natural disasters, climate change, and poverty. And they help make our communities and the world a better place to live in". Internationalisation, interdisciplinarity, integration and social-cultural awareness and skills are key in spatial engineering: spatial engineers approach wicked real-world problems in an international context, combining different fields of expertise, including Spatial Information Science (SIS), TE (Technical Engineering) and Spatial Planning for Governance (SPG), using intercultural communication skills. This makes spatial engineers "empathic engineers", which is in line with the high tech - human touch (HTHT) identity of the University of Twente.
The programme management, teachers, students, alumni and the work field representatives might vary in emphasising specific aspects within the profile, but during the site visit it became clear that there is consensus about the common denominator and that the current description of a spatial engineer is widely supported. It also became clear that there have been many fruitful discussions about the name of the programme. The panel encourages the programme to keep on reflecting on the name of the programme and involve alumni and employers in these discussions to get a clearer view of the image of the programme's name in and outside The Netherlands.

[2] The International Institute for Geo-Information Science and Earth Observation (ITC) was an institute of higher (tertiary) education located in Enschede. As of 1 January 2010 it has been incorporated into the University of Twente as the sixth faculty, while preserving its own unique international character as a faculty *sui generis*, and is now formally known as University of Twente, Faculty of Geo-Information Science and Earth Observation (ITC).

Intended learning outcomes

The goal of the M-SE is expressed in seven Programme Intended Learning Outcomes (PILOs).

1	Is an expert in integrated knowledge development of technical engineering, spatial information science and spatial planning for governance.
2	Does research in a purposeful and methodological way.
3	Can design context specific and appropriate interventions for sustainable development.
4	Has an academic approach to the development, justified use and validation of theories and models.
5	Is competent in reasoning, reflection, and judgment.
6	Is competent in cooperation and communication.
7	Can work internationally as a global citizen and as an empathic engineer.

The programme transparently linked the PILOs to the Meijers' criteria for technical academic master programmes (which implicitly also represent the Dublin descriptors for academic master programmes). Moreover, the PILOs are developed against the background of relevant international frameworks, including the ABET[3] framework for TE, the GI-BoK[4] framework for SIS and the AESOP[5] framework for SPG.
The panel thinks the PILOs are relevant for the (international) field and reflect master level. For further improvement, the panel suggests changing the formulation of PILO 1 into 'Is an expert in integrat*ing perspectives and skills* of technical engineering, spatial information science and spatial planning for governance' to emphasise the mediating role and the ability to integrate TE, SIS and SPG.

Professional Advisory Board

The programme installed a Professional Advisory Board (PAB) in 2019 and regularly consults this board. The PAB is broadly oriented (thereby reflecting the broad orientation of the programme) and has Dutch and international members (thereby reflecting the international orientation of the programme). The PAB was involved in reviewing the PILOs and had notable influence on the current formulation of PILO 1 and 3 and on the discussions about the upcoming changes in programme design.

Assessment of this standard (summary and conclusion)

The M-SE profile has rapidly grown into a mature unique profile with distinctive characteristics. The PILOs reflect master level and are relevant for the (international) work field. The panel especially appreciates that the programme demonstrably involves the PAB in the evaluation of the PILOs and that the international perspective is clearly of paramount importance. Suggestions for further improvement include finetuning PILO 1 and continuing the dialogue on the programme's name.
The panel concludes that the programme meets the criteria of standard 1.

[3] ABET stands for Accreditation Board for Engineering and Technology and is the US engineering accreditation commission.
[4] GI-BoK stands for Geographic information Science and Technology Body of Knowledge and is a university consortium for geographical information sciences.
[5] AESOP stands for Association for European schools of Planning and is is a network of European universities, their departments and affiliated schools that are engaged in teaching and research in the fields of urban and regional planning.

3.2 Standard 2: Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings and considerations

Vision on education

The programme uses innovative teaching techniques such as Challenge-Based Learning (CBL) and Project-Led Education (PLE). Students learn by executing challenging wicked-problems-projects together with other students. Throughout the programme these wicked problems, addressed in case study projects, become increasingly complex. During the site visit some students presented some of their case study projects and the panel was impressed. The core values of M-SE (stimulating curiosity, using activating methods, working on real world problems in a multicultural learning environment etc.) were clearly visible in these presentations. Moreover, case study projects are strongly student-centred and stimulate students to take responsibility for their own learning path.

During their studies, students track a Personal Development Plan and Portfolio (PDP) in which they reflect on almost everything they learn, including the development of their soft skills, intercultural sensitivity (and awareness of bias), problem solving skills etc. During the site visit students explained how they did this and what it brought them. Working in a diverse group of students (with multiple nationalities) and becoming aware of your own bias, strengths and weaknesses within a group context, was mentioned as one of the most valuable learning outcomes for their future careers.

Next to the case study projects and the PDP, the international module plays an important role in developing students' international and intercultural knowledge, skills, awareness and sensitivity. This module uses activating teaching methods (excursions, conferences, group assignments, etc.) to make students familiar with a broad spectrum of different international institutes, companies, and NGOs in the field of Spatial Engineering. The panel noticed that this module is not a goal in itself but is strongly connected to current needs in many societies. The module is strengthened by an international skills learning line and supported by an international staff and student population. According to the panel the translation from international orientation in the PILOs to the internationally oriented education in the programme is clearly effective and state of the art.

Curriculum

The 7 PILOs have been translated into 55 sub-ILOs, 12 of these are connected to internationalisation goals and called 'intended international and intercultural learning outcomes' (iiiLOs). Each sub-ILO is linked to one or more study units. Since the start of the programme (2018), students follow this curriculum:

<table>
<tr><th></th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th></tr>
<tr><td rowspan="2">Year 1</td><td rowspan="2">Case study project 15 EC:
Climate-Resilient Cities</td><td rowspan="2">Case study project 15 EC:
Food and Water Security</td><td rowspan="2">Case study project 15 EC:
Human-induced Earth Movement - Energy Transition</td><td>Electives 14 EC
(Focus on methods for MSc Research)</td></tr>
<tr><td>Academic skills (justification MSc Research) 1 EC</td></tr>
<tr><td>Year 2</td><td>International Module[4] 7.5 EC</td><td colspan="2">Academic & Research Phase 37.5 EC</td><td>Internship 15 EC</td></tr>
</table>

The curriculum has been evaluated among students and alumni, work field representatives, teachers, and examiners, ending up in a revised version of the curriculum that will start in September 2023. This revised version is based on the same seven PILOs.

<table>
<tr><th></th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th></th></tr>
<tr><td rowspan="2">Year 1</td><td rowspan="2">Case study project 15 EC:
Sustainability & Resilience</td><td>Data mastery 10 EC</td><td rowspan="2">Case study project 15 EC:
Adaptation & Transitions</td><td rowspan="2">International Module 7.5 EC</td><td>Proposal writing 5 EC</td></tr>
<tr><td>Elective 5 EC</td><td>Elective 2.5 EC</td></tr>
<tr><td rowspan="3">Year 2</td><td colspan="5">Electives 10 EC</td></tr>
<tr><td colspan="5">Academic & Research Phase 35 EC</td></tr>
<tr><td colspan="5">Internship 15 EC</td></tr>
</table>

The most important change has been made in year 1: one of the case study projects has been replaced by a module on data mastery. Knowledge on collecting and interpreting data is important in many jobs. Therefore, it deserved a more prominent place as a module in the curriculum. The panel members were divided over this choice. Most panel members considered this a valuable change, both because of acting upon input given by stakeholders (support, acceptance, quality culture) and because of the alignment with the demands of the professional field. However, one panel member was not in favour of this change and thought that the baby was thrown out with the bathwater by sacrificing a case study project to address the need for more education on data mastery. Her suggestion was to strive for the best of both worlds and *include* data mastery *in* a case study project.
Furthermore, the international module has been transferred from year 2 to year 1 and the electives from year 1 to year 2. With this interchange students are better prepared for making informed choices regarding the electives on offer. The panel welcomes this change.
Lastly, the research project for the thesis now starts with a preparatory module on writing a proposal (5 EC) which replaces the academic skills module of 1 EC. The panel appreciates this change and thinks that students will benefit from this intensified guidance at the beginning of their research project.

Influx

The programme attracts small numbers of students which enables small-scale education and guarantees that 'no one just disappears from the radar'. This is especially valuable for a programme attracting so many foreign students, new to the Dutch education system and the Dutch culture outside the campus. In 2021 no less than 75% of the new students was non-Dutch and in 2022 67%. Together with the international staff (see next page) they create a strong international and intercultural learning community.
If the programme seeks to attract more Dutch students, the panel advises to focus on the programme's strengths and flaunt these, including for instance the campus, facilities and student housing, the international orientation, innovative teaching, and small-scale education, the strong international learning community of teachers and students, and the strong focus on multidisciplinarity and integration. The panel also suggests reopening the discussion on the name of the programme (see standard 1).

Study load

Students indicate that the workload builds up during the programme because of the increasing complexity of the wicked problems they work on. None of the students speak of a heavy study load. Furthermore, they state that the study load can hardly be judged or measured objectively on an individual basis. They point out that the experienced study load largely depends on personal background, chosen electives, collaboration within a group, personal circumstances and personal development goals, etc.

Guidance and staff

The guiding network for students is well thought out: students are guided by mentors (1-on-1-meetings, PDP), tutors (groups meetings, case study projects), supervisors (for theses and internships) and study unit coordinators for each study unit (integrated knowledge development). This guiding net around students proves to be effective. Both Dutch and international students know when and where to turn to.
Staff is of very good quality: the percentage of full professors and associate professors is high, the percentage of international teachers is high (almost 40%), nearly all teachers have their UTQ, and the faculty offers plenty options for further professionalisation. During the site visit it became clear that the faculty cares about acknowledging and appreciating talents (in Dutch *erkennen en waarderen van talent*) but that in practice the younger generation benefits more from this (in terms of career opportunities) than the older staff members. The panel advises to balance this.
The teachers regularly meet each other in so-called 'transfer meetings'. All sorts of topics pass by. The transfer meetings serve multiple purposes: teachers feel part of a team which makes it easier to ask a colleague for help. But even more important, teachers are aware of and talk about their individual contributions to the programme, thereby enhancing the coherence of the programme.

Services, facilities and information

To provide a warm welcome to students from abroad, the faculty offers an extensive range of services, including assistance with the application procedure, airport pick-up, *guaranteed* housing, a prayer room, an extra introduction week for the faculty after the university's introduction week, the faculty's Student Affairs Office for personal, social, cultural and medical issues, and a very active Student Association Board that organises all sorts of activities (excursions, sports days, food festivals etc.).

Furthermore, the programme just recently moved to a brand-new building. The bright and inviting building offers good lab facilities, quiet study rooms, a large study centre, some lovely green patios with ponds and, at the heart of the building, an attractive food-work restaurant, offering freshly prepared meals, including vegetarian and halal dishes. Students obviously were very pleased with their "new home".
Students mention that the digital information and communication could be improved. As is often the case with small scale programmes, communication is not strictly formalised. Formalising communication agreements and restructuring the information on canvas with the assistance of a student panel to make it more user-friendly and easily accessible could solve this.

Assessment of this standard (summary and conclusion)

The 7 programme's intended learning outcomes (PILOs) have been adequately translated into 55 "sub-ILOs". Many of those (12 out of 55) are linked to internationalisation and are called intended international and intercultural learning outcomes (iiiLOs). Each sub-ILO, including each iiiLO, is linked to one or more study units in the curriculum. Together with the programme's educational concept, based on CBL and PLE, and combined with great attention to personal development (PDP), this enables students to achieve the PILOs. This applies to both current and new curriculum. Students starting in September 2023 will follow the new curriculum. Changes in the new curriculum are based on evaluations and feedback of stakeholders and reflect a strong quality culture.
There are no indications that the programme's study load is too high. The programme attracts mainly international students, and the panel considers this to be a strength. At the same time, the panel thinks it would be possible to attract more Dutch students by focusing on "selling" the programme's USPs.
Students are guided by enthusiastic and inspiring teachers, and teachers and students alike share a vibrant pioneering mentality (also a USP).
Facilities and services provided by the faculty and the programme are of very good quality and tailored to the needs of both Dutch and non-Dutch students. Every single student will be able to benefit from this wide variety of what is on offer. The panel advises to formalise communication agreements and restructure the programme information on canvas with the assistance of direct stakeholders (students) to make it more user-friendly and easily accessible.
The panel concludes that the programme meets the criteria of standard 2.

3.3 Standard 3: Assessment

The programme has an adequate system of student assessment in place.

Findings and considerations

Vision on assessment

The programme has a clear vision on assessment. The assessment is focused on acquisition and integration of knowledge in authentic work situations of a spatial engineer, on empowering students and on stimulating their lifelong learning (LLL). According to the panel, this vision is in line with the vision on education and enables assessing the achieved levels of students.

Assessment methods

The programme uses a variety of assessment methods, including inception reports, project reports, written tests and oral tests. The panel was particularly enthusiastic about the combination of the PDP and the oral assessment of the case study projects, an adequate assessment style for assessing CBL-outcomes. Furthermore, there is a good balance between group assignments used to assess the collaboration skills of the students and individual tests to assess other knowledge and skills. A description of the assessment of each study unit can be found in the Education and Examination Regulations (EER, in Dutch OER: *onderwijs- en examenregeling*) and in the study guide.
Oral exams are recorded, and students are offered the possibility to listen to the recordings afterwards to receive extra feedback on their performances and extra substantiation on their grades. The panel considers this quite valuable, both in terms of assessment for learning (lifelong learning) and in terms of fair and verifiable assessment.

Thesis and internship

The programme has a multiple eyes judging and grading system in place for the thesis: two ITC supervisors, a chair and an external examiner are involved and their judgment was generally aligned. The programme also has a multiple eyes judging and grading system in place for the internship report: one ITC examiner and at least one (sometimes two) host supervisors are involved.
The rubrics for the thesis and the internship are of good quality and contain a lot of helpful, steering information for examiners. For further improvement, the measuring of achievements of the student's integration and mediation skills should be explicitly mentioned in the rubric.

Advice and grading by externals

External organisations (possible future employers) are closely involved in the process of guiding and grading the student's final products (thesis and internship report). This approach stresses the importance of the role of the work field and the panel supports this. At the same time, the panel thinks that the exact role of the externals should be clearer to everyone involved. For instance, on the internship report judging forms a weighting factor of 50% for the host's grade was mentioned. During the site visit this was nuanced by some

programme representatives, stating that in practice the internal supervisor could overrule the grade given by the host supervisor and that the internal supervisor is in fact always the only one that takes the final decision. The panel advises to be transparent about this, also in the judging forms.

Examination Board

The Examination Board (EB) operates at faculty level, meaning that M-SE and the master Geo-information Science and Earth Observation (M-Geo) are serviced by one EB. The EB is on top of things and made a professional impression on the panel. Tasks were clearly distributed among EB-members. And although a couple of members were quite new, they did have a clear view of their tasks and responsibilities. The EB obviously surpassed the level of just checking procedures, handling individual requests for exceptions and appointing examiners: EB-members focus their energy on safeguarding assessment quality through frequent test screenings and a thesis carrousel. The panel advises to introduce an internship report carrousel as well.

Assessment of this standard (summary and conclusion)

The programme has a clear vision on assessment, in line with the vision on education and adequate for assessing the achieved level.
The programme has a variety of assessment methods in place. Assessment methods are transparently communicated (EER, study guide), verifiable (recordings) and reliable (multiple eyes). The panel was especially enthusiastic about the combination of the PDP and the oral assessments to assess CBL-outcomes. According to the panel, the measuring of student's integration and mediation skills could be made more explicit in the rubric of the thesis and the internship report.
The EB functions well and focuses on its most important task: safeguarding assessment quality in general and the assessment quality of the theses and internships in particular. The EB has a well-working thesis carrousel in place. The panel advises to introduce an internship report carrousel as well.
The panel concludes that the programme meets the criteria of standard 3.

3.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings and considerations

Graduation programme

The graduation programme consists of a master research project ending up in a thesis and an internship ending up in an internship report. The student must pass both to graduate. (It is not possible to compensate the thesis grade with the internship grade or the other way around.)
According to the panel, the scientific oriented thesis and the more industry-oriented internship form a balanced graduation programme enabling students to demonstrate they achieved the PILOs. It is possible to do the research project and the internship at the same organisation, which can be timesaving for students and at the same time interesting for the host organisation.

Thesis

The panel reviewed fifteen theses of recent graduates of the programme. The grades were generally transparently and well substantiated, and the theses were clearly of master level. The panel was impressed by the high level of most theses, especially since the majority of graduates had been affected by pandemic restrictions in education. This does not seem to have had any negative effect on their achievement. In two cases the panel would have given a slightly lower grade than the examiners, but without any doubt a good enough to pass.
Regarding the relevance for the work field, the panel is convinced that all topics were relevant. Students are demonstrably trained in working independently on finding mitigation and adaptation strategies for wicked problems, although in some theses the integration of two out of the three fields of expertise (SIS, TE and SPG) could have been more significant to make it a true M-SE- thesis.

Internship

The panel reviewed fifteen internship reports (of the same fifteen graduates). Most grades were transparently and well substantiated by ITC examiners. The host supervisors sometimes were a bit too “generous” according to the panel and they should give more elaborated feedback. The panel concluded that fourteen out of fifteen reports were clearly of master level, one deserved a question mark.
All internship reports were relevant for the work field, some even “extremely relevant” according to the panel. As was the case with the theses, students are demonstrably trained in working independently on finding mitigation and adaptation strategies for wicked problems during their internships. But the panel also found a couple of internship reports not convincingly integrating two (or three) fields of expertise. With a more explicit integration of fields of expertise, the M-SE characteristics would have been more prominent. Therefore, the panel advises the supervisors to focus on this integration early on in the internship phase.

Alumni and their careers

The programme management has a clear picture of the careers of the M-SE graduates. Careers vary from jobs at former internship providers, to owners of self-started companies and holders of PhD-positions. About fifty percent of the alumni works in an international environment, meaning in a country other than the graduate's home country or in an organisation with a strong international profile. Alumni especially appreciate this outcome of their education. For many of them, the international orientation of the programme was the main reason for choosing M-SE.
According to the alumni, a point for improvement is preparing international students for the Dutch labour market, since some (international) graduates end up in jobs in the Netherlands. The panel was divided on this matter since working in the Netherlands is not an explicit goal of the programme whereas working in an international environment is. Furthermore, alumni stood up for including more programming and data analysis in the curriculum. The programme has already demonstrably acted upon this advice (see standard 2).
The panel was impressed by the contribution of the powerful and confident alumni during the site visit. They turned out to be real ambassadors of the M-SE and the panel thinks that the programme management could benefit more from their valuable input. The panel advises to strengthen the relationship with alumni and perhaps even align the role of the alumni with the role of the PAB.

Assessment of this standard (summary and conclusion)

The theses and internship reports were relevant for the field and of master level (one internship report with the narrowest of margins). Students are demonstrably trained in working independently on finding mitigation and adaptation strategies for wicked problems during their research projects and their internships. Sometimes the integration of two (or three) fields of expertise could be more explicit to do justice to the specific characteristics of M-SE.
Alumni find their way to the job market or academia quite easily and the international orientation of the programme is clearly reflected in their careers. The panel advises to keep close track of alumni and their careers and to intensify the relationship with them to receive extra input on strategic level, next to the input provided by the PAB.
The panel concludes that the programme meets the criteria of standard 4.

4. Overview of assessments

Master programme Spatial Engineering

Standard	Assessment
Standard 1, intended learning outcomes	Programme meets Standard 1
Standard 2, teaching-learning environment	Programme meets Standard 2
Standard 3, assessment	Programme meets Standard 3
Standard 4, achieved learning outcomes	Programme meets Standard 4
Conclusion, overall judgment	Positive

5. Strengths and points of attention

In this report, strong points and points of attention have been addressed. In this chapter these are summarised in a compact list to provide a quick overview.

Strengths of the programme

The panel observed the following strengths:

- Distinctive, unique profile with the following characteristic features:
    - internationalisation,
    - interdisciplinarity and integration,
    - combination of soft skills and hard skills
    - enthusiastic, powerful, confident empathic graduates with a true pioneer's mentality
- Well-functioning broadly oriented professional advisory board with international members and demonstrable influence on the intended learning outcomes of the programme
- Innovative teaching methods, especially in the case study projects (challenge-based learning, project-led education, personal development plan and portfolio etc.)
- State of the art education regarding international orientation, strong international and intercultural learning community of teachers and students
- Small-scale education
- Mature quality culture leading to widely supported changes in the programme
- Well thought out and well-functioning teaching and guiding network for students, including mentors, tutors, teachers, study unit coordinators and internal and external supervisors
- Coherence of the programme and the coherence of the teaching team safeguarded through frequent 'transfer meetings'
- Great variety of facilities and services at university level
- Brand-new faculty building with all sorts of facilities
- Variety of assessment methods tailored to the learning objectives
- Combination of PDP (personal development plan and portfolio) and oral assessment
- Multiple eyes judging and grading system for thesis and internship
- Well-functioning Examination Board
- Possibility of combining thesis and internship at one host organisation
- Both research projects and internships prepare students well for working on wicked problems
- About 50% of the alumni works in international environment

Points of attention for further improvement

The panel observed some points of attention leading to the following suggestions for improvement:

- The spatial engineer's mediating role and the ability to integrate the different fields of expertise (SIS, TE and SPG) should be more explicit in the PILOs and in the rubrics of the thesis and the internship. This will also stimulate supervisors to focus their student coaching on these aspects as early as possible in the trajectory.
- The Examination Board's working method to monitor the achieved level in theses (thesis carrousel) could be transferred to a comparable monitoring system for internship reports.
- Continue evaluating the programme's name and seek for more exposure (in the Netherlands) if the programme wants to attract more (Dutch) students.
- Restructure the information on canvas with the assistance of students.
- Improve career opportunities for older staff members (*erkennen en waarderen*).
- Make the exact contribution (weighting factor in the grade) of external supervisors transparent particularly in the assessment of internship reports.
- Intensify the relationship with alumni of the programme.

Appendix I Assessment process

Certiked VBI received a request from the University of Twente to conduct a limited programme assessment for the re-accreditation of the master programme Spatial Engineering.
The objective of the programme assessment process was to assess whether the programme meets the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands of September 2018 (officially published in Stcrt. 2019 no. 3198, on 29 January 2019). (In addition, the CeQuInt framework for assessing the 'special feature internationalisation' has been used. These outcomes are documented in a separate report.)

The Spatial Engineering programme management provided a longlist of panel candidates. After having conferred with the programme management, Certiked invited candidate panel members to participate in the assessment panel. The panel composition was as follows:

- Dr. P.A. (Philipp) Magiera, chair
  Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
  Head of section departmental coordination for the regional department Europe, Central Asia, Mediterranean
- Prof. dr. K.T. (Karin) Rebel, panel member
  Utrecht University, Faculty of Geosciences & Copernicus Institute of Sustainable Development
  Professor Sustainability Science & Education
  Utrecht University, Center for Academic Teaching and Learning
  Principle Fellow
- A.K. (Anna-Karin) Högfeldt, panel member
  Kungliga Tekniska högskolan (KTH), Sweden
  Operations manager of the faculty training and education development support
- Dr. E.A. (Elisabeth) Addink, panel member
  Utrecht University, Faculty of Geosciences
  Associate Professor Remote Sensing & Vegetation, Director of Geosciences Honours College
- Prof. dr. D. (Dirk) Kruijt (emeritus professor), panel member (CeQuInt-trained)
  Utrecht University, Faculty of Social and Behavioural Sciences
  Professor of Development Studies
- Mrs. J (Jessica) Wray, panel member (student)
  University of Amsterdam
  MSc student Earth Sciences and bat researcher
- Drs. B.E. (Barbara) Roemers, secretary (NVAO-certified)
  Edu van nu educational services
  Process coordinator and secretary

All panel members and the process coordinator/secretary confirmed that they had no conflict of interest regarding the programme and that they would observe the rules of confidentiality. Having obtained the authorisation ("*volmacht*") by the University of Twente, Certiked submitted the request-for-approval-form ("*verantwoordingsformulier*") including detailed information on the proposed panel members to conduct the assessment. NVAO approved of the suggested panel ("*instemmingsformulier*") on 26 April 2023 with file number PA-1421.

To prepare the assessment process, the process coordinator/secretary had contact with the Spatial Engineering programme director and the programme manager regarding the self-evaluation report and the programme of the site visit. The planning of activities in preparation of the site visit were also discussed and the final planning was distributed among the programme management and the panel members on 14 December 2022. The activities prior to the site visit were performed as planned.

Prior to the site visit, on 17 March 2023, the panel chair and the panel secretary met to discuss the assessment process. The panel chair was informed about the NVAO profile for panel chairs. The panel chair agreed to work in line with this profile.

On 10 march 2023, the programme management provided a list of theses and internship reports of alumni from the two most recent years. Acting on behalf of the assessment panel, together with the chair the process coordinator/secretary selected fifteen theses from this list. The grade distribution in the selection matched the grade distribution in the list forwarded by programme management, on the understanding that special attention was paid to the lower grades.

The secretary explained the NVAO framework (and the CeQuInt framework) and provided the information file of the programme to the panel members on 3 April 2023, being the programme's self-evaluation reports (including a student chapter) and the 15 theses and 15 internship reports. *(Note that the student did not receive the theses and internship reports.)*

Prior to the date of the site visit, all panel members sent in their preliminary findings and questions on 1 May 2023, based on the two self-evaluation reports of the programme management and the theses and internship reports of the alumni. The secretary summarised this information, compiling a list of questions, which served as a starting point for the sessions with the programme representatives during the site visit. On 8 May 2023, the panel met online (teams) to prepare the site visit, based on this list of questions. The procedures to be adopted during the site visit, were also discussed.

Programme site visit 15 and 16 May 2023

Monday 15 May

Location: ITC Building, UT Campus panel room **LA -** 1208

Time	Room	Activity
13:15 - 13:30	LA - 1208	*Arrival of the panel at ITC building*
13:30 - 13:45	LA - 1212	Welcome by Students + Faculty Board
13:45 - 14:30	LA - 1212	Showcase
14:30 - 14:45	*Break/internal panel discussion*	
14:45 - 15:30	LA - 1208	Meeting with programme management and internationalisation staff
15:30 - 15:45	*Break/internal panel discussion*	
15:45 - 16:30	LA - 1208	Meeting with students (incl. PC member)
16:30 - 16:45	*Break/internal panel discussion*	
16:45 - 17:30	Hybrid LA - 1212	Meeting Alumni (some will attend online)

Tuesday 16 May

Location: ITC Building, UT Campus panel room **LA** 1208

Time	Room	Activity
9:00 - 9:30	LA - 1208	*Arrival of the panel/internal discussion*
9:30 - 10:15	LA - 1208	Meeting with teaching staff (incl. PC member)
10:15 - 10:30	*Break/internal panel discussion*	
10:30 - 11:15	walk	Site visit tour
11:15 - 11:30	*Break/internal panel discussion*	
11:30 - 12:15	LA - 1208	Meeting with Examination Board
12:15 - 12:25	*Break/internal panel discussion*	
12:25 - 13:05	Hybrid LA - 1212	Meeting Professional Field
13:05 - 14:00	*Lunch & internal panel discussion (including 'inloopspreekuur'/consultation time)*	
14:00 - 14:45	LA - 1208	*internal panel discussion – programme management available for questions ("pending issues")* continued with Final interview with Programme Management/Education Management
14:45 - 15:45	*Break/internal panel discussion; Deliberations panel (formulating preliminary findings and conclusions)*	
15:45 - 16:15	LA - 2405	Initial feedback to the management and stakeholders, closing of formal visitation
16:15 - 17:15	LA - 1208	Development Dialogue (agenda distributed in advance by programme management)
17:30		Departure

The programme management displayed course material and assessment examples and student products of courses on the reading table for the panel members.

Open-office hours ("*inloopspreekuur voor stafleden, docenten en studenten*") were communicated timely by the programme management to the programme staff, lecturers and students. No one came forward to make use of these open hours.

At the end of the second day, the panel discussed findings and considerations and arrived at conclusions regarding the quality of the programme. The panel chair presented a broad outline of findings, consideration, and recommendations to a large group of programme stakeholders, including management, teachers, students, examiners, and work field representatives.

The advisory report, based on the findings and considerations of the panel, was drafted by the secretary. The draft report was sent to the chair on 31 May 2023 and to the panel members on 6 June 2023, who provided feedback. After having processed this feedback, the secretary sent the report to the programme management on 12 June 2023 to be corrected for factual inaccuracies. The programme management responded on 21 June 2023. Factual inaccuracies have been corrected and the chair adopted the report on 3 July 2023. The report has been sent to the programme management and the university board to accompany the request to continue the accreditation of this programme.

The so-called 'development meeting' ("*ontwikkelgesprek*") was held on the second day of the site visit (16 May). A separate report has been drafted by the secretary. The programme has been informed about the obligation to publish this report (for instance on Brightspace/Canvas etc.), to enable stakeholders (students, lecturers, examiners etc.) to take note of what has been discussed. The development meeting report should *not* accompany the request for re-accreditation.

Appendix II Abbreviations

CBL	Challenge-Based Learning
CDHO	*Commissie Doelmatigheid Hoger Onderwijs* (Committee for the Efficiency of Higher Education)
EB	Examination Board
iiiLOs	Intended international and Intercultural Learning Outcomes
M-SE	Master Spatial Engineering
NVAO	*Nederlands-Vlaamse Accreditatieorgasisatie* (Dutch-Flemish Accreditation Organisation)
PAB	Professional Advisory Board
PDP	Personal Development Plan and Portfolio
PILOs	Programme intended learning outcomes (programme level)
PLE	Project-Led Education
SIS	Spatial Information Science (one of the three field of expertise of M-SE)
SPG	Spatial Planning for Governance (one of the three field of expertise of M-SE)
Sub-ILOs	Intended Learning Outcomes linked to study units, derived from PILO
TE	Technical Engineering (one of the three field of expertise of M-SE)
UT	University of Twente
UTQ	University Teaching Qualification