



EDUCATIONAL ASSESSMENT **Fire Safety Engineering**

An evaluation of the quality of the Master of Science in Fire Safety Engineering
at Ghent University

www.vluhr.be/kwaliteitszorg

Brussels - April 2019

vluhr



**EDUCATIONAL ASSESSMENT
FIRE SAFETY ENGINEERING**

Ravensteingalerij 27

1000 Brussel

T +32 (0)2 792 55 00

F +32(0)2 211 41 99

The report is available electronically at www.vluhr.be/kwaliteitszorg

Legal deposit number: D/2019/12.784/5

PREFACE BY THE VLUHR QA BOARD

The assessment panel reports its findings on the Master of Science in Fire Safety Engineering. This programme is assessed in the autumn of 2018 on behalf of the Flemish Higher Education Council (VLUHR).

First of all, this report is intended for the programme involved. This assessment report provides the reader a snapshot of the quality of the programme and is only one phase in the process of the ongoing concern for educational quality. After a short period of time the study programme may already have changed and improved significantly, whether or not as an answer to the recommendations by the assessment panel. Additionally, the report intends to provide objective information to a wide audience about the quality of the evaluated programme. For this reason, the report is published on the VLUHR website.

I would like to thank the chairman and the members of the assessment panel for the time they have invested and for the high levels of expertise and dedication they showed in performing their task. This assessment is made possible thanks to the efforts of all those involved within the institution in the preparation and implementation of the assessment site visit.

I hope the positive comments formulated by the assessment panel and the recommendations for further improvement provide justification for their efforts and encouragement for the further development of the study programme.

Petter Aaslestad
Chair VLUHR QA Board

Preface by the VLUHR QA Board	3
-------------------------------	---

SECTION 1 GENERAL SECTION

Part I	Educational assessment Fire Safety Engineering	9
Part II	Table with scores	13

SECTION 2 REPORT OF THE STUDY PROGRAMME AND SUMMARY

Ghent University	19
Master of Science in Fire Safety Engineering	

APPENDICES

Appendix I	Curriculum vitae of the members of the assessment panel	39
Appendix II	Time schedule of the site visit	41

SECTION 1

General Section

PART I

Educational assessment Fire Safety Engineering

1 INTRODUCTION

In this report, the assessment panel Fire Safety Engineering announces its findings with regard to the Master of Science in Fire Safety Engineering at Ghent University. This study programme was assessed in the autumn of 2018 on behalf of the Flemish Higher Education Council (VLUHR).

This assessment procedure is part of the VLUHR activities in the area of external quality assurance in Flemish higher education which are meant to ensure that the Flemish universities, university colleges and other statutory registered higher education institutions are in compliance with the relevant regulations imposed by law.

2 THE ASSESSED STUDY PROGRAMME

In accordance with its mission, the assessment panel visited the Master of Science in Fire Safety Engineering at Ghent University from November 8 to 9, 2018.

3 THE ASSESSMENT PANEL

3.1 Composition of the assessment panel

The composition of the assessment panel Fire Safety Engineering was ratified on February 9, April 20 and May 25, 2018 by the VLUHR Quality Assurance Board. The NVAO sanctioned the panel composition on July 2, 2018. The assessment panel was subsequently installed by the Quality Assurance Board by its decision of September 3, 2018.

The assessment panel had the following composition:

- Chairman of the assessment panel:
 - **Jean-Marc Franssen**, Full Professor, Université de Liège, Department of Architecture, Geology, Environment & Constructions
- Panel members:
 - **Ann Beusen**, adviseur-ingenieur VIPA, teamverantwoordelijke Bouwtechnisch Team van Departement Welzijn, Volksgezondheid en Gezin, ministerie van de Vlaamse Gemeenschap
 - **René Van den Braembussche**, honorary professor in Turbomachinery and Propulsion, Von Karman Institute
 - **Larsen Priem**, masterstudent Industrial engineering Electromechanics, University of Antwerp

Klara De Wilde, coordinator of the Quality Assurance Unit of the Flemish Higher Education Council, was project manager of this educational assessment and acted as secretary to the assessment panel.

The brief curricula vitae of the members of the assessment panel are listed in Appendix 1.

3.2 Task description

The assessment panel is expected:

- to express substantiated and well-founded opinions on the study programme, using the assessment framework;
- to make recommendations allowing quality improvements to be made where possible;
- to inform society at large of its findings.

3.3 Process

3.3.1 Preparation

The study programme was asked to compile an extensive self-evaluation report in preparation for the educational assessment. An assessment protocol, with a detailed description of the expectations regarding the content of the self-evaluation report, was presented by the Quality Assurance Unit of VLUHR for this purpose. The self-evaluation report reflects the accreditation framework.

The assessment panel received the self-evaluation report a number of months before the on-site assessment visit, which allowed for adequate time to carefully study the document and to thoroughly prepare for the assessment visit. Additionally, the members of the assessment panel were asked to read a selection of recent Master's theses.

The assessment panel held its preparatory meeting on September 13, 2018. At this stage, the panel members were already in possession of the assessment protocol and the self-evaluation report. During the preparatory meeting, the panel members were given further information about the assessment process and they made specific preparations for the forthcoming on-site assessment visit. Special attention was given to the uniformity of the implementation of the accreditation framework and the assessment protocol. Also, the time schedule for the assessment visit was agreed upon (see Appendix 2) and the self-evaluation report was collectively discussed for the first time.

3.3.2 On-site visit

During the on-site visit the panel interviewed all parties directly involved with the study programme. The panel spoke with those responsible for the study programme, students, teaching staff, educational support staff, alumni and representatives from the professional field. The conversations and interviews with all these stakeholders took place in an open atmosphere and provided the panel with helpful additions to and clarifications of the self-evaluation report.

The panel visited the programme-specific infrastructure facilities, including the library, classrooms, computer facilities, and laboratories. There was also a consultation hour during which the assessment panel could invite people or during which people could come and be heard in confidence.

Furthermore, the institution was asked to prepare a wide variety of documents to be available during the on-site visit for the assessment panel to consult as a tertiary source of information. These documents included minutes of discussions in relevant governing bodies, a selection of study materials (courses, handbooks and syllabuses), indications of staff competences, testing and assessment assignments. Sufficient time was scheduled throughout the assessment visit for the panel to study these documents thoroughly. Additional information was requested during the on-site visit when the assessment panel deemed that information necessary to support its findings.

Following internal panel discussions, provisional findings were presented by the chairman of the assessment panel in conclusion of the on-site assessment visit.

3.3.3 Reporting

The last stage of the assessment process was the compilation of the panel's findings, conclusions, and recommendations into the present report. The panel's recommendations are separately summarised at the end of the report.

The study programme director was given the opportunity to reply to the draft version of this report. The assessment panel considered this response and included elements of it into the final version when deemed appropriate.

PART II

Table with scores

The following table represents the assessment scores of the assessment panel on the three generic quality standards set out in the assessment framework.

For each generic quality standard (GQS) the panel expresses a considered and substantiated opinion, according to a two-point scale: satisfactory or unsatisfactory. The panel also expresses a final opinion on the quality of the programme as a whole, also according to a two-point scale: satisfactory or unsatisfactory.

In the report of the study programme the assessment panel makes clear how it has reached its opinion. The table and the scores assigned ought to be read and interpreted in connection to the text in the report. Any interpretation based solely on the scores in the table, is unjust towards the study programme and passes over the assignment of this external assessment exercise.

Explanation of the scores of the **generic quality standard**:

Satisfactory (S) the study programme meets the generic quality standard

Unsatisfactory (U) the generic quality standard is unsatisfactory

Rules applicable to the final **opinion**:

Satisfactory (S) The final opinion on a programme is 'satisfactory' if the programme meets all generic quality standards.

Unsatisfactory (U) The final opinion on a programme is 'unsatisfactory' if all generic quality standards are assessed as 'unsatisfactory'.

Satisfactory for a limited period (S') The final opinion on a programme is 'satisfactory for a limited period', i.e. shorter than the accreditation period, if, on a first assessment, one or two generic quality standards are assessed as 'unsatisfactory'.

	GQS 1 Targeted outcome level	GQS 2 Educational learning environment	GQS 3 Outcome level achieved	Final opinion
Master of Science in Fire Safety Engineering	S	S	S	S

SECTION 2

Report of the study programme

GHENT UNIVERSITY

Master of Science in Fire Safety Engineering

SUMMARY OF THE ASSESSMENT REPORT

Master of Science in Fire Safety Engineering

Ghent University

From 8 to 9 November 2018, the Master of Science in Fire Safety Engineering of Ghent University has been evaluated in the framework of an educational assessment by a peer review panel of independent experts. In this summary which describes a snapshot, the main findings of the panel are listed.

Profile of the programme

The objective of the Master of Science in Fire Safety Engineering (FSE) is to enable students to become recognized experts in the field of fire safety engineering. The programme focuses primarily on the built environment and to a lesser extent on industry processes. To reach this objective, the programme aims to provide the students with a fundamental understanding of the fire safety strategy in the context of the performance based design (PBD). This PBD approach intends to incorporate the fire safety conditions in the design and construction of buildings and is becoming more and more main stream worldwide.

The programme-specific learning outcomes are those that are expected in a master's programme on FSE addressing knowledge-oriented, scientific, intellectual, societal and engineering competences and competences in cooperation and communication.

Programme

The programme FSE is organised in four semesters and counts 120 ECTS. The curriculum consists of basic FSE courses (21 ECTS), advanced FSE courses (54 ECTS), broadening and elective courses (21 ECTS) and the Master's thesis (24 ECTS). The basic courses are scheduled in the first semester, providing the students with the fundamentals of fire safety engineering. The students proceed with the advanced courses, addressing various aspects of fire safety engineering, including specific topics like risk management, legislation and human behaviour. All courses support the students to evolve towards the principles of performance-based fire protection designs. In the third semester the students test their knowledge and skills in the final course on Performance-Based Design. Students complete their study with the master's thesis.

Students can fill in a part of the programme according to their personal interest. Students make a choice out of three different types of electives: elective courses FSE (max. 9 ECTS), elective social courses (max. 6 ECTS) and elective courses from Ghent University in general (max. 6 ECTS). The curriculum does not include a mandatory internship. Students may take the internship as one of their electives and most students do an internship during the summer break, corresponding to 3 ECTS.

The content of the programme is based on ongoing research activities and targets for a high academic level with a large emphasis on recent developments in the field of FSE. Students are exposed to recent research projects, those made by their lecturers as well as those reported by the lecturers. Videos of experiments are being shown. As a fire safety engineer most likely will work project based, projects take an increasing role in the curriculum and are already in place in the first year.

The Master's thesis is a research project and students have the opportunity to conduct the research individually or in team with a fellow student. Students can choose the topic of their research from a list offered by the supervisors but they can suggest a topic themselves as well. The progress of the research is monitored by the supervisor in weekly meetings. The research results in a master's dissertation that includes a summary in the form of an abstract or an article.

The programme offers the students an international learning environment. Lectures, courses and communication are in English. Further-

more, the international dimension is strengthened by the presence of the International Master and the Postgraduate Programme organised in the department on the same topic. Some courses are organized jointly and also the teams for joint project assignments are intentionally composed of students from the different programmes.

The programme is immediately accessible for holders of a bachelor's degree of 11 engineering programmes. Students with a master's degree in Engineering Technology with sufficient links to the FSE-programme must follow an adjusted programme. Holders of a master's degree in Engineering Technology or a bachelor's degree in Engineering that is not sufficiently closely linked with the FSE-programme are admitted after passing a preparatory programme. Foreign students may be admitted after an individual application procedure. As the programme is taught in English, all students must demonstrate their language proficiency at level B2 (Common European Frame of Reference for Languages).

Evaluation and testing

The programme uses a good variety of assessment forms, like written multiple choice or open book exams, oral exams, reports and assignments. There is a mix of periodic evaluations and permanent evaluations. The chosen methods provide a broad platform to test the student's skills and competences.

Permanent assessment is used to evaluate the projects. A pre-defined evaluation form is used but the relative importance of the different criteria could be made clearer to the students. As the projects are often made in group, the contribution of each student in the group must be reflected in the individual marks of every team member. Peer assessment should be more widely used, in order to grasp the group dynamic as well as the individual contributions.

The evaluation of the master's thesis is based on the year's work done, the quality of the written dissertation and the oral defence. A pre-defined evaluation form is used here as well. As this assessment form has been in place for only one year, an evaluation of the use is planned. The programme management should evaluate whether the weight of the "soft skills" in the final grade is not excessive and the weight of the different categories under the "product assessment" could be made clearer.

Services and student guidance

The programme uses the facilities of the Faculty in the Plateau building (Ghent) and campus Ardoyen (Zwijnaarde). The students have also access to the laboratory facilities of WarringtonFireGent, which is the most important fire lab in Belgium that performs commercial tests (reaction to fire and fire resistance tests). Students use the facilities to conduct research projects.

Study guidance is offered to students in different ways. The students can contact the lecturers for course-related issues. For administrative and organisational issues there is a dedicated person – the FSE administrator - to support the students and who functions effectively as a bridge between the students and the staff. On the level of the Faculty, students can consult various other guidance services such as student administration, learning track counsellor and the ombudsperson. The students reported to be pleased with the general environment of the programme and its support.

Study success and professional opportunities

The feedback from alumni and professionals is very positive. The professionals emphasize the fact that there are not enough fire safety engineers who graduate for the market. The employers are struggling to recruit such profiles. Employability is very high. Students receive job offers even before they graduate.

ASSESSMENT REPORT
Master of Science in Fire Safety Engineering
Ghent University

Preface

This report concerns the master programme: Master of Science in Fire Safety Engineering organised by Ghent University. The assessment panel (further referred to as “the panel”) visited the study programme on the 8th and 9th of November, 2018.

The panel assessed the study programme based on the three generic quality standards of the VLUHR programme assessment framework. This framework is designed to fulfil the accreditation requirements applied by the NVAO. For each standard the panel gives a weighted and motivated judgement on a two-point scale: unsatisfactory or satisfactory. In assessing the generic quality assurance, the concept of ‘generic quality’ means that the standard is in place and the programme - or a mode of study of the programme - meets the quality standards that can reasonably be expected, from an international perspective, of a Bachelor’s or Master’s programme in higher education. The score “satisfactory” points out that the programme meets the generic quality because it demonstrates an acceptable level for the particular standard. The score “unsatisfactory” indicates that the programme does not attain the generic quality for that particular standard.

The panel’s opinions are supported by facts and analyses. The panel makes clear how it has reached its opinion. The panel also expresses a final opinion on the quality of the programme as a whole, also according to the same two-point scale.

The panel assessed the quality of the programme as it has been established at the time of the site visit. The panel has based its judgement on the self-evaluation report and the information that arose from the interviews with the programme management, lecturers, students, representatives of the professional field, alumni and personnel responsible at programme level for internal quality assurance, internationalization, study guidance and student tutoring. The panel has also examined the course materials, Master theses, test and evaluation assignments and standard answering formats, and relevant reports available. The panel has also visited the educational facilities such as laboratories during the site visit at the university.

In addition to the judgement, the panel also formulates recommendations with respect to quality improvement. In this manner, the panel wants to contribute to improving the quality of the programme. The recommendations are included in the relevant sections of the respective standard. At the end of the report there is an overview of improvement suggestions.

Context of the study programme

The Master of Science in Fire Safety Engineering is a master's programme, organised by the Faculty of Engineering and Architecture at Ghent University. Ghent University is the only institute in Flanders that offers a programme on Fire Safety Engineering at master's level. This programme aligns with the International Master of Science in Fire Safety Engineering which is a European funded programme organised by Ghent University in cooperation with the Lund University and the University of Edinburgh. Next to these programmes the Faculty also offers a postgraduate in Fire Safety Engineering.

The content and the implementation of the programme is monitored by the Study Programme Committee. This committee consists of representatives of the teaching staff, the students and the Advisory Group. Programme reviews, revisions and updates of the study programme are proposed by the Study Programme Committee and are advised by the Education Quality Control Unit before being submitted to the Faculty Board.

The programme received an initial accreditation (TNO – toets nieuwe opleiding) in 2014. The programme was first organised in 2015-2016 with 6 students. In 2017-2018 there are 16 students registered.

Generic quality standard 1 - Targeted Outcome Level

The assessment panel evaluates the targeted outcome level for the Master of Science in Fire Safety Engineering as satisfactory.

The **objective** of the Master of Science in Fire Safety Engineering (FSE) programme is to enable students to become recognized experts in the field of fire safety engineering. The programme focuses primarily on the built environment and to a lesser extent on industry processes. Furthermore, the programme aims to provide the students with a fundamental understanding of the fire safety strategy in the context of the performance based design (PBD). This PBD approach intends to incorporate the fire safety

conditions in the design and construction of buildings and is becoming more and more main stream worldwide.

As the programme is unique in Flanders, it drafted the **domain-specific learning outcomes** (DSLO) which were validated by NVAO. The DSLO are based on the general learning outcomes of the master programmes in Engineering and embody the specific focus of fire safety engineering.

The DSLO are translated into **programme-specific learning outcomes** (PSLO) which are subdivided in six domains addressing knowledge-oriented, scientific, intellectual, societal and engineering competencies and competencies in cooperation and communication. Within these groups, distinction has been made between competencies which apply to all of the master programmes in Engineering Science of Ghent University and specific competencies, applicable to the FSE programme only. The competencies specify in detail the knowledge and skills that the graduates of the programme should have been acquired at the completion of the programme.

The comparative summary of the programme-specific learning outcomes demonstrates that the targeted PSLO cover all DSLO. The summary also demonstrates that the PSLO are in line with all the characteristics specified in the Flemish qualification network with sufficient emphasis on independent and innovative work.

The panel reviewed the PSLO in depth and concludes that the targeted outcomes are appropriate to an academic master's level because the main focus is on principles first, as opposed to application rules. Fundamental physical phenomena are taught first and will serve as a base, not only for practical applications during the programme but, more important, for any problem that the students will face in their future career for which there is no application rule available. They will then be able to go back to the fundamentals and find a solution by themselves. Furthermore, the competences are those that are expected in a master's programme on Fire Safety Engineering program. There is a combination of matters related to fire dynamics on one hand versus structural questions on the other hand (plus other topics such as human behaviour, explosions and risks evaluation).

The interviews with the alumni and the **professional field** gave the panel insight in the current requirements the industry demands from FSE graduates. The representatives of the professional field were very positive

on the set of skills that are acquired during the FSE master. This shows that the programme-specific learning outcome targets match the current requirements from the professional field. The panel appreciates that the programme has installed an Advisory Group with representatives of all relevant local stakeholders in order to get feedback on the programme-specific competences and the programme structure, including changes. It is also a platform to discuss the evolutions in the professional field.

Following the available documents, the panel ascertains that the targeted programme specific learning outcomes are in line with the **international specified standards and requirements** specified by international organizations such as the International Association for Fire Safety Science and the Society of Fire Protection Engineering. The fact that the outcomes of this local programme are not significantly different from those of the international master organised at Ghent University in collaboration with two other renown universities, is another proof of the fact that the outcome matches international standards.

To conclude, it is the panel's opinion that the targeted programme-specific learning outcomes fit the domain-specific outcomes and the requirements of the Flemish Qualification Framework. The interviews and the available documents showed that they meet the requirements from an academic and industry point of view. As a conclusion, the targeted outcome level is judged as "satisfactory" by the panel.

Generic quality standard 2: Educational Learning Environment

The assessment panel evaluates the educational learning environment for the Master of Science in Fire Safety Engineering as satisfactory.

The **programme** of the Master of Science in Fire Safety Engineering is organised in four semesters and counts 120 ECTS. The curriculum consists of:

- Basic FSE courses (21 ECTS)
- Advanced FSE courses (54 ECTS)
- Broadening and elective courses (21 ECTS)
- Master's thesis (24 ECTS)

The basic courses are scheduled in the first semester, providing the students with the fundamentals of fire safety engineering. The students proceed with the advanced courses, addressing various aspects of fire

safety engineering, including specific topics like risk management, legislation and human behaviour. All the courses support the students to evolve towards the principles of performance-based fire protection designs. In the third semester the students test their knowledge and skills in the final course on Performance-Based Design. Students complete their study with the master's thesis.

It is the panel's opinion that the curriculum is well designed. The different aspects of the learning outcome targets are well represented. There is an equilibrium between active and passive fire protection, with room for prescriptive and performance based design. The content of the programme is based on ongoing research activities and targets for a high academic level with a large emphasis on recent developments in the field of FSE. In view of the performance based design approach, the panel recommend to emphasize slightly more the aspects related to the behaviour of structures. The industrial members of the advisory committee mentioned in the interviews that they had expressed the same opinion to the Study Programme Committee and they appreciated that their remarks were heard, in the sense that the planned modification of the curriculum will strengthen the structural component.

The programme is well balanced in terms of experimental versus computational approaches. Regarding CFD software, the panel noted that a range of different software is being used, but some are rather general than FSE specific only. It should be considered to introduce FDS in a more advanced form, as it is open source software that is used extensively in the professional field and many students use it in their thesis. The panel feels that more emphasis on FSE related software such as FDS and SMARTFIRE would be a further improvement and would result in a more targeted program.

The panel appreciates that the students can fill in a part of the programme according to their personal interest. Students make a choice out of three different types of **electives**: elective courses FSE (max. 9 ECTS), elective social courses (max. 6 ECTS) and elective courses from Ghent University in general (max. 6 ECTS). Although the panel is in favour of electives, not all courses seem to be equally relevant for FSE and the panel noted that some of the elective courses are taught in Dutch. The curriculum does not include a mandatory internship. Students may take the internship as one of their electives and most students do an internship during the summer break, corresponding to 3 ECTS.

The **Master's thesis** is a research project and students have the opportunity to conduct the research individually or in team with a fellow student, although the latter has not occurred yet. Students can choose the topic of their research from a list offered by the supervisors. The panel appreciates that the students have the option to formulate a topic themselves, in agreement with their supervisor. The fact that several students came up with a subject of their own interest is for the panel a positive sign. The progress of the research is monitored by the supervisor in weekly meetings. The research results in a master's dissertation that includes a summary in the form of an abstract or an article.

The programme offers the students an **international learning environment**. Lectures, courses and communication are in English. Furthermore, the international dimension is strengthened by the presence of the International Master and the Postgraduate Programme. Some courses are organized jointly and also the teams for joint project assignments are intentionally composed of students from the different programmes. The panel agrees that the number of international students and lecturers adds great value to the local programme.

The panel is satisfied with the **teaching and learning methods** that are used in the different courses. A large variety of different teaching techniques is used. Theoretical lectures are supported by a practically-oriented component. If the opportunity arises to introduce more practical experiments and research into FSE, without decreasing the broad academic basis taught, the panel suggests to consider it. Students are exposed to recent research projects, those made by their lecturers as well as those reported by the lecturers. Videos of experiments are being shown. As a fire safety engineer most likely will work project based, projects take an increasing role in the curriculum and are already in place in the first year. In the interviews, the panel heard one minor element from the students regarding the duration of some lectures. Lectures organised in a period of 6 consecutive hours may not be the best option, pedagogically speaking.

The programme uses the **facilities** of the Faculty in the Plateau building (Ghent) and campus Ardoyen (Zwijnaarde). The panel appreciates that the students have access to the laboratory facilities of WarringtonFireGent. This is the most important fire lab in Belgium which performs commercial tests (reaction to fire and fire resistance tests) and students use the facilities to conduct research projects. For computational lab work, the students use their own laptop or the computer infrastructure of the Faculty. For their

master's thesis, the students have also access to the High Performance Centre of the University. In the interviews, the students expressed their satisfaction with the facilities, with the exception of computer time which is not always as available as they wish. Even though students need to learn to work with limited resources, the panel believes it should be beneficial to increase their access to computer time for their simulations. Students deal with lots of projects which (partially) depend on very demanding numerical simulations and they can be bottlenecked by limited computer time and licences.

All **programme related information** is available on the electronic learning platform "Minerva". The structure of the Minerva platform could be better at the level of the courses: the name of the files or folders should give a better indication about the content that the student can expect to find in the folders. But the panel is satisfied with the content. For most courses a syllabus is available, which is an added value to just PowerPoint presentations. Preferably all courses should have a syllabus. The panel noted that the PSLO are embedded in the course specifications and in this way are easy accessible for every student. All programme-services presented (platform Minerva, facilities at WFlab) should enable students to get the needed information and support.

The **teaching staff** is well balanced and gives a good overview of the disciplines. The basic FSE courses as well as the broadening and elective courses are taught by the academic staff of the university. The advanced FSE courses are taught by either academic staff or expert visiting professors. The latter are from industry and administration and all experts in their field. They add practical and up to date fundamental knowhow to the programme. The quality of the staff has been mentioned as one of the strong points of the programme by several students and alumni. The panel agrees that the staff is of high scientific quality and very motivated. Also, there is a permanent concern of the staff to adapt the programme to the changing needs of the professional field, which is very positive.

At the moment the number of incoming students is fairly low: 6 in 2015-2016, 9 in the academic year 2017-2018. This small student population is excellently matched with the teaching staff and allows a close relationship between students and lecturers, which is seen as a positive aspect. The availability of PhD students doing research in the field of FSE provides competent support for course project work and final master theses.

The **admission requirements** are available on the website of the programme. The programme is immediately accessible for holders of a bachelor's degree of 11 engineering programmes. Students with a master's degree in Engineering Technology with sufficient links to the FSE-programme must follow an adjusted programme. Holders of a master's degree in Engineering Technology or a bachelor's degree in Engineering that is not sufficiently closely linked with the FSE-programme are admitted after passing a preparatory programme. Foreign students may be admitted after an individual application procedure. As the programme is taught in English, all students must demonstrate their language proficiency at level B2.

As the panel heard in the interviews, students come from different backgrounds, having bachelor diplomas in different domains. So, their knowledge and skills may differ as well but at the end all students must meet the learning outcomes. The basis FSE courses of the first semester are intended to bring all of the students, regardless of the domain of their prior bachelor education, to the same level. The students confirmed in the interviews that the lecturers are easy accessible for additional information. A lot of information is also available on Minerva.

During their study, **study guidance** is offered to students in different ways. The students can contact the lecturers for course-specific issues. For other issues there is a dedicated person – the FSE administrator - to support the students and who functions effectively as a bridge between the students and the staff. On the level of the Faculty, students can consult various other guidance services such as student administration, learning track counsellor and the ombudsperson, but the students in FSE don't make much use of these services. The students reported to be pleased with the general environment of the programme and its support, although there is always room for improvement. This is proven by the success of the information day at the beginning of the year that was organized for the first time in October 2017. Students who received this service faced less problems and were more satisfied than their colleagues of the previous year who needed to pave their own way.

To conclude, it is the panel's opinion that the curriculum, staff and facilities link very well together to make up a coherent and effective learning environment. The panel considers the curriculum to be well designed. The topics that are taught are relevant for practical applications of Fire Safety Engineering worldwide. A slightly more emphasis on the aspects related to the behaviour of structures would make the programme even better.

The teaching staff is composed of experts in their own fields of research. The available experimental facilities are adequate and relevant to this FSE program. Large computer facilities and specific software are available although an increase in available capacity is desirable. The facilities and services supplied to the students are overall sufficient to enable the student achieving the target learning outcomes. As a conclusion, the educational learning environment is judged as “satisfactory” by the panel.

Generic quality standard 3 - Outcome Level Achieved

The assessment panel evaluates the outcome level achieved for the Master of Science in Fire Safety Engineering as satisfactory.

The study programme adheres to the educational policy of Ghent University and the Ghent University evaluation concept. The central principle is that the assessment methods must assess the integrated knowledge, competences and attitudes of students, rather than merely testing the knowledge absorbed by the students. In addition, the evaluation concept underlines the philosophy of validity, reliability and transparency. The FSE programme adopted these principles in outlining the evaluation methods.

It is the panel's opinion that the programme uses a good variety of assessment forms, like written multiple choice or open book exams, oral exams, reports and assignments. There is a mix of periodic evaluation and permanent evaluation. The chosen methods provide a broad platform to test the student's skills and competences. The panel examined a sample of assessments and exam questions on Minerva and is satisfied with the quality level. In sum, the assessments meet the standards of a master's level.

The responsibility for composing and grading the assessments lies with lecturers, but as the panel could experience during the interviews, there is frequent consultation and finetuning between the lecturers. The course specifications, available on Minerva, contain detailed information on the assessment methods of each course. In order to prepare the students for the assessments, example questions are available on Minerva.

As mentioned in GQS 2 the projects take an increasing role in the curriculum and this goes hand in hand with a relative increase in permanent assessment. Concerning the evaluation of the projects, the panel has some remarks. Firstly about the pre-defined evaluation form.

The use of a standard form is a plus but the panel was unsure about the relative importance of different criteria (e.g. scientific quality versus layout of the report). This feeling was acknowledged in the interviews with the students. This could be made clearer to the students. Secondly, about the evaluation of group projects. Group work is positive because it stimulates teamwork. But the contribution of each student in the group must be reflected in the individual marks of every team member. The panel noticed in the interviews that students are unsure about how this process of grading is carried out. The panel suggests a more widespread use of student peer-assessment, in order to grasp the group dynamic as well as the individual contributions. The panel was informed that there is a new system in place and that this should favour the use of peer assessment as it becomes better known to the teaching staff. Finally, during the interviews the students expressed the need for more structured feedback.

The evaluation of the master's thesis is based on the year's work done, the quality of the written dissertation and the oral defence. As FSE is a new programme, there are only six graduates until now. The panel read all master dissertations and finds these to be of the appropriate level. The panel also examined the evaluation forms and for the panel there is some discrepancy between the value and level of the scientific work delivered and the graded mark. The panel believes that the weight of the so called "soft skills", which are nevertheless important for a FSE, can influence the final grade of the master dissertation too much. It is not very clear to the panel which weight is given to the different categories under the "product assessment". In the interviews the programme management explained that the assessment form is used faculty wide but that adjustments in weighting the categories are possible. The programme implemented the assessment form for the first time in the past academic year and plans an evaluation of the use of it. The panel advises to review thoroughly the weight of the different criteria. Because of the high scientific level of a FSE, it is important that this is reflected in the master dissertation assessment. This said, the panel emphasizes that five out of six master dissertations meet the standards of a master's level whereas one was less convincing.

The feedback that the panel received from alumni and professionals was very positive. The professionals emphasized in the interviews the fact that there are not enough fire safety engineers who graduate for the market. The employers are struggling to recruit such profiles. So, employability is very high. Students receive job offers even before they graduate.

To conclude, it is the panel's opinion that the study programme has an appropriate system of assessment, testing and examination. The shown assessments including the master's dissertations together with the feedback from the industry, students and graduates show that the programme achieves its targeted outcome level. As a conclusion, the outcome level achieved is judged as "satisfactory" by the panel.

Final judgement of the assessment panel

Generic Quality Standard 1 – Targeted outcome level	S
Generic Quality Standard 2 – Educational learning environment	S
Generic Quality Standard 3 – Outcome level achieved	S

As the Generic quality standards 1, 2 and 3 are evaluated as satisfactory, the final judgement of the assessment panel about the Master of Science in Fire Safety Engineering is satisfactory, such according to the decision rules.

Summary of the recommendations for further improvement of the study programme

Generic quality standard 1 – Targeted Outcome Level

/

Generic quality standard 2 – Educational learning environment

- Emphasize slightly more the aspects related to the behaviour of structures in the curriculum.
- Consider introducing FDS in a more advanced form, as it is open source software which is used extensively in the professional field and by many students in their thesis.
- Consider increasing the access to computer time for the student's simulations.
- Improve the meaning of the structure of the Minerva platform at the level of the courses so that the name of the files or folders give a better indication about the content.
- Avoid organizing lectures in a period of 6 consecutive hours.
- Provide a syllabus for all courses.

Generic quality standard 3 – Outcome Level Achieved

- Review the weight of the different criteria for assessing the master's theses (e.g. scientific quality versus layout and presentation of the report).
- Make the relative importance of the different criteria for assessing master's theses and project assignments clearer to the students.
- Make the individual mark given to the students after an assignment made in groups more clear to the students.
- Peer assessment in assignments performed in groups should be more widely used.
- Provide more structured feedback about projects and group work.

The programme management has informed the panel about the improvement actions that have been taken or are planned, following the recommendations of the panel. The panel appreciated that their remarks were heard.

APPENDICES

APPENDIX I

Curricula vitae of the members of the assessment panel

Ann Beusen is architectural engineer and works as advisor VIPA and teamleader Bouwtechnisch Team of the department Welzijn, Volksgezondheid en Gezin of the Ministry of the Flemish Community. She chairs the Technical Council for Fire Protection that analyses requests for deviation of fire safety regulations concerning children's day care centers and senior's care centers.

Jean-Marc Franssen graduated as a civil engineer from the University of Liege in 1982. The first part of his career at the University of Liege was with the FNRS (NFWO) where he conducted research work on the behaviour of building structures under fire and on the development of compartment fires. He got his PhD on this subject in 1987 and his aggregation in 1997. Since 2008, he is a professor at the University of Liege where he is the director of the fire resistance laboratory. He was a member of the draft team of the fire part of Eurocode 3 on steel structures and is the author or co-author of several books and more than 100 papers on the subject of structures in fire. He founded the "Structures in Fire" movement. In Belgium, he is a member of the Superior Council for safety against fire and explosion of the Ministry of Interior and is vice-chairman of ISIB "Institut de Sécurité Incendie – Instituut voor Brandveiligheid". His research topics cover the behaviour of structures subjected to fire, with non-linear numerical models as well as simple design equations, and the development of temperatures in fire compartments, with zone models as well as parametric fire models.

Larsen Priem graduated as a bachelor in Marine Engineering from the Antwerp Maritime Academy. He is a master student Industrial engineering Electromechanics at the University of Antwerp.

René Van den Braembussche is Honorary professor of the Turbomachinery and Propulsion department at the von Karman Institute since 2009. He was part-time professor at the VUB, visiting professor at the University of Genova and the academy of science in Beijing. He is a Fellow of ASME (retired), was associate editor of the ASME Journal of Turbomachinery and laureate of the biannual NFWO-FNRS award "Iwan Akerman". He is reviewer for several international journals and evaluator of National Sciences and Engineering Research Council of Canada, Deutsche Forschung Gemeinschaft and European Commission (FP7 and Clean Sky 2 program). He recently published a book on "Design and Analysis of Centrifugal Compressors".

APPENDIX II

Time schedule of the site visit

Thursday 8 November 2018

14:00–16:00	internal consultation + consultation documents
16:00–17:30	programme management
17:30–17:45	internal consultation
17:45–18:45	alumni and professional field
18:45–19:00	internal consultation
19:00	diner panel

Friday 9 November 2018

8:30–9:00	internal consultation
9:00–10:00	programme-specific infrastructure
10:00–11:00	students
11:00–11:15	internal consultation
11:15–12:15	teaching staff
12:15–13:00	lunch
13:00–13:45	supporting staff
13:45–14:00	internal consultation
14:00–15:00	consultation round
15:00–15:30	programme management
15:30–17:30	final consideration
17:30	oral report

