UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola Tècnica Superior d'Enginyeria
de Camins, Canals i Ports de Barcelona

The self-assessment report for degree programme accreditation

- Master's Degree in Civil Engineering (MDCE)
- Master's Degree in Numerical Methods in Engineering (MDNME)

Escola Tècnica Superior d'Enginyeria de Camins, Canals i Ports de Barcelona
Universitat Politècnica de Catalunya

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1.0	03/21/2022	Original self-assessment report for AQU/ASIIN

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A. About the Accreditation Procedure

1. General Data

Website of the Higher Education Institution	https://www.upc.edu/en
Faculty/Department offering the Degree Programme	https://camins.upc.edu/en

This document describes the Self-Assessment Report (SAR) for the accreditation of two master degrees at the Barcelona School of Civil engineering at the UPC-BarcelonaTech (Universitat Politècnica de Catalunya). UPC is a public university in Spain devoted to higher education and research, specialised in the fields of engineering, architecture and applied science.

Two agencies, AQU Catalunya and ASIIN, are involved in the accreditation process. Barcelona School of Civil Engineering is applying both to AQU and ASIIN (through the AQU-ASIIN partnership). In addition, Barcelona School of Civil Engineering is also applying to the Eur-Ace quality label, which is awarded to degree programmes.

2. Self-assessment report development

Self-assessment Report team

A specific internal assessment committee, namely the Internal Evaluation Committee (in Catalan, CAI, Comitè d'Avaluació Interna), has been in charge of elaborating the present Self-Assessment Report.

Name & Surnames	Position	Collective
Esther Real Saladrigas	Director	Academic Staff
Martí Sánchez Juny	Deputy director for Planning and Academic Quality	Academic Staff
Eva Oller	Academic secretary	Academic Staff
Francesc Soriguera Martí	Deputy director of Master Degrees and Director of studies of Master's Degree in Civil Engineering	Academic Staff
César Mösso Aranda	Deputy director and director of studies of the Bachelor's Degree in Marine Science and Technologies and director of studies of the Bachelor's Degree in Environmental Engineering	Academic Staff
Daniel Fernàndez	Deputy director and director of studies of the Bachelor's Degrees in the Civil Engineering Environment.	Academic Staff
Riccardo Rossi	Responsible master's degree MDNME	Academic Staff
Daniel Fernàndez	Responsible master's degree MEA	Academic Staff
Pere Roca Fabregat	Responsible master's degree SAHC	Academic Staff
José Turmo Coderque	Responsible master's degree MEEC	Academic Staff
Jean Vaunat	Responsible master's degree MET	Academic Staff
Paula del Río Fernández	Student delegate	Student
Xavier Andreu Vallecillos López	Student of Bachelor's Degree	Student
Mar Rosell Sáenz de Villaverde	Student of Master's Degree	Student
Victor Cullell Tebé	Head of UTGAC	Support Staff
Miquel Rodríguez Rodríguez	Head of USIRE UTGAC	Support Staff
Lluis Navarro Guareño	Support Staff for Quality	Support Staff
Oriol Altisench	Dean of the Col·legi de Camins, Canals i Ports de Catalunya	Professional
Manuel Ausaverri	INDRA	Professional

Table 1. Members of the Self-assessment report Team.

Self-assessment Report development process

Following the demand for accreditation of the program by AQU Catalunya, the Internal Assessment Committee (CAI) of Escola de Camins, made up of representatives of the different interest groups identified (professors, students, administration and services staff, and 2 members of the professional field) meets.

The choice of these people for the CAI is justified and has the following characteristics:

- The School's director
- The person responsible for the Planning and Quality of the different academic programs.
- The heads of studies of the different academic programs of the School.
- The person who supports academic coordination, Academic Secretary.
- UTGAC technical staff: Lluís Navarro, Miquel Rodríguez and Víctor Cullell.
- A student acting as a student representative before the governing and management bodies.
- A Bachelor's student acting as a student representative on behalf of undergraduate students.
- A Master's student acting as a student representative on behalf of master's students.
- Two external representatives of the professional field: the Dean of the Col·legi de Camins, Canals i Ports de Catalunya, for his special relevance among graduates, and a representative of one of the main companies in the country which is a graduate of the Escola de Camins.

The CAI has been working on the preparation of the self-assessment report more intensively during the months of November 2021 to March 2022. The teaching period has been assessed since the academic year, which includes its last accreditation (2018) and subsequent follow-up, to date. Different committee members have been appointed as responsible for developing the initial versions of each section and have worked together with cooperative work tools (i.e., Google Drive). The process has been enriching, although it has required an additional coordination effort to ensure that all information is provided in a consistent manner but without duplication.

In the first instance, the report was reviewed by the Planning, Evaluation and Quality Office (GPAQ) of the UPC. Subsequently, suggestions were incorporated and it was approved by all the members of the CAI and by the Standing Committee of the School, a collegiate body with competencies. It has subsequently been made known to all faculty, students and administrative and service staff, and a deadline was established for the collection of their contributions.

Actions	**Dates**	**People involved**
1st coordination meeting	05/10/2021	Academic & Support Staff
CAI update	12/10/2021	School's Director & Academic Staff
Collection of data and evidence	October-November 2021	Support Staff
Analysis of the contents and writing of the self-assessment report	November 2021-March 2022	CAI
1st global review by CAI members of the document	17-21/01/2022	CAI
Delivery of 1st draft to GPAQ	18/02/2022	CAI
Reception of suggestions to the GPAQ's technical review	23/02/2022	CAI
Pooling meeting	25/02/2022	GPAQ, Academic & Support Staff
Incorporation of new content developed following the technical review of the GPAQ	01-11/03/2022	Academic & Support Staff
Distribution of the document to the members of the CAI and the ORM	12-18/03/2022	CAI
Final proposal and closure	20/03/2022	CAI
Public exhibition of the document	21-25/03/2022	Academic Staff
Self-assessment report approval by the CAI	23/03/2022	CAI

Self-assessment report approval by the Standing Committee	23/03/2022	Standing Committee
Incorporation of suggestions	26/03/2022	Academic & Support Staff
Delivery to GPAQ of the self-assessment report's final version	28/03/2022	School's Director

Table 2. Actions that have been taken to prepare the self-assessment report.

Self-Assessment Report evaluation

The agents involved in the preparation of the self-assessment report have shown a high degree of involvement and commitment in the CAI working meetings. The evidence and data used for the preparation of the document was considered to be sufficient and adequate by the members of the CAI.

The quality of the evidence and data used is guaranteed because most of it comes from the official databases of the UPC, especially from the Planning, Evaluation and Quality Office (GPAQ). The CAI guarantees that the samples of executions provided are real samples.

The groups involved in this process (Teaching & Research Staff (TRS), Administrative & Services Staff (ASS), students) have expressed their interest in this process because it serves to highlight aspects related to the quality of the Escola de Camins. On the other hand, this process allows and makes it possible to detect and implement new processes for the continuous improvement of the school.

3. Document Structure

This Self-assessment report includes the necessary information for the joint accreditation process carried out by AQU and ASIIN quality agencies.

The remainder of this document is structured following ASSIN Guideline for Programme Accreditation ASIIN Seal & European Networks (EUR-ACE®, Euro-Inf®, Eurobachelor®, Euromaster®) v2017.

AQU defines 6 standards for the criteria and requirements of programme assessment (2014, "Guide to the accreditation of recognised first and second cycle degree programmes"). The left-hand side of Table 3 shows ASSIN guidelines and criteria while their related AQU standards are indicated on the right-hand side of the same table.

ASSIN Guidelines	**Standard AQU**
1. The Degree Programme: Concept, content & implementation	
Criterion 1.1	S1.1 S1.2 S2.1
Criterion 1.2	S1.2
Criterion 1.3	S1.2
Criterion 1.4	S1.3 S1.5 S2.1
2.The Degree Programme: Structures, Methods & Implementation	
Criterion 2.1	S1.2 S1.4 S1.5 S6.1 S6.2 S6.3S6.4
Criterion 2.2	S1.2
Criterion 2.3	S6.2
Criterion 2.4	S5.1 S5.2
3. Exams: System, Concept & Organisation	S6.2
4. Resources	
Criterion 4.1	S4.1 S4.2
Criterion 4.2	S4.3
Criterion 4.3	S5.2
5.Transparency and Documentation	
Criterion 5.1	S2.1 S2.2
Criterion 5.2	
Criterion 5.3	S1.5
6. Quality Management: Quality Assessment and Development	S2.3 S3.1 S3.2 S3.3

Table 3. ASIIN guidelines and AQ standard.

Additionally, the following information required by AQU has been added:

- Context information has been included at the beginning of this document.
- The improvement plan has been summarised at the end of the report in Section D. Continuous improvement process. A more detailed improvement plan has been included as an annex.
- COVID-19 specific actions have been described in different sections.

4. Seals applied for

Name of the degree programme (in original language)	**(Official) English translation of the name**	**Labels applied for [1]**	**Previous accreditation (issuing agency, validity)**	**Involved Technical Committees (TC)[2] (will be completed by ASIIN)**
Máster Universitario en Ingeniería de Caminos, Canales y Puertos por la Universidad Politécnica de Catalunya	Master's Degree in Civil Engineering by the Universitat Politècnica de Catalunya	ASIIN, EUR-ACE® Label	ASIIN, 27.03.2015 – 30.09.2020 EUR-ACE®, 27.03.2015 – 30.09.2020	
Máster Universitario en Métodos Numéricos en Ingeniería por la Universidad Politécnica de Catalunya	Master's Degree in Numerical Methods in Engineering by Universitat Politècnica de Catalunya	ASIIN, EUR-ACE® Label	ASIIN, 27.03.2015 – 30.09.2020 EUR-ACE®, 27.03.2015 – 30.09.2020	

Table 4. Labels applied for, accreditations and TC involved in the MDCE and MDNME programmes.

[1] ASIIN Seal for degree programs; EUR-ACE® Label: European Label for Engineering Programs; Euro-Inf®: Label European Label for Informatics; Eurobachelor®/Euromaster® Label: European Chemistry Label

[2] TC: Technical Committee for the following subject areas: TC 01 - Mechanical Engineering/Process Engineering; TC 02 - Electrical Engineering/Information Technology; TC 03 - Civil Engineering, Geodesy and Architecture; TC 04 - Informatics/Computer Science; TC 05 - Physical Technologies, Materials and Processes; TC 06 - Industrial Engineering; TC 07 - Business Informatics/Information Systems; TC 08 - Agriculture, Nutritional Sciences and Landscape Architecture; TC 09 - Chemistry; TC 10 - Life Sciences; TC 11 - Geosciences; TC 12 - Mathematics; TC 13 - Physics.

B. Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Master's Degree in Civil Engineering by the Universitat Politècnica de Catalunya	Máster Universitario en Ingeniería de Caminos, Canales y Puertos / Master's Degree in Civil Engineering	- Speciality in structural and construction engineering - Speciality in geotechnical engineering - Speciality in water engineering - Speciality in computational engineering - Speciality in transportation engineering and urban planning - Speciality in environmental engineering and sustainability	7	Full time	No	4 Semesters	120 ECTS	2012, every semester
Master's Degree in Numerical Methods in Engineering by Universitat Politècnica de Catalunya	Máster Universitario en Métodos Numéricos en Ingeniería / Master's Degree in Numerical Methods in Engineering		7	Full time	No	4 Semesters	120 ECTS	2006, annually in the fall semester

Table 5. Characteristics of the MDCE and MDNME programmes.

[3] EQF = The European Qualifications Framework for lifelong learning

C. Self-assessment for the AQU/ASIIN/Euro-Ace Seal

Barcelona School of Civil Engineering

Barcelona School of Civil Engineering (hereinafter Escola de Camins) unique in Catalonia in the field of Civil Engineering, is a school of higher education that was created in 1973 on the initiative of a series of Catalan road engineers and companies at the Universitat Politècnica de Barcelona, which in 1984 became the Universitat Politècnica de Catalunya. A board of trustees was set up to create it, chaired by civil engineer Victoriano Muñoz Oms, who commissioned José Antonio Torroja Cavanillas to direct the new school. Professor Torroja set up a school model with a core of highly qualified professors, with an exclusive dedication to teaching and research that has persevered throughout the years.

The School has a proven track record in the training of Civil Engineers, Public Works Engineers and Geological Engineers and is internationally recognized for the quality of our graduates, the high-level research carried out by our teaching staff through the 23 research groups recognized by the Generalitat de Catalunya and for their contribution to the social and economic progress of our country.

The School is located on the North Campus of the UPC and has modern facilities, some shared with other centres such as the Rector Gabriel Ferraté Library, the entrepreneurship space, the study rooms, the multimedia laboratory and recording set, the reprographic services, the restoration facilities, the bank office, etc. and the student house, where the School's student's union and other student associations carry out their activities.

In addition to the facilities, another important pillar of the centre is the educational platforms and ICT-based tools that allow for a qualitative monitoring of teaching Examples of these tools are: ATENEA digital campus, "CaminsOpenCourseWare" (a portal through which the School offers universal access to knowledge), Media Camins (the School's YouTube channel), and the MOOC "The language of engineering" (which allows the consolidation of the basic knowledge necessary to undertake first year's engineering courses).

In the 2006-2007 academic year, the process of adapting degrees to the EHEA began with the launch of the first specialized university master's degrees, which culminated in 2007-2008. The 2010-2011 academic year saw the onset of the degrees with professional attributions and the extinction of the diploma courses. The Degree in Technical Engineering in Public Works was implemented simultaneously in all the courses and, therefore, had the most graduates. In 2012-2013, the Master's Degree in Civil Engineering was introduced with professional attributions. In the 2018-2019 academic year, the school management, promoted an analysis and assessment of the centre's degree map among the agents involved (teaching staff, school management, student representatives, private companies in the sector, public administrations, etc.). This driving group concludes, after the results of recent years, among others, the deprogramming of the Bachelor's Degree in Geological and Environmental Engineering and the decline in demand for the Bachelor's Degree in Public Works Engineering, that the School's degree offer required a reorganization. This group continues to work with the school management on the new approach, and as a result the following proposal is made:

2018-2019	**Process**	**2020-2021**
Bachelor's Degree in Civil Engineering (2010 program)	Re-verification	Bachelor's Degree in Civil Engineering (2020 programme)*
Bachelor's Degree in Public Works	Extinction	
Bachelor's Degree in Geological & Environmental Engineering	Deprogramming in 2019-2020	
Bachelor's Degree in Marine Science & Technologies		Bachelor's Degree in Marine Science & Technologies

	Verification	Bachelor's Degree in Civil Engineering Technologies
	Verification	Bachelor's Degree in Environmental Engineering

* Includes the requirements of Orders CIN 307 and 309 from 2009

Table 5. Status quo of the MDCE and MDNME programmes with regards to the verification process.

This proposal for new degrees was taken to the School Board on April 3rd 2019, debated and approved (evidence: minutes of the School Board session).

Currently the School offers:

Bachelor's Degrees which qualify for the exercise of regulated professions:
- Civil Engineering (2010 program in extinction)*
- Civil Engineering (2020 program)
- Public Works Engineering (in extinction)*
- Bachelor's Degree in Civil Engineering (taught in English, in extinction)*

* These programs were certified by AQU, ASIIN and EUR-ACE in 2015.

Bachelor's Degrees which do not qualify for the exercise of regulated professions:
- Marine Science & Technologies
- Environmental Engineering
- Civil Engineering Technologies (taught in English)

Master's Degrees which qualify for the exercise of regulated professions:
- Master's Degree in Civil Engineering (certified by AQU in 2018 with excellence, ASIIN and EUR-ACE in 2015).

Specialty master's Degrees:
- Master's Degree in Environmental Engineering.
- Master's Degree in Geotechnical Engineering.
- Master's Degree in Structural & Construction Engineering.
- Master's Degree in Numerical Methods in Engineering[4] (certified by AQU, ASIIN and EUR-ACE in 2015).
- Master's Degree in Structural Analysis of Monuments & Historical Constructions (international master's degree, member)
- Master's Degree in Urban Mobility

The School currently has 123 exchange agreements with foreign universities in 36 countries in Europe, Asia, Latin America and the United States, as well as 11 double degree agreements with prestigious universities. In addition, it actively participates in prestigious global networks such as EUCEET (European Civil Engineering Education & Training), CLUSTER (Consortium Linking Universities of Science & Technology for Education & Research), TIME (Top Industrial Managers for Europe), UNITECH, CINDA (Centro Interuniversiario de Desarrollo) and Smile Magalhaes. The former two institutions are formed by prestigious universities in Latin America and Europe. These networks allow for the establishment of exchange agreements or double degrees and the promotion of joint initiatives to share knowledge, ideas and projects.

The School also participates in several other mobility programs, such as: South America, Erasmus+ KA103 studies, Erasmus+ KA103 internships, Erasmus+KA107 studies, UPC-China, UPC-Canada, UPC-Europe, UPC-World, UPC-USA, SICUE (mobility within Spain).

Evolution of Students

[4] This includes the 3 Double Degrees with the Master's Degree in Numerical Methods in Engineering, signed in 2019-2020.

Figure 1 shows the evolution of enrolled and graduated students since the 2017-2018 academic year. The degree dashboard presents a more detailed description, by degree, of the main indicators of the school.

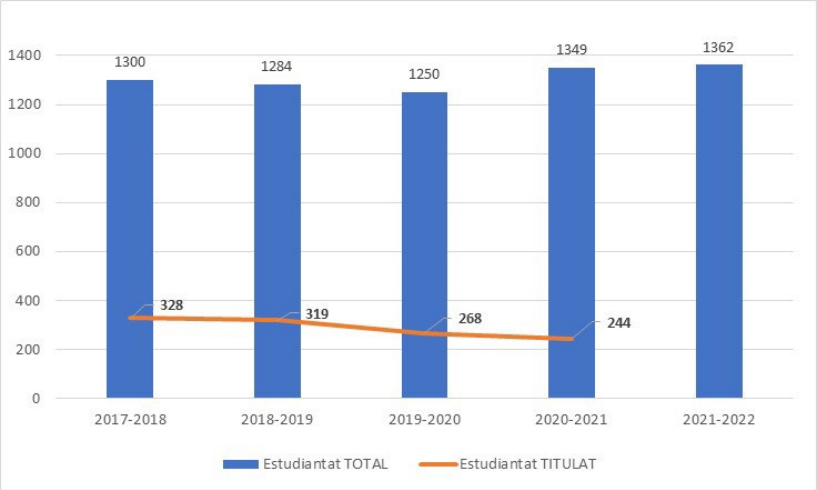

Figure 1. Evolution of enrolled and graduated students from Barcelona School of Civil Engineering.

Of particular relevance to the school is the mobility of students (Figures 2 and 3). As the number of outgoing students is the third highest in the UPC (evidence E.0.1.) and the number of incoming students is also among the 4 highest (evidence E.0.2)

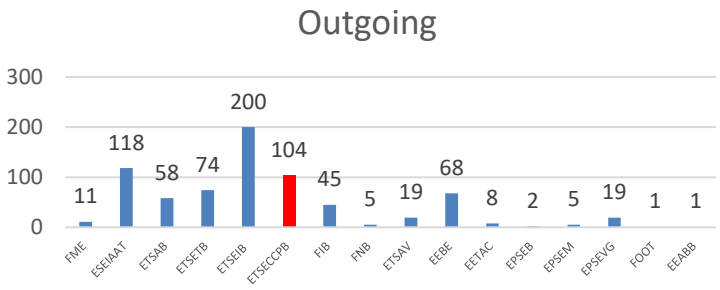

Figure 2. Total number of outgoing students in the UPC during the 2020-2021 academic year per centre.

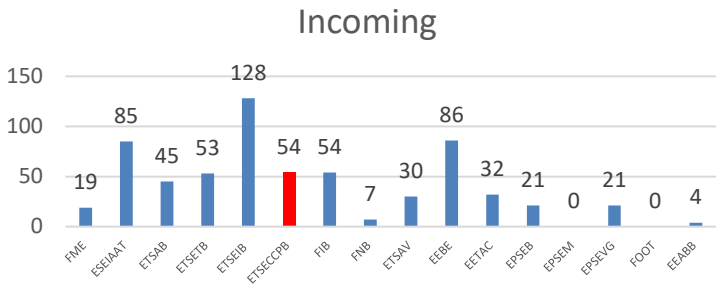

Figure 3. Total number of incoming students in the UPC during the 2020-2021 academic year per centre.

Professors and typology

		TRS with a PhD and in an open-ended contract	TRS without a PhD and in an open-ended contract	TRS with a PhD and not in an open-ended contract	TRS without a PhD and not in an open-ended contract	TOTAL
TRS composition on 1st assignment	2020-2021	104	3	43	54	204
	2019-2020	108	3	39	57	207
	2018-2019	111	5	42	54	212
	2017-2018	114	6	33	48	201
	2016-2017	116	6	34	49	205

Table 7. Teaching and Research Staff (TRS) per typology and year.

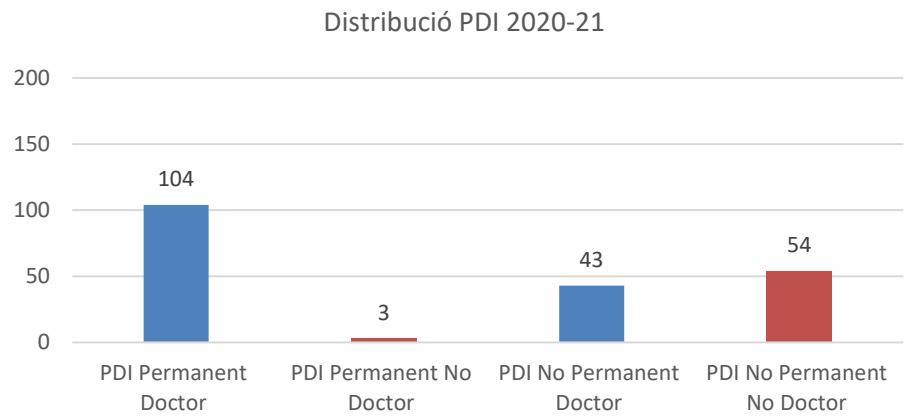

Figure 4. Distribution of TRS.

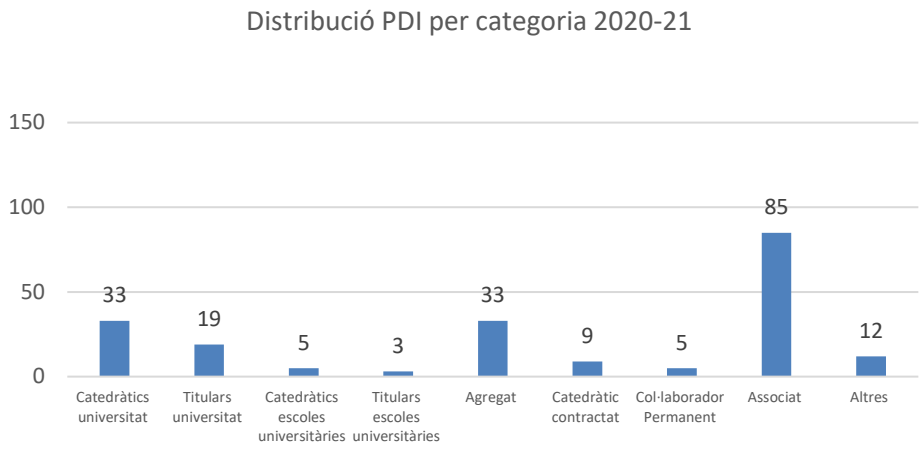

Figure 5. Distribution of TRS by professional category.

As observed in Table 7, the total number of professors is 204, of whom 72% are doctors. The ratios of staff in an open-ended contract show that more than 97% are doctors.

Finally, we would like to highlight the good results of the School in the national and international rankings (evidence E.0.3 and evidence E.0.4). Barcelona School of Civil Engineering ranks 29th in the world in the area of Civil and Structural Engineering, 8th in Europe, and is number 1 in Spain.

5. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Master's Degree in Civil Engineering (MDCE)

- Curriculum: https://www2.camins.upc.edu/plaestudis/2020/master_MECCP.php?idioma=en
- Competencies: https://camins.upc.edu/en/Studies/master/civil-engineering

Master's Degree in Numerical Methods in Engineering (MDNME)

- Curriculum: https://www2.camins.upc.edu/plaestudis/2021/master_MMNE.php?idioma=en
- Competencies: https://camins.upc.edu/en/Studies/master/numerical-methods-in-engineering

The upper-links list the objectives, competencies and expected learning outcomes of the analysed programs. They are accessible to any group of interest, concise and easy to understand.

At the time of design and formulation of the programs, different working groups were set up, which were formed by the different groups of interest (professors, students, managers, representatives of the professional world, etc.) who participated and contributed different points of view (see Point 2 of the Program Verification Reports (MDCE, MDNME), which describes the program formulation process). The process of monitoring the degrees, including the various subsequent accreditations carried out by AQU, is done at a first level and annually by the academic committees of the programs and, in the case of the accreditation processes, by the corresponding CAI. During these processes, the potential amendments and improvement plans are analysed, discussed and proposed (evidence 1.1.1).

As for the objectives and learning outcomes, they largely coincide with those described in the SSC (ASIIN_SSC_03_Civil_Engineering), as already shown in the previous accreditation. It should be noted that no further modifications were deemed necessary.

Master's Degree in Civil Engineering

The competence profile of the graduates of the Master's Degree in Civil Engineering is split up into three parts: general and basic competences, transverse competences and subject-specific competencies, all defined by the university itself based on the legal framework for the regulated profession. The panel confirmed a full conceptual compliance with the requirements for both the ASIIN and the EURACE seal (see Annex 1). The expected competences show a clear progress compared to the Bachelor's level. As an example for the conceptual compliance with the ASIIN requirements, the panel stated that e.g. the ability "to face complex projects in an interdisciplinary and holistic way in light of sustainability, environmental, ecological and economic aspects, and to operate them responsibly by the help of contributions of other disciplines" is reflected in the programme requirement CB8 (basic competence), defining "the capacity to integrate knowledge and face complexity of making a judgement based on an incomplete or limited information and, in the same time, including reflections on the social and ethical responsibility of their knowledge and judgments". In addition, the ability to provide "novel and complex designs, constructions and developments (design), e.g. construction of buildings, development of new building products and components, development of new construction methods, design of wastewater systems, planning and development of transport facilities" is reflected in the programme requirement CienTec10 (subject-specific competence), defining the "ability to plan, manage and exploit infrastructures related to civil engineering", as well as in requirement CienTec3 (subject-specific competence), foreseeing the "knowledge of all types of structures and their materials, and ability to design, project, execute and maintain civil works structures and buildings".

Master's Degree in Numerical Methods of Engineering

The competence profile of the graduates of the Master's Degree in Numerical Methods of Engineering is structured in the same way as the one of the Master's Degree in Civil Engineering and also fully complies with the requirements of the ASIIN and EURACE seals (see Annex 1). In the following analysis, the panel concentrated on the subject-specific part, given that, some of general or transferable competences are similar or partly the same as in the case of the Master's Degree in Civil Engineering and were already dealt with above. Given that, this programme is a priori conceived as an interdisciplinary one, the competences selected below are applicable to a vast range of tasks and duties in the engineering. For instance, the subject-specific ability "to develop new, challenging and innovative methods for documented evidence and forecasting, such as methods for verifying stability, energy efficiency, noise protection, flood protection, water supply" as defined by the Technical Committee 03 is integrated into the broader competence CE1 which refers to the knowledge of the advanced practical application of the numerical modelling in Civil, Environmental, Mechanical, Shipbuilding or Spatial Engineering, as well as nano-, bio-engineering. Also, the ability "to establish quality management systems based on scientific methods, to support and develop them further and by this to evaluate their own activities and the activities of others" is reflected in the programme learning outcome CE4, stating the knowledge of the criteria of validation and verification and the ability to apply them in the quality management of the numerical simulation. Furthermore, the competence "to integrate interdisciplinary research and development processes in planning and concepts", which can be placed among the crucial ones, is represented by the competence CE5, requiring the experience in applying modern numerical simulation tools in multidisciplinary problems of engineering and applied sciences.

Overall, the panel appreciated the high standards for teaching and learning applied by the school, and stated that all the programmes presented here are conceived and implemented at state-of-the-art international level. However, the panel considered the list of the competencies for both the master's programmes to be too long and partly too detailed to serve as a good point of reference for students and teaching staff. The panel understood that both teaching staff as well as students usually refer to the "guía docente", or course guide, where only 2-3 programme learning outcomes are mentioned equally as the respective module learning outcomes so that there is no risk that the stakeholders will get confused by a potential long list. However, the panel recommended to shorten the list of the competencies on programme level or to sum them up/further generalize them, given that by now several competencies (e.g. Master's Degree in Civil Engineering: AFC2, CienTec4 – Ability to design, evaluate, build and maintain hydraulic works) could be rather module-learning outcomes than programme-learning outcomes.

Moreover, the panel learned that most students were not aware of the learning outcomes on programme levels, nor were the invited employers well informed about the "competence profile" or intended learning outcomes of the programmes. For the latter reason, the peers recommend to further enhance the involvement of the representatives of the employers' side and of the industry, but also alumni, in the definition and development process of the learning outcomes and to make sure that students are informed in a comprehensive manner about what they are expected to achieve upon graduation.

We agree that the list of learning outcomes is rather long. This is motivated by the process of design of "order CIN" from which we must develop the programs. Actually, these documents establish the learning outcomes to be satisfied by the program in order to cover all the by-law engineering permits in Spain. As an example, CIENTEC for the Master's Degree in Civil Engineering intend to cover all the possible activities of a Civil Engineer from the point of view of "signing" projects or legal responsibility in infrastructure construction, even in an exclusive manner. This means that engineers with another education and competencies cannot be legally responsible for this type of projects because they do not have the skills necessary. In short, specific learning outcomes are largely conditioned by legal aspects of the Organization of Civil Engineering in Spain, which states 2 levels: Technical Engineer (Bachelor's Degree) and Engineer (Master's Degree).

As for the objectives and learning outcomes of both master's degrees, they are considered viable and valid, as demonstrated by the indicators obtained over time.

Master's Degree in Civil Engineering (MDCE):

The values obtained for the MDCE program are shown in the following link: MDCE indicators
Moreover, the values provided in the verification are:

- Graduation rate: 85%
- Dropout rate: 5%
- Efficiency rate: 95%

However, the graduation rate for the 2018-19 academic year is significantly below (79.8%) the committed value (85%). This unique value is explained by the increase in double degree students, which implies a delay in the graduation of these students. Also, in the 2020-2021 academic year, the results of graduation and efficiency rates are slightly lower (84.4% and 93.4%, respectively) than expected (85% and 95%), due to COVID, which slightly delayed some Master's Thesis defences, and thus delayed graduation. On the contrary, the same 2020-2021 dropout rate is exceptionally good compared to the expected results, with a result of 0%.

Master's Degree in Numerical Methods in Engineering (MDNME):

The values obtained for the MDCE program are shown in the following link: MDNME indicators.
Moreover, the values provided in the verification are:

- Graduation rate: 78%
- Dropout rate: 15%
- Efficiency rate: 90%
-

The values obtained, expressed in the tables of the previous link, reflect that they are, in general, within the values foreseen in the verification of the degree:

The class of 2018-2019 had an exceptionally high dropout rate. A more accurate analysis of the reasons for this is based on the fact that it was an 8-student class (who enrolled in the master's degree in 2017-2018), which amplifies the effect of any deviation. Of these 8 students, 1 has delayed defending his Master's thesis, another has currently left the program for "work" reasons but has the intention of completing the master's degree in the near future, and two more have actually dropped out of school. This deviation also caused an abnormal graduation rate during the 2018-2019 academic year.

Fortunately, as shown in the table that refers to the evolution of enrolment, the number of enrolled students evolved favourably from 8 in 2017 to 28 in 2019. This ensures that such results as those of the 2018-2019 academic year will not repeat in subsequent years.

Special mention should be made of the deviation in the data for the 2020-2021 academic year, which is similar to that mentioned in the case of the MDCE due to COVID.

Surveys of students, employers, teaching staff and administration and services staff

MDCE student satisfaction

MDCE student satisfaction surveys are carried out at the UPC on a voluntary basis, which means that the participation rate is low and, therefore, sometimes unrepresentative. However, the surveys show that those students who participate show remarkable positive opinions (above 3.5 out of 5, in terms of satisfaction with the courses, and above 4 out of 5 with regards to the teaching staff). In addition, from the results, we can extract that the students' satisfaction with the internship placements has constantly increased in the last academic years, reaching a value of 4 out of 5 in the 2019-2020 academic year, which is the last year that recorded data on that account (satisfaction indicators tab of evidence 1.1.2).

Regarding mobility programs, the students' satisfaction is very high, scoring always above 4 out 5, and this considering that all students have had a mobility experience during or just before the masters' degree, as it is mandatory. In addition, it can be observed that all (100%) of the graduated students are working, meaning the studies have an excellent working insertion rate.

Working insertion rate of MDCE graduates

From the 2020 employment outcomes for graduates of master's degrees elaborated by AQU (evidence 1.1.3) we deduce that, in general, job satisfaction of MDCE graduates is remarkable both in terms of job content and salary.

In spite of the previous, only around one third of the students consider that the obtained degree is required to develop their working activities. Although the perception of students with regard to the degree obtained may seem to give a bad result, it could be partly justified by the fact that the MDCE provides a generalist and holistic education in the vast field of civil engineering, while current work placements tend to a particular discipline. The training our graduates receive might allow them to learn and progress quickly in their jobs, although they do not become aware of this right away.

MDNME student satisfaction

MDNME student satisfaction surveys are carried out at the UPC on a voluntary basis, which means that the participation rate is low and, therefore, sometimes unrepresentative. However, the surveys show that those students who participate show remarkable positive opinions (above 3.5 out of 5 in terms of satisfaction with the courses, and above 4 out of 5 with regards to the teaching staff (satisfaction indicators tab of evidence 1.1.4).

Working insertion rate of MDMNE graduates

From the 2020 employment outcomes for graduates of master's degrees elaborated by AQU (evidence 1.1.5) we can extract that the sample of people who answered the job satisfaction survey slightly exceeds one third of the surveyed population, which makes it necessary to take the results of this survey in cautious consideration.

Data shows that, in general, job satisfaction of MDMNE graduates is remarkable both in terms of job content and salary.

Finally, we can confirm that both master's degrees scored a good position in the study "Access to the labour market for graduates of Master's degrees from Catalan universities" by AQU Catalunya (evidence 1.1.6).

Regarding the correlation of competency profile and learning results, it can be seen in the following tables. The full name of the acronyms of the competencies can be seen in Annex 2.

Master Degree in Civil Engineering (MDCE)

		Competencies		
Modules	**Subjects**	**Basic**	**Cross**	**Specific**
Scientific and Technological	Expansion of Scientific and Technological training	CB6, CB7, CB8, CB9, CB10	G3, G4	AFC1, AFC2, CienTec2, CienTec3, CienTec4, CienTec5, CienTec7
	Application of Advanced Sciences and Technologies	CB6, CB7, CB8, CB9, CB10	G1, G3, G4	CienTec1, CienTec2, CienTec3, CienTec4, CienTec5, CienTec6, CienTec7, CienTec8, CienTec9, CienTec10
Specialty track	Specialty in Structural and Construction Engineering	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec2, CienTec3
	Specialty in Geotechnical Engineering	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec1, CienTec5

	Specialty in Computational Engineering	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec1, CienTec2, CienTec3, CienTec4, CienTec5, CienTec6, CienTec7, CienTec8, CienTec9, CienTec10
	Specialty in Water Engineering	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec4, CienTec5, CienTec7
	Specialty in Transportation Engineering and Urbanism	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec8, CienTec9, CienTec10
	Specialty in Environmental Engineering and Sustainability	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec3, CienTec5, CienTec6, CienTec7, CienTec9
	Elective courses (complementary depending on the track)	CB6, CB7, CB8, CB9, CB10	G1, G2, G5	CienTec1, CienTec2, CienTec3, CienTec4, CienTec5, CienTec6, CienTec7, CienTec8, CienTec9, CienTec10
Master's thesis	Master's thesis	CB6, CB7, CB8, CB9, CB10	G6	TFM

Table 1.1.1. Correlation of competency profile and learning results for the MDCE.

Master Degree in Numerical Methods in Engineering (MDNME)

	Numerical Fundaments	Computational mechanics	Multidisciplinary applications	Calculation tools	Vocational training	Placements	Master's thesis
CB6	X	X		X			
CB7	X	X	X	X	X	X	
CB8			X		X	X	X
CB9			X	X	X	X	X
CB10	X	X	X	X	X	X	X

Table 1.1.2. Correlation of basic competency profile and learning results for the MDNME.

	Numerical fundaments	Computational mechanics	Multidisciplinary applications	Calculation tools	Vocational training	Placements	Master's thesis
CT1	X	X	X	X	X	X	X
CT2	X	X	X	X	X	X	X
CT3	X	X		X	X	X	X
CT4	X	X	X	X			

CT5	X	X	X	X	X	X	X
CT6	X	X	X	X	X	X	X
CT7	X	X	X	X	X	X	X

Table 1.1.3. Correlation of cross-competency profile and learning results for the MDNME.

	Numerical fundaments	Computational mechanics	Multidisciplinary applications	Calculation tools	Vocational training	Placements	Master's thesis
CG1	X	X	X	X			
CG2	X	X	X	X			
CG3	X	X	X	X	X	X	X
CG4		X		X	X	X	X
CG5		X		X	X	X	X
CG6	X	X	X	X	X	X	X
CG7	X	X		X	X	X	X
CG8	X	X	X	X			
CG9	X	X	X		X	X	X

Table 1.1.4. Correlation of general competency profile and learning results for the MDNME.

	Numerical fundaments	Computational mechanics	Multidisciplinary applications	Calculation tools	Vocational training	Placements	Master's thesis
CE1	X	X	X				
CE2		X	X	X			
CE3	X	X	X				
CE4	X			X			
CE5	X	X	X		X	X	X
CE6	X	X	X	X	X	X	X
CE7	X	X	X	X	X	X	X

Table 1.1.5. Correlation of specific competency profile and learning results for the MDNME.

Criterion 1.2 Name of the degree programme

The name of the degree programme reflects the intended aims and learning outcomes as well as, fundamentally, the main course language.

MDCE

Civil Engineering is the equivalent in Spain to *Ingeniero de Caminos, Canales y Puertos*, which is a regulated profession.

The name *Master en Ingeniería de Caminos, Canales y Puertos*, was generally chosen as the most representative term for the master's degree, by all the professional schools and high education institutions, public administrations and regions involved and is determined by the established regulations, that is OM CIN 307/2009 and OM CIN 309/2009.

MDNME

The use of so-called numerical methods (a term equivalent to calculation methods) is now firmly established in all engineering companies and in engineering and applied science research. These methods are used on a daily basis, within powerful computer programs, for the design and project of new products and processes and for the analysis of the behaviour of existing products. The terms "product" and "process" are understood here in their broadest sense and range from the construction of buildings and infrastructure in civil engineering, to the manufacture of automobiles, ships, aircraft and devices in biomedicine, or any other product manufactured by the industry. For all these reasons, and after more than 35 years of experience (the first postgraduate course with this name dates back to 1985), we can state that the name of the program is appropriate, it describes its content, it is easily recognizable by groups related to the topic and does not confuse either students or employers.

For all of such reasons we believe that the name of the program is well in line with the content of the course and there is no possible confusion between the content of the course and the notions delivered.

Criterion 1.3 Curriculum

The learning outcomes achieved correspond to the intended training objectives and to the level of the MECES of the degree.

Both programs curricula are shown in Section 1.1 of the present report.

The curriculum of the Master's Degree in Civil Engineering (evidence 1.3.1) complies with the competencies set out in Ministerial Order OM CIN 309/2009, which establishes the requirements to obtain a Master's Degree enabling for the exercise of the regulated profession of Civil Engineer.

The MDMNE curriculum (evidence 1.3.2) has been designed to cover the basics of "numerical methods" with a particular focus on the Finite Element Method. The study program is organized so to match closely the program of corresponding masters delivered throughout Europe. This is in a sense certified by the numerous double degree options that have been signed over the years with other leading institutions. In recent years the program was subjected to a minor change, which brought in the possibility of optionally replacing the "placement" with a selection of 3 courses, which were identified so to provide the same set of competencies. This change was also introduced, based on the feedback of former students, to provide an overview of modern subjects in the field of Machine Learning so to make the master's degree more attractive to new generations of students.

Criterion 1.4 Admission requirements

The general admission criteria for master's programs at UPC can be found at: https://www.upc.edu/en/masters/access-and-admission

As for the specific admission requirements of each program, they can be consulted in the links on the respective web pages of the programs.

Master's Degree in Civil Engineering (MDCE)

The specific criteria for admission to the master's degree can be found at the MDCE web page, in the "Admission" tab.

The admission criteria to the MDCE is regulated by law in Spain. Therefore, only students with a Bachelor's Degree in Civil Engineering (or equivalent) can access the MDCE. By "or equivalent" we mean that if a student with a different engineering background applies for admission, a specific admission analysis is performed. Students are then asked to take some bachelor's courses until their education matches that of a Bachelor's Degree in Civil Engineering.

Given this context, it can be said that the admission requirements are very strict in promoting the achievement of the intended competence profiles, which assures a high probability of students' success in the MDCE.

The admission process guarantees that the students have the capability to fulfil the learning outcomes of the Master's Degree. However, it requires a high dedication which cannot be matched by all students and in particular by students which attempt a part-time dedication.

The success rate is very high for people with a full-time dedication to the master.

As commented before, the admission requirements do fulfil the objectives of selecting students with a higher probability of success in the MDCE. If a student is rejected, the reaction is of complete understanding, given the strict legal admission criteria in the MDCE.

120 new places are offered each year at the MDCE. Applications have been on a downward trend since the 2017-2018 academic year, which is why most of the students accessing the master's degree come from the school's own bachelor's degrees in Civil Engineering and in Public Works Engineering. The applications to the MDCE have decreased significantly in recent years, however, there is evidence of a change in the upward trend from 2020-2021, a change that seems consolidated, as shown in Table 1.4.1 (evidence.1.4.1).

		2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Access	Places	120	120	120	120	120
	Applications	145	116	88	91	95
	Applications vs. places	120,80%	96,70%	73,30%	75,80%	79,20%

Table 1.4.1. Comparison between places and applications at the MDCE.

The body responsible for the admission to the Master's Degree, at the end of each pre-registration period, takes into account the applications for admission and, in accordance with the criteria and requirements for admission (evidence 1.4.2), issues an admission resolution, which is then published on the Master's Degree website (evidence 1.4.3).

The number of students enrolled in the last 5 years shows a noticeable downward trend in the first years, and a change in the upward trend, more discreet but continuous in time (figure 1.4.1). All this is explained by the above, as well as by the fact that some of the candidates admitted in May do not end up formalizing

their registration to the master's degree in September because they have not been able to finish their degree studies in time (Bachelor's thesis not presented or failed 4th-year courses).

This last year trend, as discussed above, is justified by the decrease in graduates from the Bachelor's Degrees that allow access to the MDCE. Consequently, the decrease in the number of students in admitted to the Bachelor's Degrees in Civil Engineering or in Public Works Engineering0 at our school are translated into a decrease in applications to the MDCE in 4 to 5 years.

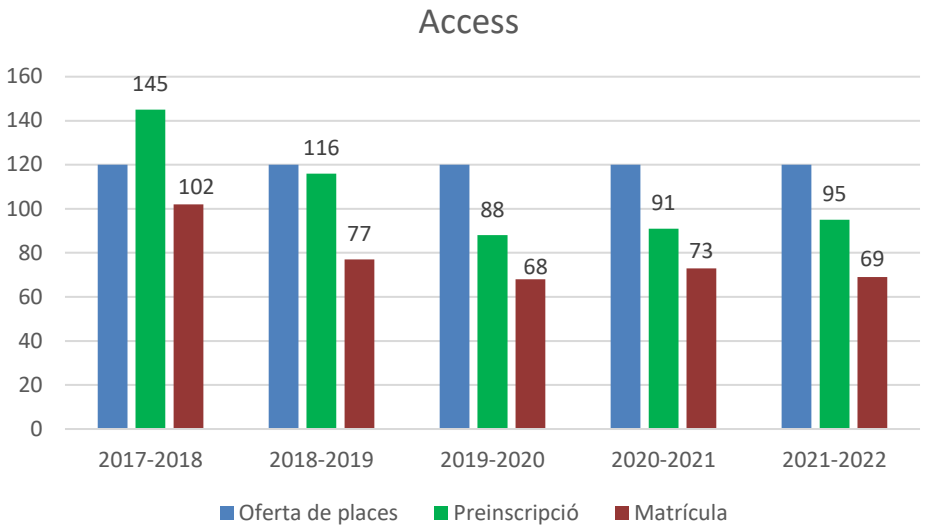

Figure 1.4.1. Evolution of the number of places, applications and enrolled students at the MDCE.

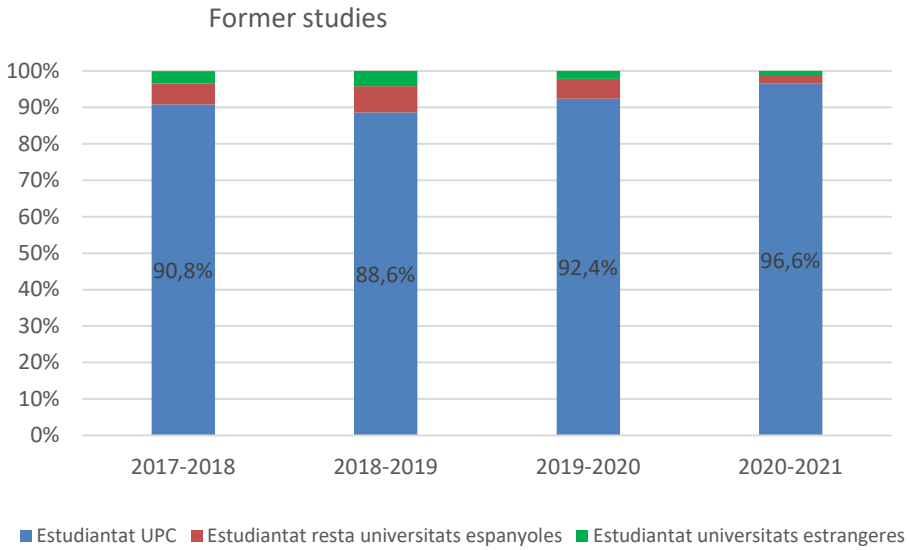

Figure 1.4.2. Former studies of the students enrolled in the MDCE.

The blue stripes in Figure 1.4.2 correspond entirely to Bachelor's graduates in Civil Engineering or in Public Works Engineering who studied at our school. Despite receiving several applications from graduates from other UPC degrees, they did not have the necessary qualification to be admitted. The fact that they had to take some additional training to access the master's degree diluted these applicants' interest in taking the MDCE. As for the applications from other Spanish universities, until the 2015-2016 academic year, they mostly came from the Universidade da Coruña, Euskal Herriko Unibertsitatea and Universitat d'Alacant. The latest admission data for the 2021-2022 academic year show a clear increase in graduates from other Spanish universities such as the Universitat d'Alacant, Universidad de Granada and the Universidad

Politécnica de Valencia.

Technical Public Works Engineers, from short-cycle studies, may access by adapting to the Bachelor's Degree in Public Works Engineering. However, and in order to comply with the Additional Amendment 4th, of Article 3 of RD 1393/2007, graduates from former study programs who wish to access the master's degree without adapting to current studies, must take additional training as stated in the text regulating the admission to Master's Degrees. The additional training or courses are as stated in Table 1.4.2.

Subjects	**ECTS**
Basic sciences and applied sciences	19.5
Engineering tools	12
Introduction to technology and Structural and Foundation Engineering	10.5
Tracks: CC, H or TSU	6
Elective courses (the number of elective credits can be reduced if there are more than enough credits from the rest of subjects)	12
Total	**60**

Table 1.4.2. Additional credits necessary for students from former short-cycle studies in Technical Public Works Engineering (former studies) to access the master's degree

This additional training, consistent with the adaptation tables between the Degree in Technical Public Works Engineering and the Bachelor's Degree in Public Works Engineering (where the courses are taken) and where the details of the competencies and descriptors can be found, are based on the difference in content between the former short-cycle training (3 years) and the current Bachelor's Degree (4 years = 240 ECTS).

As no student of this short-cycle training has applied for access to the program, no assessment on the adequacy of the additional training is available.

The gender distribution of new students is shown in figure 1.4.3, with a percentage that had an upward trend until 2018-2019 and a clear downward trend, which is closer to the percentages of the years prior to 2017-2018 and almost constant (27%) for women compared to men.

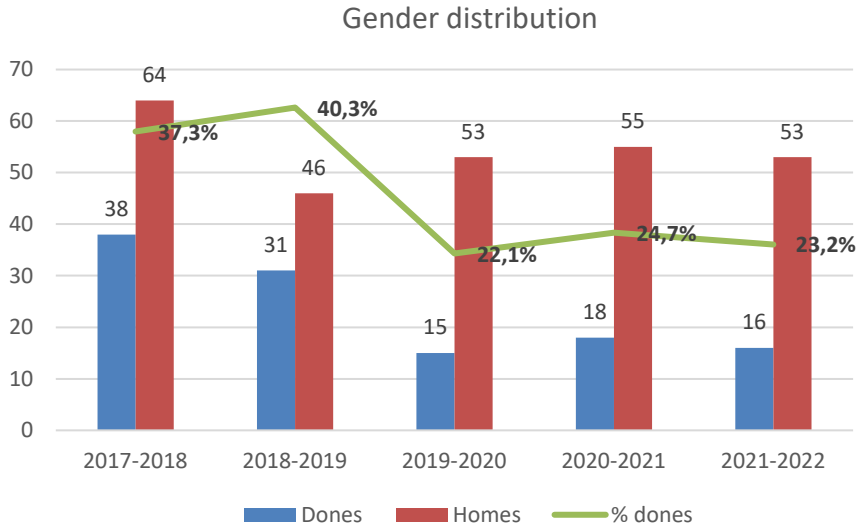

Figure 1.4.3. Gender distribution of enrolled students.

As an enabling master's degree, the admission profile of graduates is regulated by Order CIN / 309/2009. All admitted students come from degrees with the necessary competencies to meet the MDCE admission requirements established in Section 4.2 of Order CIN / 307/2009. Students admitted to the MDCE are

mainly bachelor's graduates in Civil Engineering or Public Works Engineering from the UPC, although in recent years we have received applications from other Spanish universities subject to the aforementioned Order CIN, which also have an adequate admission profile. There is also a growing demand for foreign students with a degree in civil engineering or similar not homologated by the Ministry of Education of Spain. As a result, the School has included an amendment in the verification report, in order to respond to these demands.

The amendment was collected and approved by the UPC in the Governing Council of July 2nd, 2020 (evidence 1.4.4) and sent to AQU for processing. The amendment to admission requirements states:

Section 4.2. where it reads:
"Access to the MDCE is not foreseen for graduates in possession of an official title of Diploma, Technical Architect or Technical Engineer (except for Technical Public Works Engineers), or any degree that does not give access to the regulated profession of Technical Public Works Engineer."

must read:
"Graduates in possession of an official title of Diploma, Technical Architect or Technical Engineer (except for Technical Public Works Engineers), or any other degree that does not grant access to the regulated profession of Technical Public Works Engineer, must undergo the assessment of the Body Responsible for the Master's Degree in Civil Engineering, which will determine if they meet the established admission requirements, and will determine the additional training to be completed."

Master's Degree in Numerical Methods in Engineering (MDNME)

The specific criteria for admission to the master's degree can be found at the MDNME web page, in the "Admission" tab.

The admission process guarantees that the students have the capability to fulfil the learning outcomes of the master. The master however requires a high dedication which cannot be matched by all students and in particular by students which attempt a part-time dedication.

The success rate is very high for people with a full-time dedication to the master.

As stated before, the admission requirements do fulfil the objectives of selecting students with a higher probability of success in the MDNME. If a student is rejected, the reaction is of complete understanding, given the strict legal admission criteria for the MDNME.

The MDNME offers, each year, 25 new places. The applications for admission have exceeded the offer since the 2017-2018 academic year and the trend continued, as shown in table 1.4.3 (evidence 1.4.5), up until the last academic year, which shows a small setback.

		2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Access	Places	25	25	25	25	25
	Applications	34	30	43	29	19
	Applications vs. places	136%	120%	172%	116%	76%

Table 1.4.3. Comparison between places and applications at the al MDNME.

The body responsible for the admission to the Master's Degree, at the end of each pre-registration period, takes into account the applications for admission and, in accordance with the criteria and requirements for admission (evidence 1.4.6), issues an admission resolution, which is then published on the Master's Degree website (evidence 1.4.7).

The number of students enrolled in the last 5 academic years shows a significant increase in enrolment (up to 28) in the 2019-2020 academic year. From this academic year onwards, there has been a steady decline (figure 1.4.4). It is difficult to safely assess the difference between pre-enrolled and enrolled students. We

consider it probable that this can be explained by considering the competition between our master's degree and other alternative master's degrees at Spanish or European level. There is a chance that some students have pre-registered for multiple master's degrees and have finally chosen another one different from the MDNME.

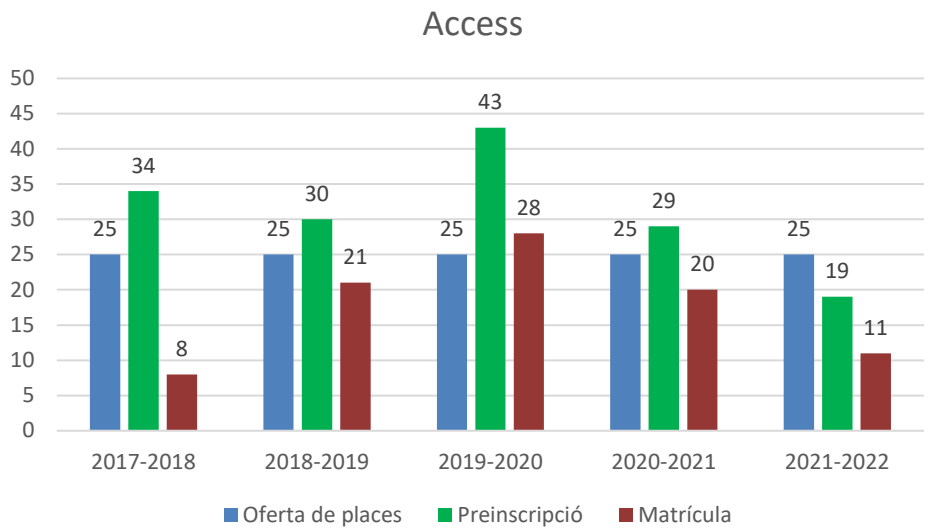

Figure 1.4.4. Evolution of the number of places, applications and enrolled students at the MDNME.

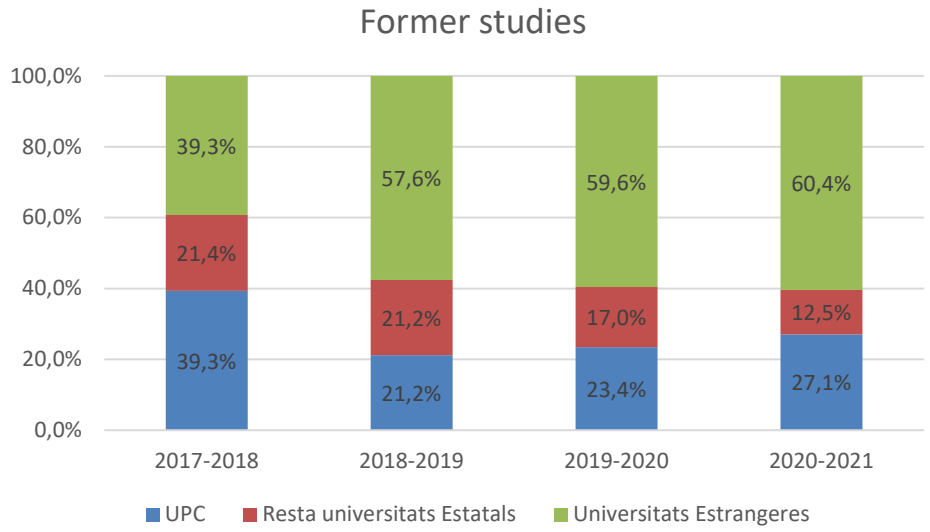

Figure 1.4.5. Former studies of the students enrolled in the MDNME.

When the application for admission is made from a degree other than the one provided for access, the body responsible for the master's degree analyses the candidates profile in order to determine, for each case, the additional training necessary.

Figure 1.4.6 shows the gender distribution of new students. The percentage of women compared to men, which at first showed a 14 to 17%, increase in 2018-2019, has plummeted. While this percentage can be improved in absolute terms, it is consistent with the percentage of women that study in our school, in particular, and in the UPC, in general.

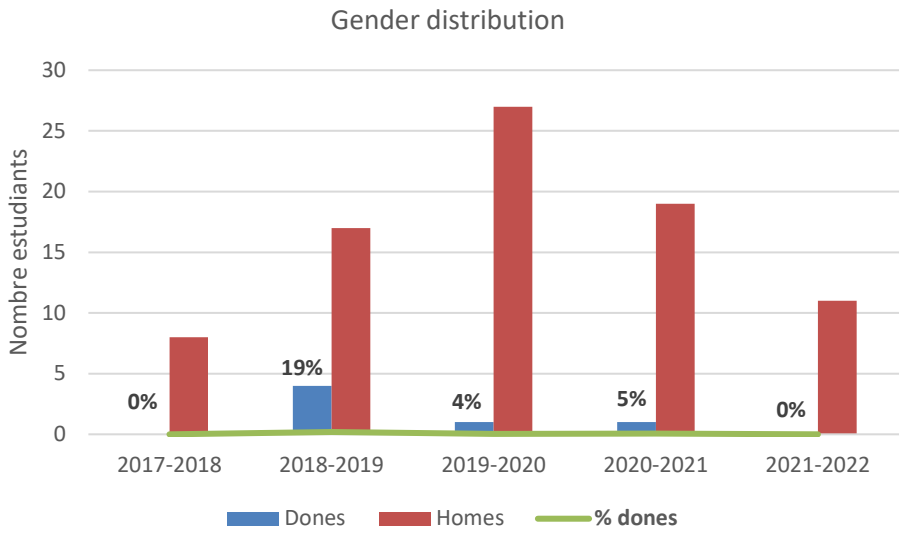

Figure 1.4.6. Gender distribution of enrolled students.

Looking at the data we can conclude that MDNME students have the appropriate admission profile for the degree, and mostly have the same training background on enrolment. This allows to organize the courses satisfactorily considering the profile of new students.

Improving pre-enrolment and enrolment statistics is certainly a challenge for the upcoming years. In this sense, it is very important to maximize the visibility of the master's degree inside and outside Spain, with the aim of competing with the best European master's degrees in the sector. In this sense, an effort will be made to make the master's degree visible outside Spain, both in America and in Asia.

6. The Degree Programme: Structures, Methods & Implementation

Criterion 2.1 Structure and modules

The programme's design (competence profile and structure of the curriculum) meets the requirements of the discipline and complies with the required level of study according to the qualification framework in the EHEA in Spain (in Spanish, Marco Español de Cualificación para la Educación Superior or MECES). This verification ensures that all degree programmes are divided into modules. Each module is a sum of teaching and learning whose contents are coordinated. With its choice of modules, the structure ensures that the learning outcomes can be reached and allows students to define an individual focus and course of study. The curriculum is structured in a way that allows students to complete the degree without exceeding the regular course duration. The modules have been adapted to the requirements of the degree programme and ensure that each module's objectives help to reach both the qualification level and the overall intended learning outcomes.

Planning, delivery and assessment are adequate for enabling achievement of the learning outcomes, and are consistent with the intended ones that correspond to the appropriate level for the programme in the EHEA at adequate rates. Masters' degrees (MDCE and MDNME) were designed in accordance with EHEA curricula, which implies new teaching criteria: student participation, innovation in teaching methods, and use of modern educational technologies. For both programmes, and as an incentive for excellence, students' mobility is supported and promoted, as well as student's participation in educational activities related to university-business cooperation. The goal of these activities is to complete the training received by students at the university.

Teaching coordination mechanisms

All the degrees presented here have coordination mechanisms in the School. The bachelor's and master's degrees with professional attributions have different coordination mechanisms and different activities to coordinate. Among the most relevant mechanisms and coordination elements are the Standing Committee and, for each degree, the Teaching Committee, the Coordination Committee and the Coordination Meetings of each academic year. These committees meet at least once a year.

The one-person positions with responsibility in coordination include the Heads of Studies for each degree, the Line Coordinators and the Course Coordinators (evidence.2.1.1). The different activities to be coordinated are course and exam schedules, classroom distribution, field trips, academic calendar and course guides (competencies and academic programmes of the courses).

Course coordination:

During the coordination of the course, a transversal coordination is carried out between the courses of the same academic year. This committee is made up of the professors in charge of the courses of each academic year and is chaired by the Head of Studies. The different activities to be coordinated are within the academic calendar: class and exams schedules, field trips, assignments, etc.). As a group work tool for the course coordination, different virtual subjects are created annually in the ATENEA Virtual Campus, one per year for each degree where all the information necessary for the coordination is shared and analysed (courses, lab sessions, assignments, field trips, etc.). A report on how the School coordinate the different degrees in pandemic can be seen in evidence 2.1.2.

Line coordination:

The main objective of the Line coordination (Transport & Territory, Water, Land, Structures and Physics & Mathematics,) is to ensure that the contents of the different subjects in each of the areas coordinate avoiding unnecessary overlaps and gaps. This committee is made up of the Head of Studies of each of the degrees and a representative from each of the lines appointed by the Director of the School. This

commission will carry out the coordination through the course guides, reviewing the competencies and programme of the courses.

Structure of the Master's Degree in Civil Engineering

Scientific and Technical Module	
Subject	**Credits**
Scientific and technological extension training	30 ECTS
Application of advanced sciences and technologies	30 ECTS
Total credits	60 ECTS

Applied Technologies Module	
Subject	**Credits**
Specialization	35 ECTS
Master's Thesis (Comprehensive Dissertation on Civil Engineering)	25 ECTS
Total credits	60 ECTS

		1st year	**2nd year**
Scientific and technological extension training	18	18	
Extension training in advanced sciences and technologies	42	42	
Specialization track	35		35
Comprehensive Dissertation on Civil Engineering	25		25

Table 2.1.1. Curriculum of the Master's Degree in Civil Engineering.

As described before, the definition of the curriculum in the MDCE is guided by the related Ministry Order regulating the studies in Civil Engineering in Spain. This "Ministry Order" was developed by an *ad-hoc* commission including academics and professional organizations to ensure the consistency of the curriculum and that the required learning outcomes were obtained.

The concept of the MDCE degree program is that of the classical civil engineering profession with a limited evolution in the "concepts" that define the modules of the curriculum, although with a significant advance in the techniques used. This makes the MDCE a classical but still innovative degree where the coherence of the curriculum (seen as a whole) has been stablished by a long academic and professional tradition in the field.

In addition, the selection of an extension training course during the second year of the MDCE, allows students to achieve a particular competency profile. Students may choose an extension training course from the following list:

- Computational Engineering
- Environmental Engineering & Sustainability
- Geotechnical Engineering
- Structural Engineering & Construction
- Transportation Engineering & Urban Planning
- Water Engineering

All these courses can be complemented with individual windows of mobility. Actually, students must have a mobility experience within the MDCE if they did not have one in their previous bachelor's studies, so that any student achieving the MDCE degree has been exposed to a mobility experience at some point. The reaction of students to these mobility regulations is good, as reflected by the extremely high satisfaction of students towards the mobility options offered. In spite of this, some problems arise because of some limitations to taking the mobility leave (e.g. economical, familiar dependency, mobility limitations, etc.). In such very specific cases, the mobility condition can be waived by an internship in a company with international scope.

Regarding the time of completion, the MDCE is established to be completed in a minimum of two years and a maximum of three, and the vast majority of students achieve this goal. In spite of this, some students involved in dual degree programs with other institutions require more than 3 years to finish the MDCE. In such cases, an extension is granted according to the curriculum of the dual degree.

Regarding the placements (i.e. internships in companies), they are voluntary and most of the students decide to take them while enrolled in the MDCE. The number of hours of the internship is limited, and depends on the number of credits enrolled, to avoid an increase in the work load for students. Students receive a minimum wage from the companies for their work. The outcome of the internship is assessed from the students' and the company report, which, in the vast majority of cases, is positive. The satisfaction of students with the internship placements is high, as shown by the related survey data.

Finally, regarding the ECTS students acquire externally, the MDCE agrees to recognize a maximum of 60 ECTS of equivalent courses obtained only at master's level in a higher education institution (i.e. a University). Under no circumstances will the master's thesis be recognized as it must be done at the UPC.

A full description of the curriculum is shown in evidence 1.3.1 and evidence 2.1.3.

Structure of the Master's Degree in Numerical Methods in Engineering

Semester 1, **30 ECTS**	**Semester 2,** **30 ECTS**	**Semester 3,** **30 ECTS**	**Semester 4,** **30 ECTS**
COMMON MANDATORY TRAINING MODULE	**COMMON MANDATORY TRAINING MODULE**	**PROFESSIONAL TRAINING MODULE**	**MASTER'S THESIS MODULE**
Subjects	**Subjects**	**Subjects**	**Subjects**
Basics on numerical methods (15 ECTS)	Computational mechanics (20 ECTS)	Professional training (30 ECTS)	Master's thesis (30 ECTS)
Computational mechanics (10 ECTS)			
COMMON ELECTIVE TRAINING MODULE	**COMMON ELECTIVE TRAINING MODULE**		
Subjects	**Subjects**		
(at least 5 ECTS)	(at least 10 ECTS)		
Calculus tools	Calculus tools		
	Multidisciplinary applications		

Table 2.1.2. Curriculum of the Master's Degree in Numerical Methods in Engineering.

The modification introduced in 2020 consists in providing a selection of 3 courses as an alternative to the internship (evidence 2.1.4). From an academic point of view this change is based on the observation that the competencies of the internship could be matched to a selection of other courses providing practical skills in selected areas. On the other hand, this allowed to improve the attractiveness of the master's degree by introducing new courses in the field of Machine Learning.

A full description of the curriculum is available in evidence 1.3.2 and evidence 2.1.5.

The evaluation of the Master's courses, despite being quite diverse, is mainly based on a continuous assessment consisting in various exams and assignments that can be assessed throughout the year. The assessment system is public and can be consulted at the CaminsOpenCourseWare Portal. As an example,

the courses listed below use the following qualification methodology:

Numerical Methods for PDEs

The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab sessions and/or computer labs.

Continuous assessment consists in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

Laboratory sessions are assessed as the average mark achieved in the lab activities.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Finite element

The mark of the course is obtained from the ratings of continuous assessment and the final test.

Continuous assessment consists in several assignments, carried out during the year.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Master's thesis

The mark of the course is obtained from assessment of the public presentation. The evaluation panel receives a written report, submitted in accordance with the regulations and within the established periods. The evaluation panel considers the content and formal aspects of the written report, as well as the oral presentation and the defence of the Master's thesis made by the student during the panel's round of questions. Each member of the panel assesses all these aspects and issues a mark. The panel may issue a mark by consensus or suggest a mark individually. In the latter case the result will be the arithmetic mean (rounded) of the three marks.

The values of the academic indicators are appropriate for the characteristics of the degree.

Data to be verified for the Master's Degree in Civil Engineering

General data:

- Graduation rate: 85%
- Dropout rate: 5%
- Efficiency rates: 95%

	2016-2017	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**
Success rate (%)	99,50	99,10	97,30	97	97,60
Performance rate (%)	93	97	91,80	92,40	85,60
Dropout rate (%)	0	0,70	0	2	0
Graduation rate (%)	83,50	84,10	79,80	90	84,40
Efficiency rate (%)	97%	96,70%	98,10%	96,30%	93,40%

Table 2.1.3. Evolution of success, performance, dropout, graduation and efficiency rates for the Master's Degree in Civil Engineering.

The results of the quality control indicators for the master's degree are, in general, satisfactory.

The dropout rate is zero, therefore all students complete their studies in due time.
The efficiency rate is above the threshold defined in the verification process (95%), so that mostly all students pass the courses on their first enrolment.

Special mention must be made of the drop in the 2015-2016 graduation rate. The Master's Degree in Civil Engineering is a 2-year program and is required to complete it in a maximum period of time of 3 years. In 2015-2016, there were only 2 cases, duly justified for extra-academic reasons, who did not complete their studies in 3 years, but who were allowed to enrol in a fourth additional year. Likewise, the data on enrolled students in figure 1.4.1 of section 1.4.1 also includes students with a double degree (actually, a triple degree): a bachelor's degree and a master's degree at the UPC and a master's degree at a foreign university with an agreement with our School. This group of students, which average 10 people, follow an academic itinerary that extends the completion of the master's degree a year at best. All the programs offer the possibility of carrying out a professional internship within the master's degree studies to be carried out during the mobility stay. The Double Degree (DD) option, highly valued by students and promoted by our School, results, in practice, in a decrease in the graduation rate. If these students are not considered, the graduation rate is higher than 85%, which is why this values are not seen as an indicator that a contingency plan is needed.

Data to be verified for the Master's Degree in Numerical Methods in Engineering

General data:

- Graduation rate: 78%
- Dropout rate: 15%
- Efficiency rates: 90%

	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Success rate (%)	90,40	95,80	97,40	96,40	98,50
Performance rate (%)	79,20	76,80	75,20	82,40	71,80
Dropout rate (%)	5,90	6,20	47,60	25	28,60
Graduation rate (%)	64,70	68,80	28,60	50	33,30
Efficiency rate (%)	98,80	99,20	93,20	96	97,70

Table 2.1.4. Evolution of success, performance, dropout, graduation and efficiency rates for the Master's Degree in Numerical Methods in Engineering.

Since 2012, the Master's Degree in Numerical Methods in Engineering has achieved a success rate of over 90%. Considering the theoretical complexity of the contents treated, as well as their variety, this result can be considered very positive. The relatively low percentage in the graduation rate reflects the fact that many of the students are already working during the final period of the master's degree, and thus delay their graduation.

Dropout rates from 2018 to 2020 are well above the expected results, these values are basically due to two reasons:

- As it gathers small groups (e.g., 21 new students in 2018), any individual movement definitely influences the overall end result.
- In 2018, the UPC services in charge of calculating and controlling the indicators considered dropouts (47.60%), based on the criteria set by the Department of Universities of the Generalitat de Catalunya. Of these so-called dropouts, some were mobility students, who despite completing their second year at foreign universities, were not considered to be enrolled in the UPC, and were therefore declared dropouts. This criterion, with which our School disagrees, determines results that are at least unrealistic.

The values of the job placement indicators are appropriate for the characteristics of the degree.

The main employment indicators, according to AQU Catalunya (evidence 2.1.6) are as follows:

Civil Engineering	Status and adequacy						
	Working status			3 functional categories			JQI index
	Employed	Unemployed	Inactive	Specific to the degree	University-related	non-university-related	Mean
UPC	98.1%	1.9%	-	61.5%	36.5%	1.9%	70.0
Total 2020	98.1%	1.9%	-	61.5%	36.5%	1.9%	70.0
Reference 2017	100.0%	-	-	37.0%	48.1%	14.8%	68.0
Reference 2014	95.3%	-	4.7%	55.0%	35.0%	10.0%	63.0

Table 2.1.5. Main employability indicators for Master's Degree in Civil Engineering: Status and adequacy.

The Job Quality Index (JQI) takes values from 0 to 100 and is built on four indicators: contract, job satisfaction, retribution and adequacy. The higher the values, the better the occupational quality (greater stability, satisfaction, retribution or adequacy). JQI = f[(stability + retribution + adequacy) * job satisfaction.

Civil Engineering	Insertion quality: job satisfaction (over 10)				
	Satisfaction with the job's content	Satisfaction with future perspectives	Satisfaction with the job's retribution	Satisfaction with the usefulness of the master's degree content	General satisfaction with current job
	Mean	Mean	Mean	Mean	Mean
UPC	8.1	7.8	6.9	4.9	7.7
Total 2020	8.1	7.8	6.9	4.9	7.7
Reference 2017	8.2	6.2	6.4	4.0	8.1
Reference 2014	8.4	6.4	6.4	6.4	8.0

Table 2.1.6. Main employability indicators for Master's Degree in Civil Engineering: Job satisfaction.

Civil Engineering	Public or private sector and type of contract						
	Type of sector		Type of contract				
	Public	Private	Permanent	Freelance	Temporary	Training	Without contract
UPC	26.9%	73.1%	67.3%	1.9%	28.8%	1.9%	-
Total 2020	26.9%	73.1%	67.3%	1.9%	28.8%	1.9%	-
Reference 2017	14.8%	85.2%	74.1%	7.4%	18.5%	-	-
Reference 2014	50.0%	50.0%	65.0%	7.5%	20.0%	7.5%	-

Table 2.1.7. Main employability indicators for Master's Degree in Civil Engineering: Sector and type of contract.

Physics and Mathematics	Level and adequacy of Initial training: specific competencies (over 10)			
	Theory: level	Practice: level	Theory: usefulness	Practice: usefulness
	Mean	Mean	Mean	Mean
UB	7.7	5.4	5.8	4.9
UPC	7.7	6.3	6.0	5.8
Total 2020	7.6	6.0	6.0	5.6
Reference 2017	7.1	5.5	5.7	5.5
Reference 2014	7.5	6.3	6.1	5.5

Table 2.1.8. Level and adequacy of Initial training: specific competencies for Physics & Mathematics at the University of Barcelona and at the UPC.

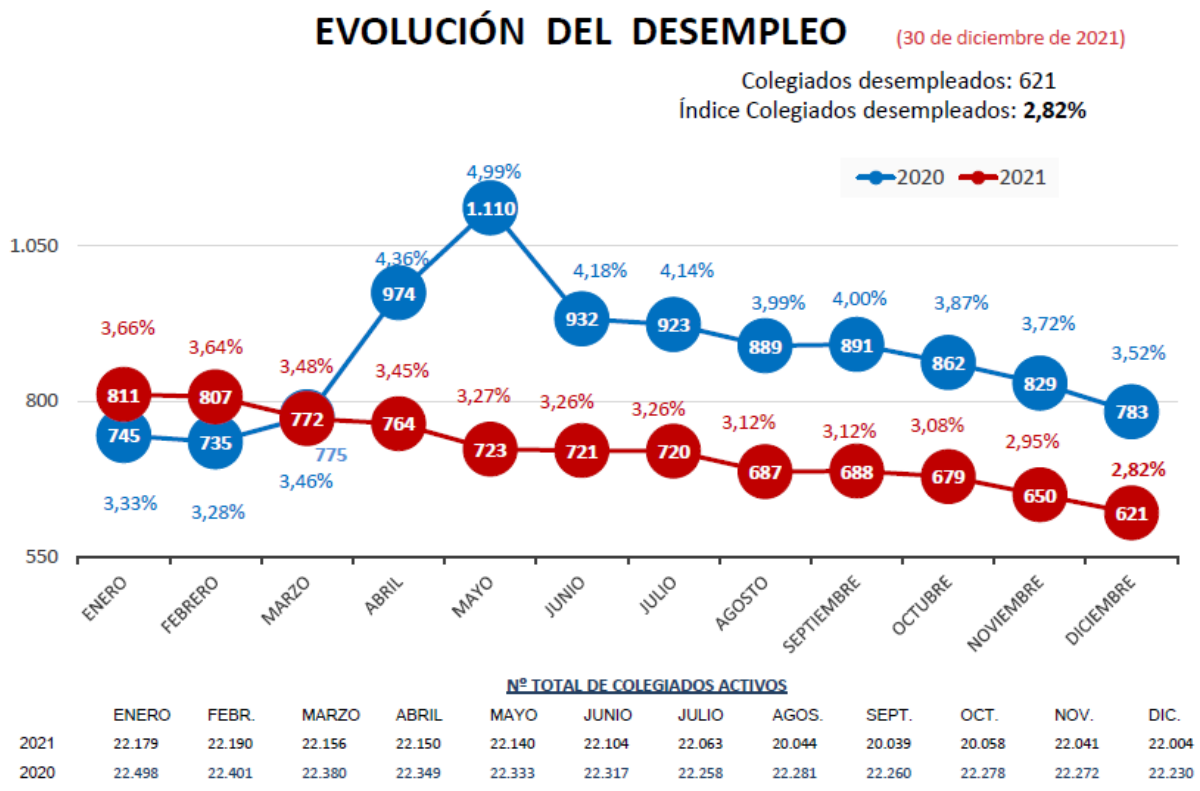

Figure 2.1.1. Average unemployment among chartered civil engineers (Source: Colegio de Ingenieros de Caminos, Canales y Puertos).

The employment rate in the field of civil engineering, due precisely to the economic crisis of recent years, which has had a particular impact on public works, is valued very positively. Even more so if it is put in the context of the unemployment rates of the other Civil Engineering Schools in Spain (see figure 2.1.1). According to data from civil engineers, from all the schools with the long-lastest and greatest tradition (Madrid, Valencia, Santander, La Coruña and Barcelona), Barcelona School of Civil Engineers has the lowest unemployment index. Due to the scarce number of civil engineers graduating annually from the Universidad Católica de Murcia and the Universidad Politécnica de Cartagena, we do not consider their unemployment rates (lower than those in Barcelona) to be comparable to those having a long-standing tradition.

In the case of the Master's Degree in Numerical Methods in Engineering, we do not have disaggregated data on employment, the data published by AQU through the *EUC Dades* (Data portal of the Catalan university system) includes them under the heading: Physics and Mathematics, which also includes data on other UPC master's degrees such as: Astrophysics, Particle Physics and Cosmology; Meteorology; Computational and applied physics; Advanced and professional physics; Synchrotron radiation and particle accelerators; Physics of biological systems and radiophysics; European Master in photonics engineering, nanophotonics and biophotonics; Generation and applications of synchrotron radiation; Advanced physics; Photonics; High Energy Physics, Astrophysics and Cosmology; Computational Fluid Mechanics; European Master in Nuclear Physics; Engineering Physics; Mathematics; Computational mathematics and data analytics; Numerical methods in engineering; Applied mathematics; Engineering mathematics; Advanced and professional mathematics; Advanced mathematics; Erasmus Mundus in Mathematical Modelling in Engineering: Theory, Numerics Applications; Advanced mathematics and engineering mathematics; Modelling for Science and Engineering).

Physics and Mathematics	**Status and adequacy**		
	Working status	**3 functional categories**	**JQI index**

	Employed	Unemployed	Inactive	Specific to the degree	University-related	non-university-related	Mean
UB	91.5%	-	8,5%	68.9%	26.7%	4.4%	57.2
UPC	92.2%	1.6%	6.3%	76.2%	22.2%	1.6%	68.0
Total 2020	91.2%	2.2%	6.6%	72.0%	25.0%	3.0%	65.9
Reference 2017	87.7%	6.5%	5.8%	65.6%	28.5%	6.0%	65.1
Reference 2014	83.9%	8.4%	7.7%	64.6%	33.3%	2.1%	64.0

Table 2.1.9. Main employability indicators for Physics & Mathematics: Status and adequacy.

Physics and Mathematics	Public or private sector and type of contract						
	Type of sector		Type of contract				
	Public	Private	Permanent	Freelance	Temporary	Training	Without contract
UB	66.7%	33.3%	26,7%	2.2%	40.0%	31.1%	-
UPC	54.0%	46.0%	54.0%	-	36.5%	9.5%	-
Total 2020	56.1%	43.9%	42.4%	1.5%	36.4%	18.9%	0.8%
Reference 2017	51.0%	49.0%	37.1%	7.9%	38.4%	16.6%	-
Reference 2014	70.8%	29.2%	25.7%	-	31.9%	42.4%	-

Table 2.1.10. Main employability indicators for Physics & Mathematics: Sector and type of contract.

Physics and Mathematics	Level and adequacy of Initial training: specific competencies (over 10)			
	Theory: level	Practice: level	Theory: usefulness	Practice: usefulness
	Mean	Mean	Mean	Mean
UB	7.7	5.4	5.8	4.9
UPC	7.7	6.3	6.0	5.8
Total 2020	7.6	6.0	6.0	5.6
Reference 2017	7.1	5.5	5.7	5.5
Reference 2014	7.5	6.3	6.1	5.5

Table 2.1.11. Level and adequacy of Initial training: specific competencies for Physics & Mathematics at the UB and at the UPC.

Pandemic-related adaptation of degree programmes (COVID-19 actions)

In general, subjects have not changed contents at all or very little modifications have been introduced. Nevertheless, the lectures have been adapted as detailed in evidence 2.1.2 The way of performing the exams has been modified as indicated in the evidence 2.1.7.

Criterion 2.2 Work load and credits

The teaching methodology, the contents and each of the activities included in each course is public and reviewed on an annual basis. The activities have to be defined by the professors in charge, indicating the time spent on face-to-face sessions (laboratory, theory and/or problems), as well as the number of hours estimated of autonomous learning and guided activities per week. This estimates the students' work load. The academic commissions review this activity so that the number of hours is adequate to the number of ECTS of the course.

Figure 13 shows an example of this work load in one of the courses (T: Theory; P: Assignments; L: Laboratory; AD: Supervised Activities; AA: Self-learning)

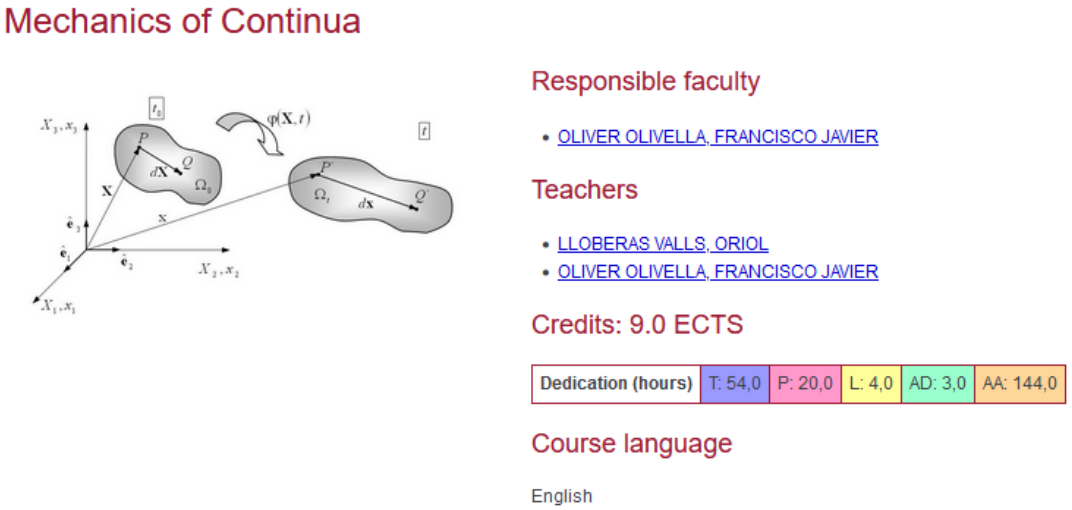

Figure 13: Workload of the course on Mechanics of continua.

Evidence 2.2.1, at its contents section, shows the distribution of hours by topic. This distribution is given for all the courses and can be consulted at CaminsOpenCourseWare.

The tables on the distribution of total credits per subject of the programs are shown in the previous section.

Likewise, in the surveys carried out each year on the courses, students consider that globally these values agree with the nature of the course. 75.6% of those surveyed consider that the workload and the resources are satisfactory in pandemic (evidence 2.2.2).

This distribution seems to be positive and is considered to be correct for the development of the course. However, as mentioned in the first paragraph of this section, the distribution of the workload is reviewed each academic year by the professors in charge of the courses, together with the Line and Course Coordinators.

The ECTS/hour ratios are defined by the university academic regulations (evidence 2.2.3).

Criterion 2.3 Teaching methodology

The modules of the programmes are clearly structured and divided into theoretical, practical and self-study parts as stated in the course guides available for students. The overall programme structure allows both for students to seek for a placement as well as pursue an international mobility stay and continue with their studies abroad. The school has built up a very good network of international cooperation so that students are mostly very internationally mixed. Moreover, the fact that there are several double degree programmes or Erasmus Mundus programmes at the university makes the study environment very international and encourages students to benefit from the mobility even in the programmes where it is not mandatory. As for the Bachelor's Degree in Civil Engineering, international mobility is encouraged among students, and therefore the structure of the studies is well adapted should they decide to take an international mobility leave.

Generally, both students and teaching staff indicated, however, an unusually high work load during the study term. Besides continuous assessment, one reason for this workload might be the rather short lecture period. Thus, a prolongation of the period of study and shortening of the summer break, starting already in May, might be worthwhile considering in order to prolong the lecture time and facilitate better preparation for tests. Many students and teachers indicated this as a helpful measure to decrease the work load of the last weeks of the semester. Also shifting some lab assignments or reports to the holiday time could be one means of improving the tests, depending on what is most convenient for the successful running of the programmes.

Every semester is composed by 15 weeks. This number corresponds to the transformation of each ECTS into 10 h face-to-face class and allowing for 20 h face-to-face class per week. Therefore, 30 ECTS x 10 h/ECTS / (20 h /week) = 15 weeks. In principle the work load should not be excessive; however, continuous assessment leads to a relatively high work load. We believe that this system improves the results of the students as they learn from day 1 the level of knowledge they should reach to pass a course. Continuous assessment was highly encouraged by the university.

Course assessment at the Master's Degree in Civil Engineering

The Master's Degree in Civil Engineering bases the training activities and assessment system on encouraging an active attitude towards learning on students and on the continuous assessment. That is why, after several teaching innovation projects, the courses focus on acquiring the associated skills through problems, exercises, or directed activities in which the student is the key element of the learning process and the teacher, a guidance resource, adapting to different developments.

The Master's Degree in Civil Engineering curriculum is structured in four teaching modules: i) Scientific and technological formation extension, ii) Application of sciences and advanced technology iii) specialties and iv) master's thesis. A course from each module has been chosen to exemplify the teaching methodology and assessment method.

Mechanics of continua (Module I. Scientific and technological formation extension)

The teaching methodology fully follows the objectives of the EHEA, where the student is the active subject of the learning process. The teaching methodology used in the course is that of the flipped classroom, where, through specific group dynamics, the student amplifies and consolidates the knowledge acquired during the preparation, individually and before the class, of the basic elements corresponding to the following face-to-face classes. The individual preparation, following the teacher's instructions, is carried out by the student in person, and prior to the class, with the support of videos, slides, the course book and bibliographic material available at ATENEA and/or provided on the website of the course. The dynamics of the face-to-face class then consist of providing the group of students with the complementary training they need according to the possible deficiencies detected by the teacher, carrying out practical exercises, clarifying doubts, consolidating knowledge and encouraging teamwork. Teaching is structured in 2-hour sessions, 3 days a week. This methodology is highly recommended to achieve learning outcomes, as the entire practical part of the course focuses on applying the conservation equations to problems of structure, hydraulics and geotechnics and finally develop and understand models of behaviour of both solid and fluid

materials.

The grading method is based on continuous assessment, following EHEA recommendations and assessing the student's gradual learning process. The evaluation of the subject is made from two marks:

- A mark based on the realization of several multiple answer test, throughout the year. There are four partial tests on contents grouped by topics. The final mark of the assessment will result in a "Partial Assessment Mark" (NAP) which will be obtained as a combination of the arithmetic mean (weighing 0.9) and the geometric mean (weighing 0.1) of the partial evaluations which are over 10 points.
- A mark based on the individualized perception, by the teacher, of the "global" knowledge of the course of each student, their involvement in the learning dynamics proposed in the face-to-face classes and the team work skills acquired throughout the course. The mark will result in a 10-point "face-to-face mark" (NP).

The final mark of the course (NF) is weighted between the two marks above-mentioned as NF = 0.9 * (NAP) + 0.1 * (NP) rounded to the lowest multiple of 0.1. Therefore, the student has several assessment acts throughout the course and the activities carried out in the classroom are valued, favouring the assistance and participation of the student.

Water engineering (Module II. Application of sciences and advanced technology)

The teaching methodology is appropriate to the objectives of the course, with a large component of lab sessions, practicals and problems that allow the continuous learning of the concepts addressed in the course. The course consists of 4 hours a week of face-to-face classes. The structure of the theoretical sessions (2 hours of class) follows this scheme:

- presentation of the theoretical concepts (usually 1.5 hours), and
- resolution of numerical exercises (usually 0.5 hours).

However, in the lab sessions, students will be classified into groups to attend the computer room and use specialized programs in Water Engineering. Since academic year 2017-2018, the idea of opening a new teaching group of less than 35 students, which will allow the appropriate interaction between teacher and student in the practical sessions or laboratories, has been considered.

The course's final mark is obtained from the continuous assessment of the student, adapted to the premises of the EHEA

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year. Specifically, the activities aimed at the evaluation of the course will be:

- a test of each part of the course (three tests in total, one for the environmental engineering part, one for the hydraulic engineering part and one for the maritime engineering part), and
- the evaluation of the case studies and work of each of these parts.

Urban hydrology (Module III. Speciality in water engineering)

The teaching methodology is appropriate to the objectives of the subject. The course consists of 1.8 hours per week of classroom activity (large-size group) and 0.8 hours weekly with half the students (medium-size group). The 1.8 hours in the large-size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the course, shows examples and solves exercises. The 0.8 hours in the medium-size groups is devoted to solving practical problems, which involves greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives. The rest of weekly hours are devoted to course assignments.

Support material in the form of a detailed course guide is provided using the virtual campus ATENEA: content, learning program, assessment of supervised activities and literature.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the

ratings of continuous assessment and their corresponding lab and/or computer practicals.

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year (both in and out of the classroom).

Lab sessions are graded as the average of all the activities.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

The final test and course assignments grades run from 0 to 10.

The final mark equals 0.5 Final Test + 0.5 Assignments

Interaction between groundwater and civil works (Module III. Speciality in geotechnical engineering)

The course consists of 3 hours per week of face-to-face classroom sessions. These hours are devoted to lectures where the teacher explains the concepts and theory, presents examples and exercises, which involves greater interaction with students. The remaining weekly hours are dedicated to practicals in laboratories. Support material in the form of a detailed course guide is provided using the virtual campus ATENEA: content, learning program, assessment of supervised activities and literature.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab and/or computer practicals.

Continuous assessment is evaluated by exercises (PR), a supervised project assignment (TD) and tests (EX). The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

The final mark is estimated as: 0.2*PR+0.4*EX+0.4*TD

Building structures (Module III. Speciality in structural and construction engineering)

The course consists of 1.8 hours per week of classroom activity (large-size group) and 0.8 hours weekly with half the students (medium-size group). The 1.8 hours in the large-size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the course, shows examples and solves exercises. The 0.8 hours in the medium-size groups is devoted to solving practical problems, which involves greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab and/or computer practicals.

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year (both in and out of the classroom).

Lab sessions are graded as the average of all the activities.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Machine learning and models for decision making (Module III. Speciality in computational engineering)

The course consists of 1,8 hours per week of classroom activity (large size group) and 0,8 hours weekly

with half the students (medium size group). The 1,8 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises. The 0,8 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives. The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab and/or computer practicals.

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year (both in and out of the classroom).

Lab sessions are graded as the average of all the activities.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Urban Mobility (Module III. Speciality in transportation engineering and urban planning).

The course consists of 3 hours per week of lectures in the classroom (large group). 2 hours are lectures, in which the teacher presents the basic concepts and materials.1 hour is devoted to present examples and exercises with a greater interaction with students.

Support material will be provided on campus ATENEA: content, programming and evaluation, activities and relevant references.

The qualification method is based on the recommendations of the EHEA. The grade of the course is obtained from the marks of 3 homework assignments (each one accounts for 15% of the final mark), 1 group mini-project (20% of the final mark) and a final exam (open notes, open book, 35% of the final mark).

These assignments and mini-project will be held during the course (outside class). All of them will be corrected during class hours.

The final exam will be held the during the last programmed lecture for the subject.

Life-Cycle Analysis and Sustainability Assessment (Module III. Speciality in environmental engineering and sustainability).

The course consists of 3 hours per week of classroom sessions in one group. These three scheduled weekly hours typically devote two sessions to presentations focusing on conceptual and theoretical and practical aspects and resolution of problems and exercises, including computer practicals. Support material will be provided on campus ATENEA: content, programming and evaluation, activities and relevant references. The course tries to encourage participation of students and their work before and after classes. Self-study hours focus on issues of less importance and difficulty, which can be solved with the help of the students' personal notes and additional documentation provided in ATENEA. Additionally, students may schedule voluntary consultation sessions and, eventually, conferences and visits are organized to complement the course programme. Classroom sessions rely basically on the blackboard, and audio-visual materials (Internet, slides and videos).

The qualification method is based on the recommendations of the EHEA. The final mark of the course is obtained from all course grades (tests, 30%; assignments, 60%; and class activities, 15%).

According to the above criteria, those students who choose to participate in the continuous assessment are graded up to 105%. In contrast, those who decide to do just the final test, are graded up to 100%.

There will be at least a final individual test and a group assigned related, the latter, to the life cycle analysis (50%) and the sustainability assessment of civil engineering products, construction solutions or any other subject that may be approved (50%).

Tests may include theoretical or applied questions.

Master's Thesis (Module IV. Master's Thesis)

Once the subject of the master's thesis has been assigned, through the intranet, the student holds several interviews with the tutor to discuss the plan of action. These meetings allow to see the progress of the work done by the student, to detect the problems or situations that will have required them to make decisions and, in the case that it is necessary, to clarify concepts and to establish mechanisms of solution and redirect the situation

In order to ensure transparency and impartiality in the evaluation and qualification process, the master's thesis tutor is never part of the evaluation panel, but completes an evaluation report, called *Fita 3A* (in English, 3A report). Moreover, in order to avoid the existence of different assessments in the evaluation of the thesis according to the composition of the evaluation panel, there is a single panel that is in charge of evaluating a set of master's theses. This panel evaluates all the Master's theses of the current call based on several common criteria (originality, complexity, defence, ability to synthesize, clarity of wording), which partially consider the assessments of the tutor's 3A report.

The Master's thesis will be developed under the supervision of a faculty member of Barcelona School of Civil engineering. Therefore, students must attend the necessary interviews with the supervisor to ensure the proper development and quality of the work. In case the Master's thesis is presented and defended at a foreign university within the framework of a mobility agreement signed by our School, the student must find a supervisor at the host university.

The grading of the master's thesis will be based on an assessment of the written report and the oral presentation of the objectives, results and conclusions of the master's thesis to an evaluation panel. The panel will consist of three professors of our School that, after the public presentation, will assign a grade based on the following criteria:

Thesis content
- Originality and innovation (30% of global mark)
- Comprehensive / integrative / interdisciplinary scope (30% of global mark)

Thesis report
- Quality of the written report (20% of global mark)

Thesis defence
- Clarity of the oral presentation (10% of global mark)
- Performance in debate with the panel (10% of global mark)

In the case of carrying out the Master's thesis within a mobility agreement in a foreign university, the final mark will be given by the host university, as long as the work has been done individually and presented to a panel of at least three faculty members. If these requirements are not met, the student must present and defend the Master's thesis in Barcelona School of Civil Engineering.

Course assessment at the Master's Degree in Numerical Methods in Engineering

The assessment of the Master's degree courses, despite being quite diverse, has an important component of continuous assessment with several tests and assignments that can be assessed throughout the year. The assessment system is public and can be consulted through the CaminsOpenCourseWare Portal. As an example, the courses listed below use the following qualification methodology:

Numerical methods for PDEs

The course consists of 1.2 hours per week of classroom sessions (large-size group) and 1.2 hours per

week of classroom sessions with half of the students (medium-size group). The 1.2 hours with the large-size groups are devoted to theoretical lectures, in which the professor presents the basic concepts and topics of the course, shows examples and solves exercises. The 1.2 hours with the medium-size groups is devoted to solving practical problems, which involves greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours are devoted to lab sessions.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab and/or computer practicals.

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year (both in and out of the classroom).

Lab sessions are graded as the average of all the activities.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Finite Element

The teaching methodology consists of 4 hours per week of classroom sessions. Part of the hours are devoted to theoretical lectures, in which the professor presents the basic concepts and topics of the subject, shows examples and solves exercises. The rest of the hours is devoted to solving practical problems, which involves greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Support material in the form of a detailed teaching plan is provided using the CIMNE virtual centre: content, program of learning and assessment activities conducted and literature.

The rating method is based on EHEA recommendations. The mark of the course is obtained from the ratings of continuous assessment and their corresponding lab and/or computer practicals.

The continuous assessment consists of doing different activities, both individually and in group, additive and formative in nature, throughout the year.

The tests consist of a part with a set of questions, which evaluates the student's knowledge and understanding of the concepts associated with the learning objectives of the course, and a part with a set of exercises, in which to apply this knowledge.

Master's Thesis

The final mark is obtained from the public presentation. The evaluation panel will have a written report submitted in accordance with the regulations and within the established periods. The evaluation panel will consider the content and formal aspects of the written report, as well as the oral presentation and the defence of the master's thesis made by the student during the panel's round of questions. A mark will be issued by each member of the panel including all these aspects. The panel may issue a mark by consensus or each member may suggest an individual mark. In the latter case the result will be the arithmetic mean (rounded) of the three marks.

Pandemic-related adaptation of teaching methodologies (COVID-19 actions)

From the beginning of the pandemic, Barcelona School of Civil Engineering has continued running all its studies from the very first day of the lockdown. At that moment, UPC had just signed an agreement with Google Education Suite, and that helped to keep performing synchronous lecturing as scheduled with a

large number of students.

In general, depending on the course, different mechanisms were used to continue the lectures, whose publication on a specific learning platform for all the students was requested, together with a dean's statement addressed to the community.

Some of the strategies carried out during the lockdown were:

- Use of video conference for synchronous lectures and practicals
- Extra material with slides, videos, exercises and practical assignments
- Use of video and/or screencast material for asynchronous lectures and practical classes
- Use of the learning platforms (ATENEA) for assignment submissions
- Use of email and/or forums for asynchronous consultation
- Use of chat and/or video conferencing for synchronous consultations

In any case, the heads of studies were in charge of solving any problems arising during lecturing both for students and professors due to the pandemic.

Regarding the assessment process, in the following section about Tests and Assessments, some examples of assessments and practicals are provided both during the lockdown and during the period when the pandemic situation became mild (after the summer of 2020). With regard to the lockdown period, note that all assessments were carried out online.

Some examples of online assessment were:

- Tests performed through a Moodle online platform (ATENEA) using new hardware as well as software support added to provide enough computational power to carry out several online tests with hundreds of students
- Tests providing the test statement and giving some limited period of time
- Oral presentations and discussions using videoconference

After the lockdown period, the government healthcare commission and universities agreed to face-to-face exam assessments as long as the health measures were guaranteed. Due to the pandemic situation and the classroom limitations to ensure social distance, the number of opportunities to do a test out of the courses' timetable was reduced. Therefore, in some cases courses had to adapt their assessment methods so that they could profit from at least one face-to-face assessment as a mid-semester test, as well as a final test, at the end of the semester, if needed.

Regarding the final projects, their evaluations have been online thanks to the videoconference tool. ICT support during the lockdown period was crucial for integrating and creating a mechanism to prepare, build and give assessment support to the final project evaluation committee. The overall feedback of the evaluation committees and students has been extremely good.

In the survey carried out on evaluation modifications in a pandemic, 73.4% of those surveyed consider the proposed evaluation system to be correct (evidence 2.2.4).

Criterion 2.4 Support and assistance

Barcelona School of Civil Engineering organizes an annual welcome session for students who have accessed a postgraduate program at our School in order to:

- To assist new students to the master's program in the process of joining the UPC.
- To inform about useful academic services for students (library, study rooms, scholarships, educational cooperation programs, academic mobility programs, etc.).
- To present the course guide and tracks foreseen in the curriculum.
- To inform about the most significant aspects of UPC's General Academic Regulations for Master's Programs (1st year minimum academic progress, course enrolment, etc.).
- To report on the assignment of each student to a coordinating professor -tutor.
- To report on a system of support and guidance for individual tutorials (coordinator-tutor).
- To inform about the virtual tools available to follow-up the courses.
- To guide on the most significant changes in postgraduate study habits and techniques with respect to undergraduate studies.

Assignment of a (individual) tutor: Students admitted to the master's program are individually assigned to a master's tutor. The tutor, prior to the deadline established for the formalization of the registration, must agree with the student for a first tutoring meeting in order to guide them in the academic aspects.

The School carries out several activities to welcome, tutor and guide academically students, and thus coordinate their training. On the one hand, the structure of the studies in courses facilitates the follow-up of the students, and is reinforced with the course coordinator, who guarantees the relationship between courses and collaborates in the tutoring. On the other hand, there is a general coordination that gives coherence, deepens and develops the competencies of each subject.

Welcome plan

Orientation and welcome session for new students

It takes place at the beginning of the academic year and is done for each degree. It is run by the School's Director, the Deputy Head of Studies, the Deputy Director of Teaching Innovation, the course coordinator and a representative of the student delegation.

Within this session the objectives are: to welcome, explain the operating methodologies, advise in the academic organization of student's work load, integrate the students and answer any questions that are raised.

Library briefing

Several meetings are convened at the beginning of the course on the services rendered by the Rector Gabriel Ferraté Library. Tools are provided to achieve the first level of generic competence: "Solvent use of information resources".

Service guide

The School publishes a service guide for students each year. This guide provides information to new students on the following areas: Information and communication, access to services, teaching resources, academic services, career guidance, participation, administrative services, and other campus services (evidence 2.4.1).

Tutoring action plan (evidence 2.4.2)

This is a system of comprehensive care and monitoring of 1st year students. The objectives of the Tutorial Action Plan are:

- To support the adaptation, learning and professional orientation of new students
- To provide elements of training, information and academic guidance in a personalized way.
- To promote the acquisition of study techniques and habits through individual and group tutoring, according to the teaching model described in the European Higher Education Area.
- To collect information about the development of the academic year through the students' experience

During the first week of the academic year, each student is assigned a tutoring group and a tutor. Learning is monitored throughout the year. The tutor and the student have a telematic platform to communicate, convene meetings, exchange information and documentation, etc. Finally, the tutors issue a final report at the end of the year (evidence 2.4.3).

This tutorial action plan is considered very useful for new students. At the end of the year, most tutored students confirm the usefulness of these sessions to their tutors. The students' positive assessment becomes evident in the surveys, which score with an average of 2.99 out of 5 their satisfaction with the tutoring sessions (evidence 2.4.4).

Students with special needs

The Disability Student Support Program and the Elite and/or High-Performance Sports Student Support Program provide for each student to be assigned a professor who acts as a tutor and helps with administrative matters.

High-performance athletes

The School Tutoring Action Plan provides special support for students who are high performance athletes. This group of students is the only one who is tutored throughout their degree.

Students doing internships

Students who do internships in companies, institutions and organizations through Educational Cooperation Agreements have an academic tutor assigned by the School. The role of the tutor is to guide, approve the internship training project proposed by the company and follow it up to the final assessment.

International mobility students

Outgoing students

There is a specific mobility information program called MOU-TE (MOVE! in English) (evidence.2.4.5). In the month of February, a presentation is made for students to inform them about their possibilities of doing a mobility stay, that is, what they can do during their mobility, when they are allowed to go abroad, where they can go, etc. Personalized attention is provided both by the person in charge of mobility at the Academic Office and by the deputy director of International Relations, either by mail, telephone or personal appointment.

Shortly after that, the application period begins. Students choose a list of possible destinations, according to their preferences and the advice received. At the end of that period, places are assigned and students must confirm or reject the assignment.

Once the mobility places have been allocated, a second information session is organized by the academic area, which focuses on the procedures to be carried out and other logistical aspects prior to, during and after the stay.

Once the students have confirmed the assigned place, they prepare the study agreement according to their interests, the academic offer at destination and the possibilities of recognition. Students have the support of the Academic Department and the deputy director of International Relations for the preparation of said document.

Incoming students

Incoming students can consult all the information available through the School's website (evidence 2.4.6). On this website you will find the following information:

- Study programmes. Courses and degrees that can be taken in English.
- Civil engineering facts.
- Application and admission.
- Useful information

The UPC organises an Orientation Week, addressed to international students who have to start theirstudies at the UPC each semester. The Orientation Week includes an institutional welcome, information on compulsory legal procedures, information about the main UPC services that can be of interest to thestudents during their stay and an introductory workshop on Catalan language and culture.

The UPC offers a "buddy" programme called *Salsa'm*, in which incoming students can request to be mentored by a local student (usually a local student can mentor 3 to 5 incoming students). Additionally, the UPC chapter of ESN offers incoming students' activities all along the semester.

Professional orientation plan

The services of the Employment Centre for graduates of Barcelona School of Civil Engineering have a key element, such as internships in companies that are mandatory in the case of the Degree in Public Works Engineering. The management of these external internships is included in process 250.1.2.5 (management and review of external internships integrated in the curriculum) of the IQAS and the entire procedure for carrying them out can be found in the Professional guidance section of the School's website (evidence 2.4.7).

In addition, the Futur Civil Day is organized every year, a forum organized by last-years students, in which different companies in the field of civil engineering send their head-hunters to scout new talents at our School. Simultaneously, during the same days, specialized sessions are also held on how to prepare a good CVs and cover letter, job-search methods and conducting interviews (evidence 2.4.8 - Futur Civil Portal) in which external specialists or the University's own specialized services participate.

The UPC has the UPC Alumni service that manages the job market and provides a whole range of very valid tools for final year students and graduates (evidence 2.4.9 - UPC Alumni Portal).

Career guidance is valued positively by students, given the satisfaction surveys. The average score in these surveys is 2.84 out of 5 (evidence 2.4.4).

Suport and assistance in pandemic

As shown by the satisfaction survey with the resources made available to students during the pandemic (evidence 2.4.10), we can consider that the support and assistance resources have been excellent.

7. Exams: System, Concept & Organisation

Criterion 3 Exams: System, concept and organisation

The face-to-face assessment method is clearly and transparently described in the academic programme, including the assessment methods, the weighting of the assessment parts as well as the calculation of the final mark. The assessments methods include, depending on the course and the expected module learning outcomes, the theoretical and practical solving of engineering problems and case studies, lab assignments, experiments etc. and are in their concept and variety fully satisfactory.

The examination practice of mandatory minimum requirements to credit points achievement is laid down transparently (12 ECTS in the first year, the other 48 ECTS from the first year are to be achieved by the end of the second year of studies at the latest).

As for the master's thesis, it is considered to be positive that the university accepts a more flexible approach and allows for a period of compilation of up to 12 months, not only for special cases or unforeseen circumstances, but also due to the fact that the students pay study fees according to the credit points envisaged to be achieved after every semester, and a master's thesis with its 25 credits makes a significant part out of the whole study time.

The university management defined the practice of continuous assessment as the mandatory assessment method and has consistently implemented it into all study programmes. However, sometimes this practice causes structural overload for students. Some students complain that from November on they are supposed to take several tests weekly, whereas some of these tests are as long as the final test (i.e. 1-1,5 hours). In some courses, the students have to submit papers instead of taking the tests. From the workload point of view, this is comparable, given that in these cases not submitting a paper means that the assessment of the whole course equals "failed". Accordingly, students have at least one and sometimes two tests in the week during the whole semester, even so, before the final assessment week. The final test is also to be taken additionally during the last week of the term.

A coordination mechanism was set up to avoid these complaints. This control mechanism supervised by the head of studies, controls whether the tests concentrate or not in the same week. The "course coordinator" (one for the 1st year and one for the 2nd year) organizes tests to avoid overlaps and concentration.

Two tests per week is a particular case and it does not happen every week. The number of tests is of the order of 15 tests during a semester including all the courses. This includes all types: continuous assessment and final assessment. For instance, if the courses are 6 ECTS, they will normally do around 3 tests in total per course. Since 5 courses of 6 ECTS result in 30 ECTS (one semester taught in 15 weeks), the number of tests is going to be 15 approximately. So, it is possible that some weeks have 2 tests scheduled, while others have 1 to none.

The prospect of students skipping classes in order to prepare tests is worrisome. The prolongation of the semesters in order to have more time to prepare for tests is something that we did in the past and proved unsuccessful. Professors and students were more worried about the period of exams than the period of classes.

With regards to the University's policy on fraud, plagiarism and academic integrity, the UPC's Academic Regulation for Bachelor's and Master's Degrees firstly states in its article 3.1.2 the students' rights and obligations during the assessment process. It states that "Irregular actions potentially leading to a significant variation of the marks obtained by one or more students will be considered a breach of the assessment regulations. Such behaviour will result in a descriptive mark of "Fail" and a numerical mark of 0 for the test in question and the course, without prejudice to any disciplinary proceedings that may result from that behaviour". In addition, during the period of home confinement caused by the COVID pandemic crisis, Barcelona School of Civil Engineering promoted among its students, professors and administrative staff a commitment to good behaviour that was very well received by the whole community.

Below you can consult the different evaluation tests of the different courses presented.

Assessment tests in the Master's Degree in Civil Engineering (MDCE)

The MDCE curriculum is structured in four teaching modules: i) scientific and technological formation extension, ii) the application of sciences and advanced technologies iii) specialties and iv) the master's thesis. A subject from each module has been chosen to exemplify the training activities and the achievement of the competencies.

Mechanics of continua (Module I. Scientific and technological formation extension)

You can check all the academic information, learning method, available resources and assessment method in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.1). Likewise, evidence of assessment tests is also available (evidence 3.2).

Figure 3.1 presents the number of enrolled and the percentage of suspended. Teaching of this course is carried out in two groups, allowing the teaching method to be perfectly developed with a flipped classroom mode. Likewise, the percentage of failing students (over enrolled students) presents data that is compatible with the efficiency and graduation rate set by this master's degree.

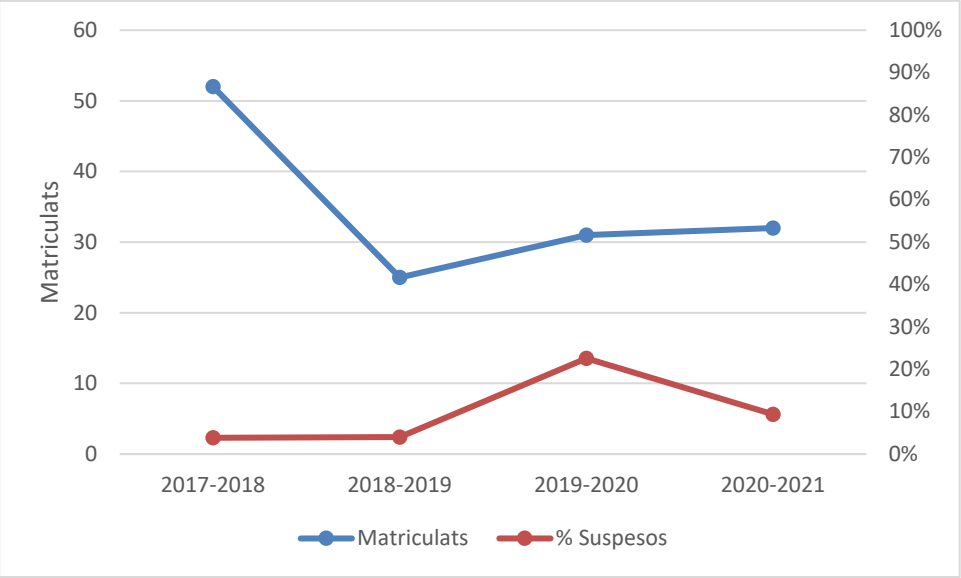

Figure 3.1. Number of enrolled students and percentage of failing students in the course on Mechanics of Continua.

Water engineering (Module II. Application of sciences and advanced technologies)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.3). Likewise, evidence of assessment tests is also available (evidence 3.4).

Figure 3.2 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of 0%.

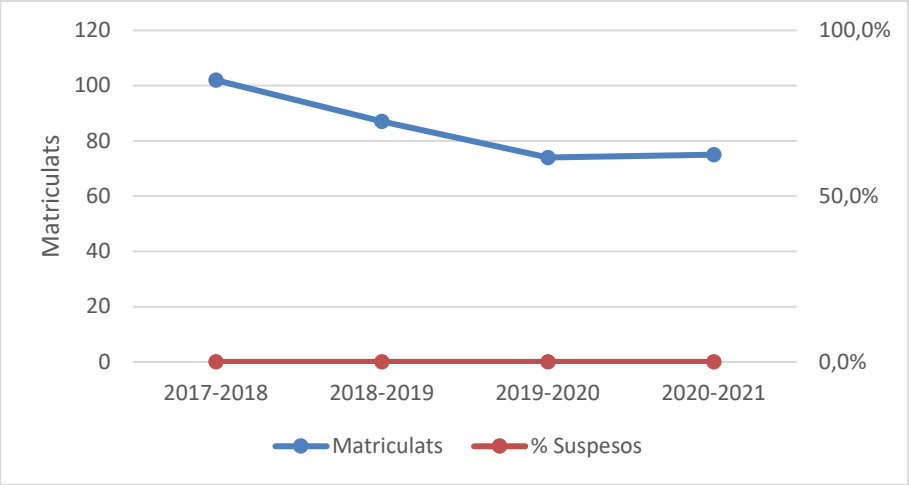

Figure 3.2. Number of enrolled students and percentage of failing students in the course on Water Engineering.

Urban Hydrology (Module III. Specialty in water engineering)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.5). Likewise, evidence of assessment tests is also available (evidence 3.6).

Figure 3.3 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of 0%.

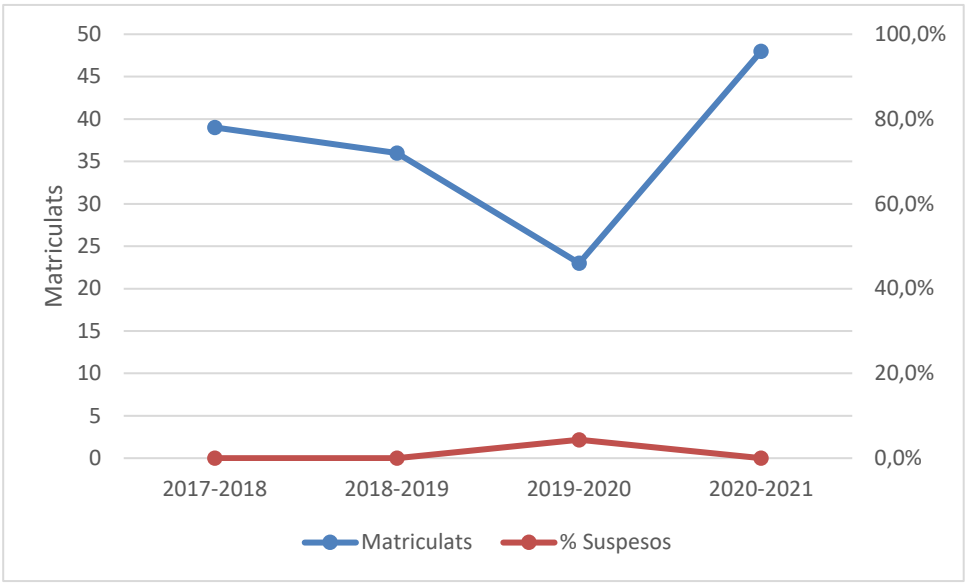

Figure 3.3. Number of enrolled students and percentage of failing students in the course on Urban Hydrology.

Interaction between groundwater and civil works (Module III. Specialty in geotechnical engineering)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.7). Likewise, evidence

of assessment tests is also available (evidence 3.8).

Figure 3.2 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of inferior to 5%.

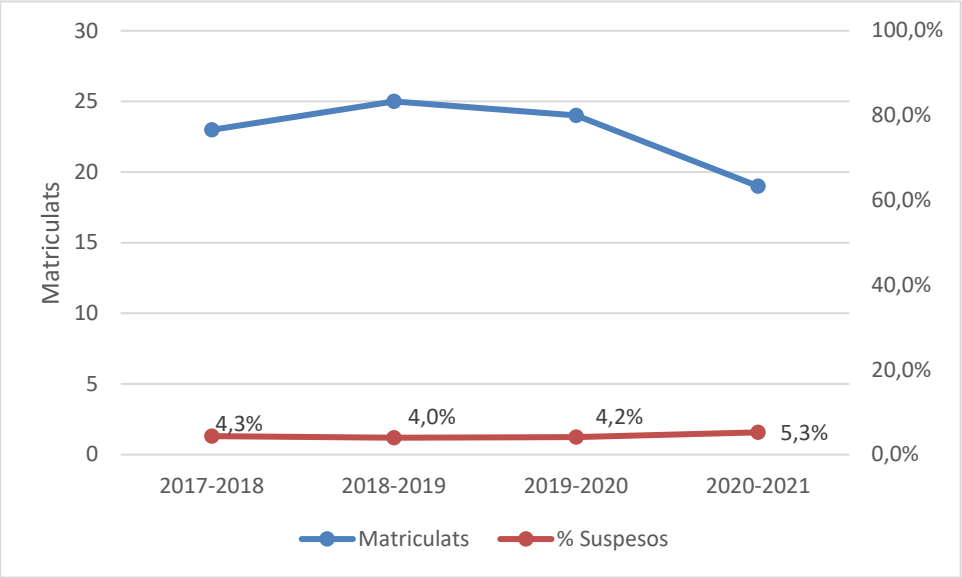

Figure 3.4. Number of enrolled students and percentage of failing students in the course on Interaction Between Groundwater and Civil Works.

Building Structures (Module III. Specialty in structural and construction engineering)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.9). Likewise, evidence of assessment tests is also available (evidence 3.10).

Figure 3.5 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of inferior to 5%.

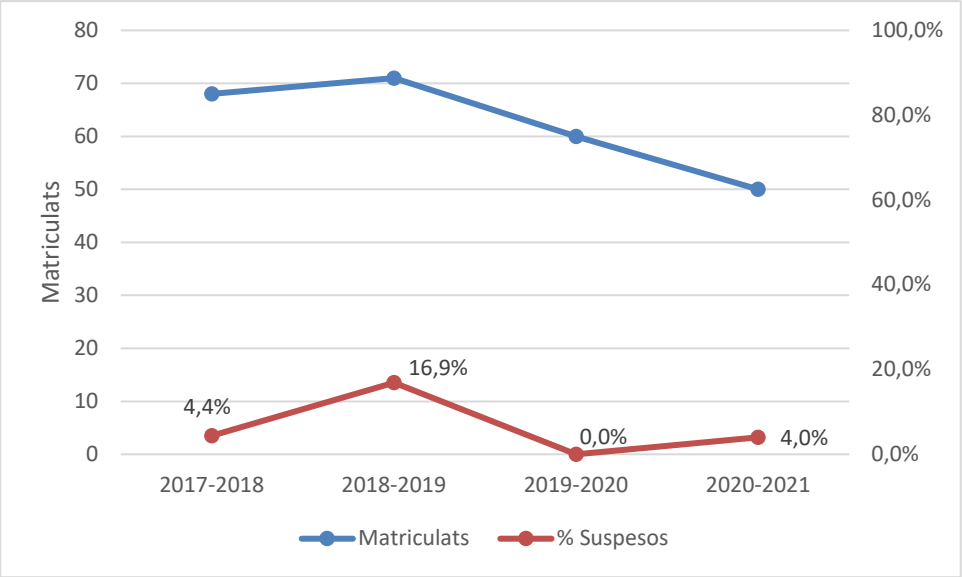

Figure 3.5. Number of enrolled students and percentage of failing students in the course on Building Structures.

Machine learning and models for decision making (Module III. Specialty in computational engineering)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.11). Likewise, evidence of assessment tests is also available (evidence 3.12).

Figure 3.6 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of 0%.

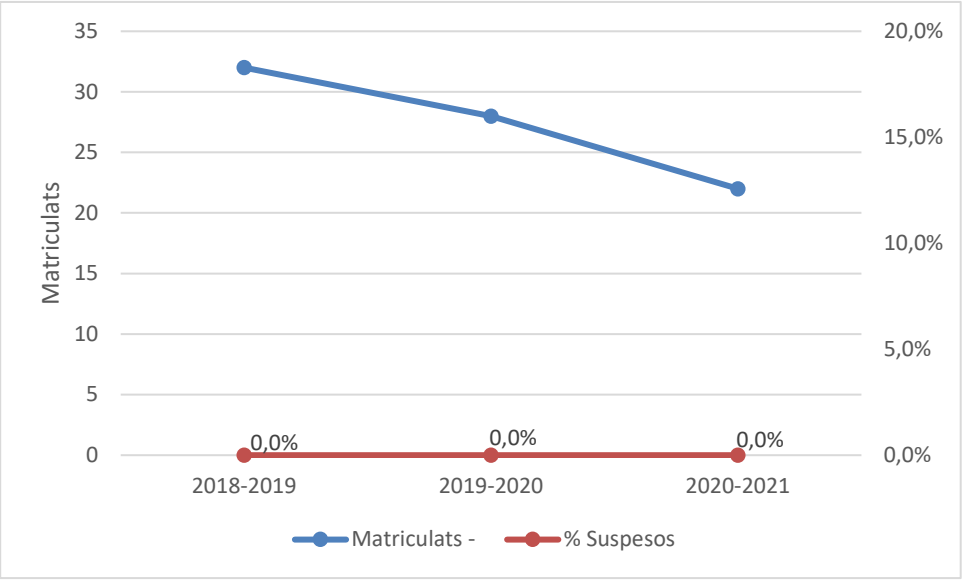

Figure 3.6. Number of enrolled students and percentage of failing students in the course on Machine Learning and Models for Decision Making.

Urban Mobility (Module III. Specialty in transportation engineering and urban planning)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.13). Likewise, evidence of assessment tests is also available (evidence 3.14).

Figure 3.7 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate inferior to 5%.

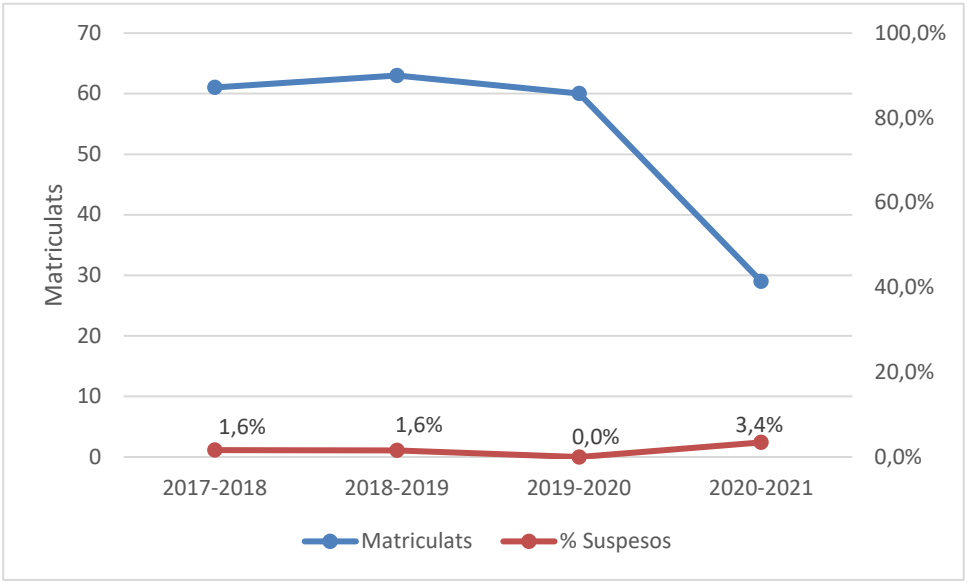

Figure 3.7. Number of enrolled students and percentage of failing students in the course on Urban Mobility.

Life-Cycle Analysis and Sustainability Assessment (Module III. Specialty in environmental engineering and sustainability)

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.15). Likewise, evidence of assessment tests is also available (evidence 3.16).

Figure 3.8 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate inferior to 5%.

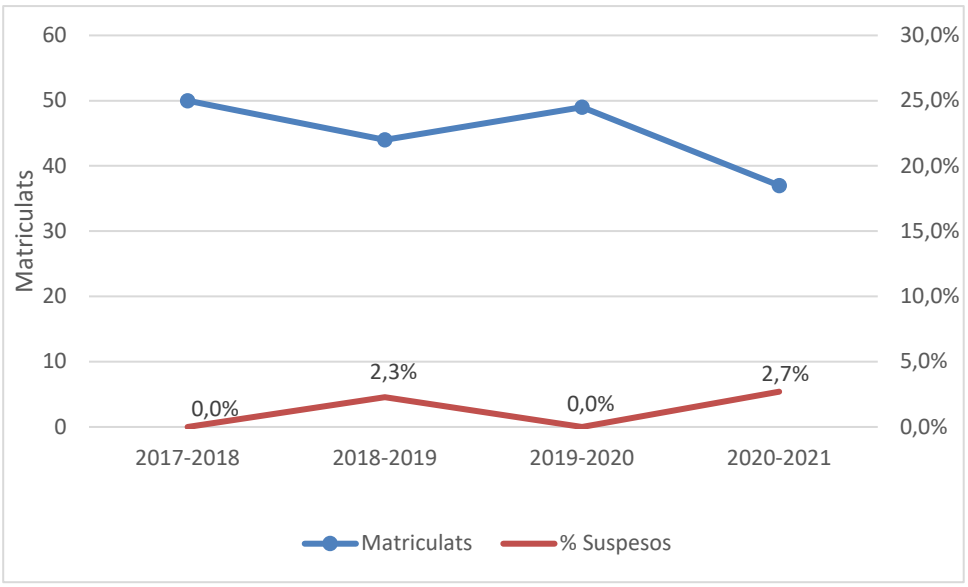

Figure 3.8. Number of enrolled students and percentage of failing students in the course on Life-Cycle Analysis and Sustainability Assessment.

Master's Thesis (Module IV. Master's Thesis).

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.17). Likewise, evidence of assessment tests is also available (evidence 3.18).

Figure 3.9 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of 0%.

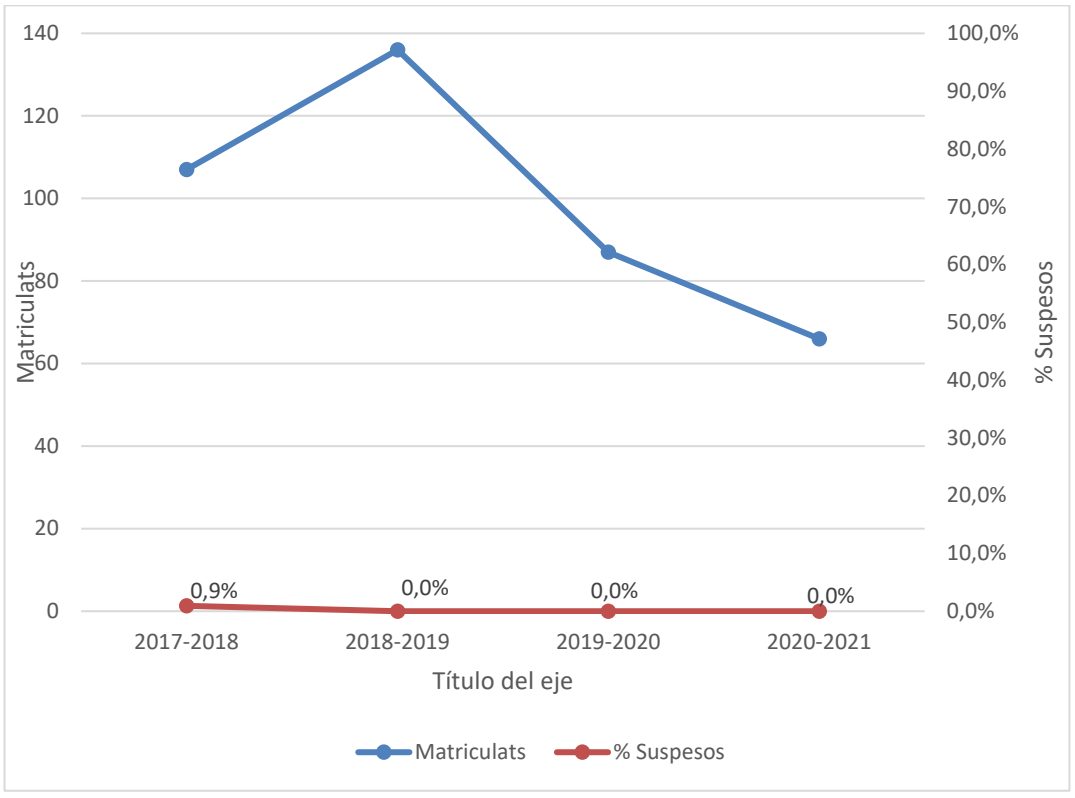

Figure 3.9. Number of enrolled students and percentage of failing students in the Master's Thesis.

Assessment tests in the Master's Degree in Numerical Methods in Engineering (MDNME)

Two courses have been chosen to illustrate the level of achievement required according to the verification report (MDNME), of which the teaching files are presented as evidence: Numerical Methods for PDEs and Finite Element.

Numerical Methods for PDEs

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.19). Likewise, evidence of assessment tests is also available (evidence 3.20).

Figure 3.10 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate inferior to 5%.

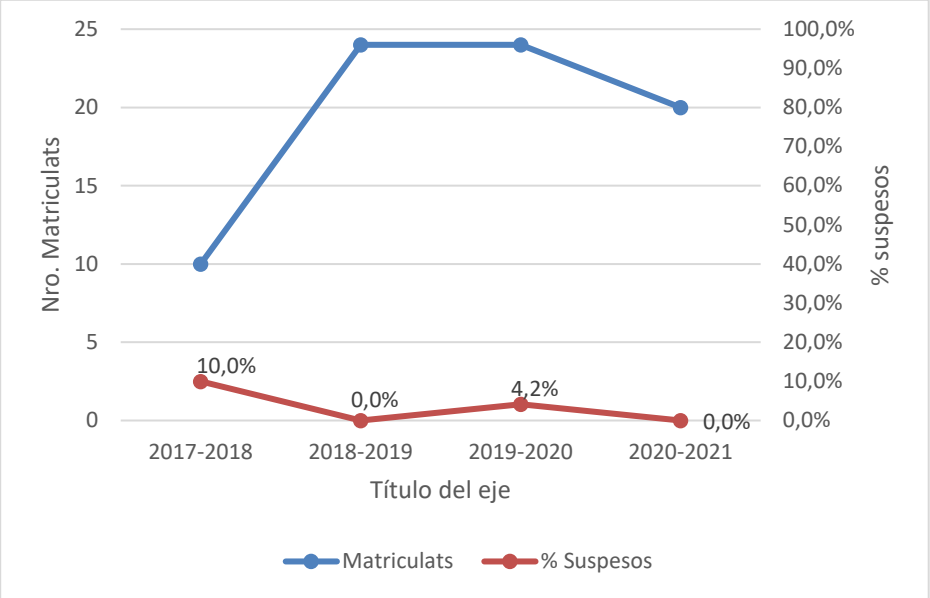

Figure 3.10. Number of enrolled students and percentage of failing students in the course on Numerical Methods for PDEs.

Finite Element

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.21). Likewise, evidence of assessment tests is also available (evidence 3.22).

Figure 3.11 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate inferior to 5%.

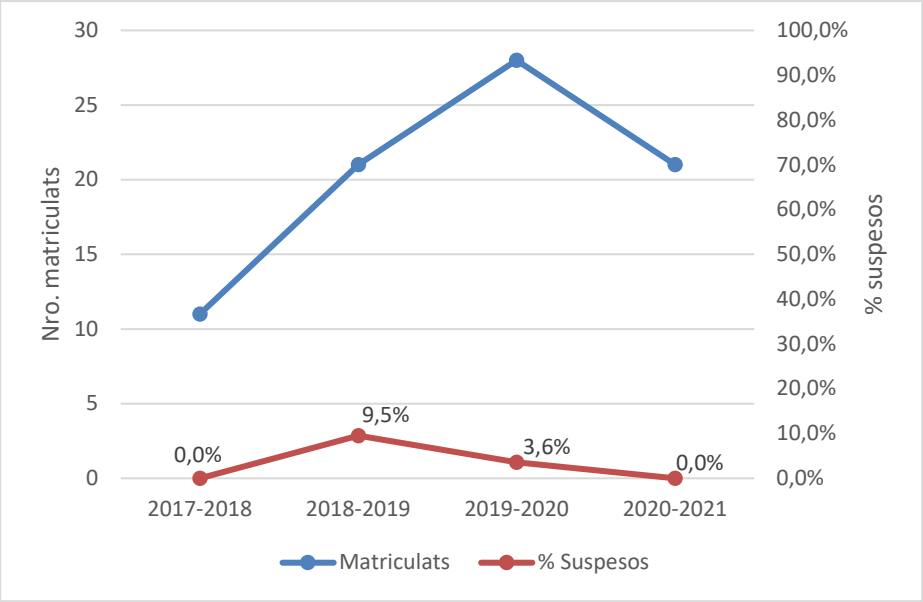

Figure 3.11. Number of enrolled students and percentage of failing students in the course on Finite Elements.

Master's Thesis

All the academic information, learning method, available resources and assessment method can be checked in the link to the course at the CaminsOpenCourseWare Portal (evidence 3.23). Likewise, evidence of assessment tests is also available (evidence 3.24).

Figure 3.12 shows the number of students enrolled in the course and the percentage of those who failed. The results of the assessment of student progress are very satisfactory and do not condition the achievement of the monitoring indicators of the master's degree (dropout rate, efficiency and graduation), with a failure rate of 0%.

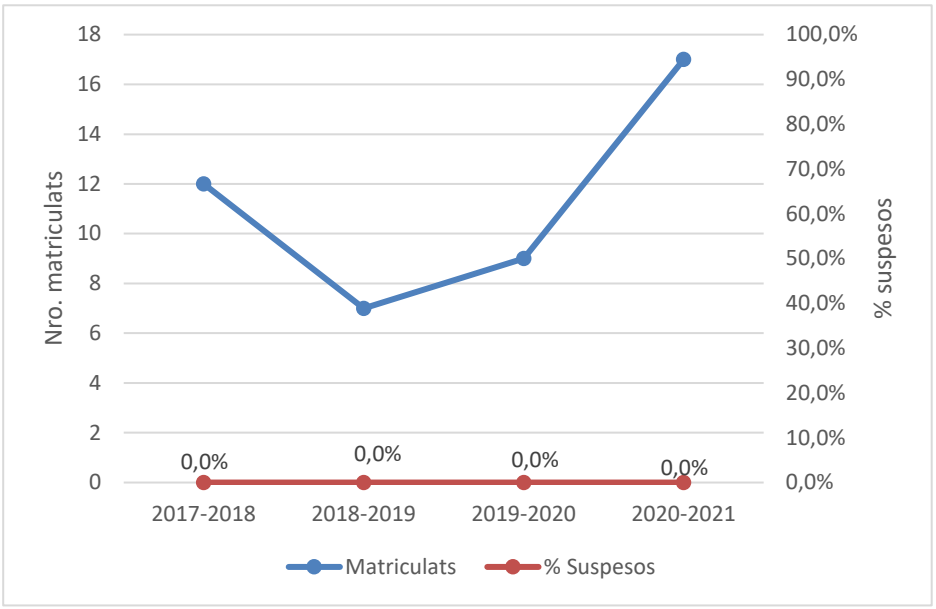

Figure 3.12. Number of enrolled students and percentage of failing students in the Master's Thesis.

8. Resources

Criterion 4.1 Staff

Barcelona School of Civil Engineering has a teaching staff with a level of qualification and experience (teaching, research and professional) appropriate to the degrees taught in the centre.

	Total Teaching & Research Staff	Full-time Teaching & Research Staff	PhDs	% Teaching hours	Num. of teaching premiums	Num. of active teaching premiums	Num. of research premiums	Num. of active research premiums	Main researchers at leading projects	researchers at leading projects (Not main res.)	Director of PhD thesis
Department of Project & Construction Engineering	**1**	**0**	**1**	**0,09%**		**0**		**0**	**0**	**0**	**0**
Adjunct professor Basic Type	1	0	1	0,09%		0		0	0	0	0
Department of Chemical Engineering	**1**	**1**	**1**	**0,43%**	**4**	**1**	**5**	**1**	**1**	**0**	**1**
Contracted full professor	1	1	1	0,43%	4	1	5	1	1	0	1
Department of Civil & Environmental Engineering	**203**	**107**	**145**	**95,43%**	**420**	**91**	**348**	**89**	**59**	**64**	**89**
Associate professor	29	29	29	21,06%	72	25	69	27	19	9	24
Assistant professor	9	9	9	4,33%		2	6	3	1	7	4
Senior professor	19	18	19	12,69%	81	17	51	13	6	10	10
Adjunct professor Type 2	15	0	7	6,00%		0		0	0	3	2
University Full professor	29	29	29	17,59%	164	28	149	27	19	8	26
Adjunct professor Basic Type	66	0	22	16,87%		0	1	0	0	15	4
Emeritus professor	3	0	3	1,11%	20	2	18	3	2	1	2
Contracted full professor	9	9	9	4,09%	35	9	32	9	7	2	9
University School Full professor	5	5	5	3,78%	30	3	21	4	2	2	3
Ordinary researcher	1	1	1	0,29%		0		1	0	1	0
Assimilated ordinary researcher	1	0	1	0,28%		0		0	1	0	1
University school associate professor	3	0	2	1,12%		0		0	0	0	0
Research director	1	1	1	0,30%		0		1	0	1	1
Juan de la Cierva postdoctoral researcher	1	1	1	0,04%		0		0	1	0	0
PhD lecturer	4	4	4	3,41%	15	4	1	1	0	2	1
Non-PhD lecturer	1	1	0	0,87%	3	1		0	0	1	0
Assimilated research director	1	0	1	0,72%		0		0	0	1	1
FPU fellowship – 4th year	1	0	0	0,14%		0		0	0	0	0
FPU fellowship – 3rd year	1	0	0	0,09%		0		0	0	0	0
Marie Curie Postdoc	1	0	1	0,04%		0		0	1	0	0
Adjunct professor Type 3	1	0	0	0,57%		0		0	0	0	0
Juan de la Cierva researcher	1	0	1	0,02%		0		0	0	0	1

FPI fellowship – 4th year	1	0	0	0,02%		0		0	0	1	0
Department of Agri-Food Engineering & Biotechnology	**5**	**1**	**3**	**1,89%**	**5**	**1**	**4**	**1**	**1**	**1**	**1**
Senior professor	1	1	1	0,59%	5	1	4	1	0	0	1
Adjunct professor Basic Type	3	0	1	0,90%		0		0	0	1	0
Ramón i Cajal	1	0	1	0,39%		0		0	1	0	0
Department of Physics	**4**	**4**	**4**	**1,83%**	**24**	**4**	**18**	**4**	**3**	**1**	**2**
Associate professor	1	1	1	0,44%	4	1	3	1	0	1	1
University associate professor	1	1	1	0,34%	6	1	4	1	1	0	0
University full professor	1	1	1	0,52%	7	1	5	1	1	0	0
Contracted full professor	1	1	1	0,53%	7	1	6	1	1	0	1
Department of Graphic & Design Engineering	**1**	**1**	**1**	**0,09%**		**0**	**2**	**1**	**0**	**0**	**0**
Lecturer	1	1	1	0,09%		0	2	1	0	0	0
Maritime Engineering Laboratory	**1**	**0**	**1**	**0,06%**		**0**		**0**	**0**	**1**	**0**
Assimilated research director	1	0	1	0,06%		0		0	0	1	0
Department of Nautical Science & Engineering	**1**	**0**	**1**	**0,02%**		**0**		**0**	**0**	**1**	**0**
Adjunct professor Basic Type	1	0	1	0,02%		0		0	0	1	0
Specific Research Centre of Numerical Methods in Applied Sciences & Engineering	**1**	**0**	**1**	**0,14%**		**0**		**0**	**0**	**1**	**0**
Assimilated research director	1	0	1	0,14%		0		0	0	1	0
Centre of Applied Research on Hydrometeorology	**1**	**1**	**0**	**0,02%**		**0**		**0**	**0**	**1**	**0**
FI AGAUR fellowship	1	1	0	0,02%		0		0	0	1	0

Table 27. Distribution of the different TRS categories grouped by field of knowledge.

Figure 4.1.1 shows that in 2020-2021 the total Teaching & Research Staff (TRS) of the school was 204, 72% of whom were doctors. If we consider the Full-time TRS, this percentage is higher than 70%.

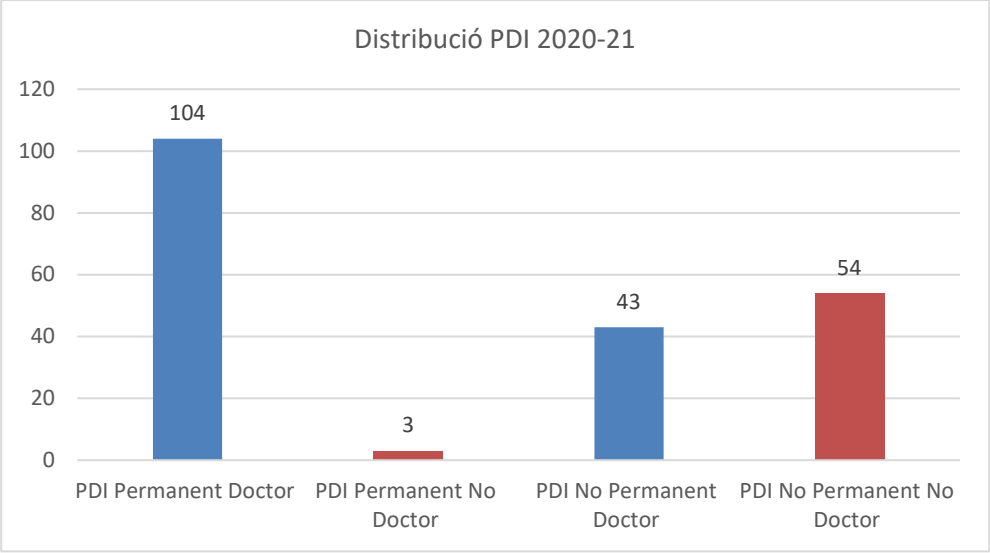

Figure 4.1.1. Distribution of the Teaching & Research Staff in 2020-2021 academic year.

Figure 4.2.2 shows this same distribution with regards to the professional category.

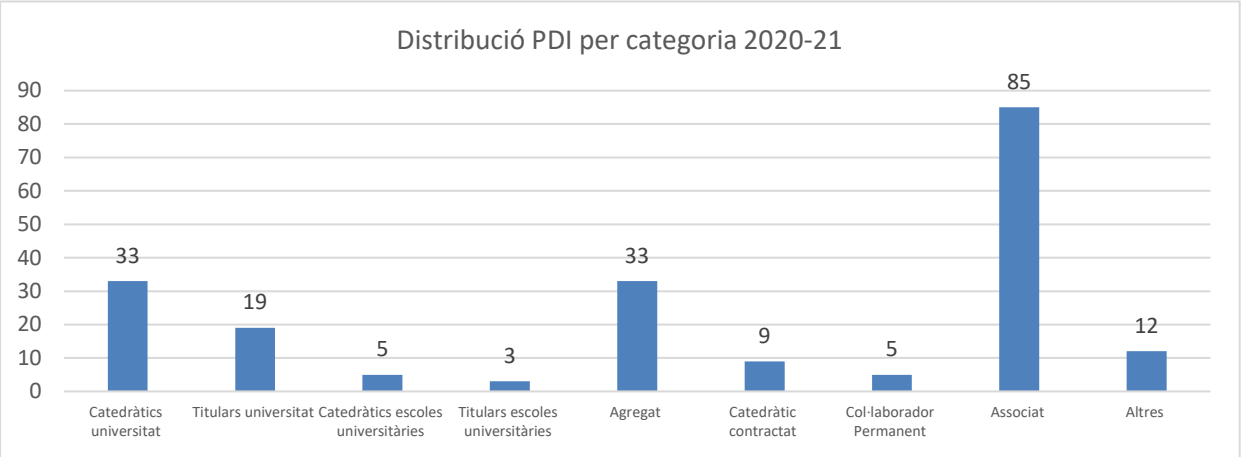

Figure 4.2.2. Distribution of the Teaching & Research Staff per category.

From these 204 TRS, correspond to 145,34 ETC TRS (1 ETC TRS equals to 72 PAD annual points at full-time and being able to work in more than one school).

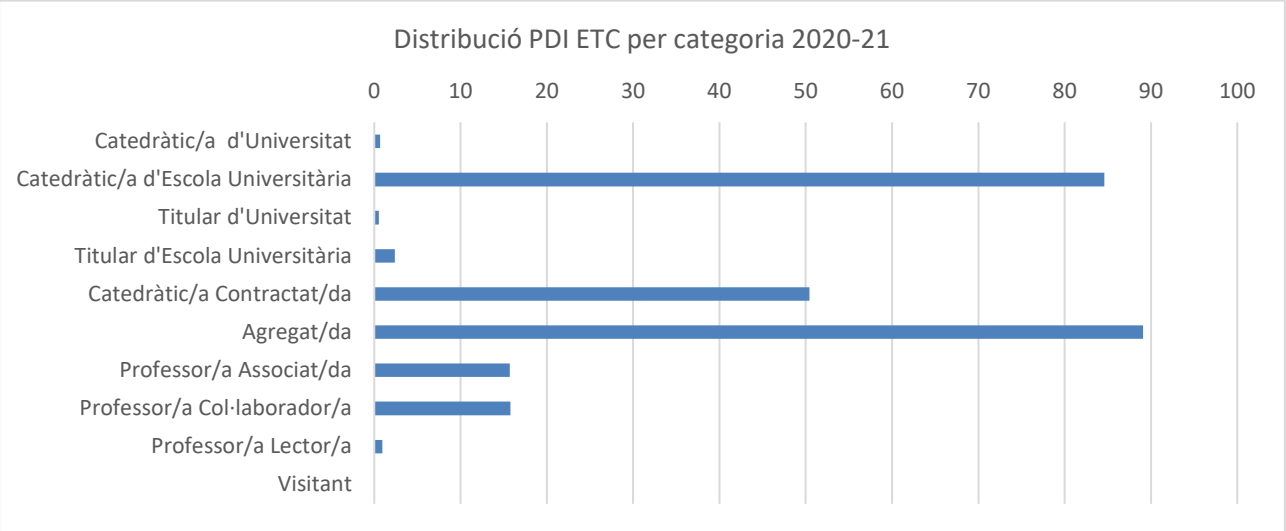

Figure 4.2.3. Distribution of the Teaching & Research Staff per category in the 2020-2021 academic year.

Teaching yearly-increments (or premiums)

Number of 5-yearly increment of teaching staff	Active	Non-active	Total	%
Teaching staff with 1 5-yearly increment	25	0	25	15.43
Teaching staff with 2 and 3 5-yearly increments	44	0	44	27.16
Teaching staff with 4 and 5 5-yearly increments	44	1	45	27.78
Teaching staff with more than 5 5-yearly increments	37	11	48	29.63

Table 4.1.1. Distribution of the 5-yearly increment of teaching staff.

Number of 6-yearly increment of teaching staff	Active	Non-active	Total	%
Teaching staff with 1 6-yearly increment	15	3	18	12.68

Teaching staff with 2 and 3 6-yearly increments	67	1	68	47.89
Teaching staff with 4 and 5 6-yearly increments	38	6	44	30.99
Teaching staff with more than 5 6-yearly increments	9	3	12	8.45

Table 4.1.2. Distribution of the 6-yearly increment of teaching staff.

Number of 5-yearly increment of teaching staff	**Active**	**Non-active**	**Total**	**%**
Teaching staff with 1 5-yearly increment	19	0	19	11.66
Teaching staff with 2 and 3 5-yearly increments	52	0	52	31.90
Teaching staff with 4 and 5 5-yearly increments	43	1	44	26.99
Teaching staff with more than 5 5-yearly increments	37	11	48	29.45

Table 4.1.3. Regional distribution of the 5-yearly increment of teaching staff.

Number of 6-yearly increment of teaching staff	**Active**	**Non-active**	**Total**	**%**
Teaching staff with 1 6-yearly increment	17	2	19	13.67
Teaching staff with 2 and 3 6-yearly increments	71	0	71	51.08
Teaching staff with 4 and 5 6-yearly increments	33	6	39	28.06
Teaching staff with more than 5 6-yearly increments	7	3	10	7.19

Table 4.1.4. Regional distribution of the 6-yearly increment of teaching staff.

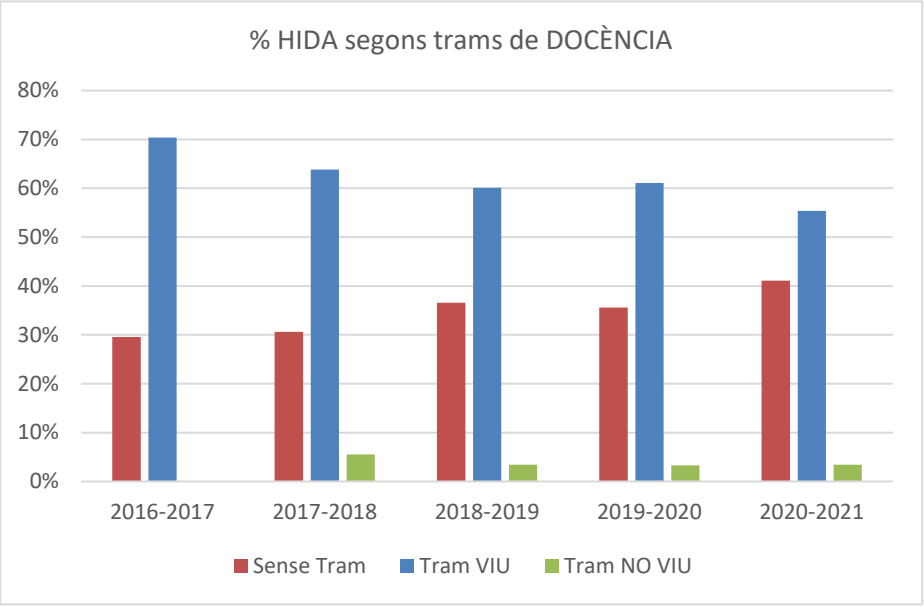

Figure 4.2.4. Percentage of teaching hours (HIDA) with regards to teaching yearly-increments.

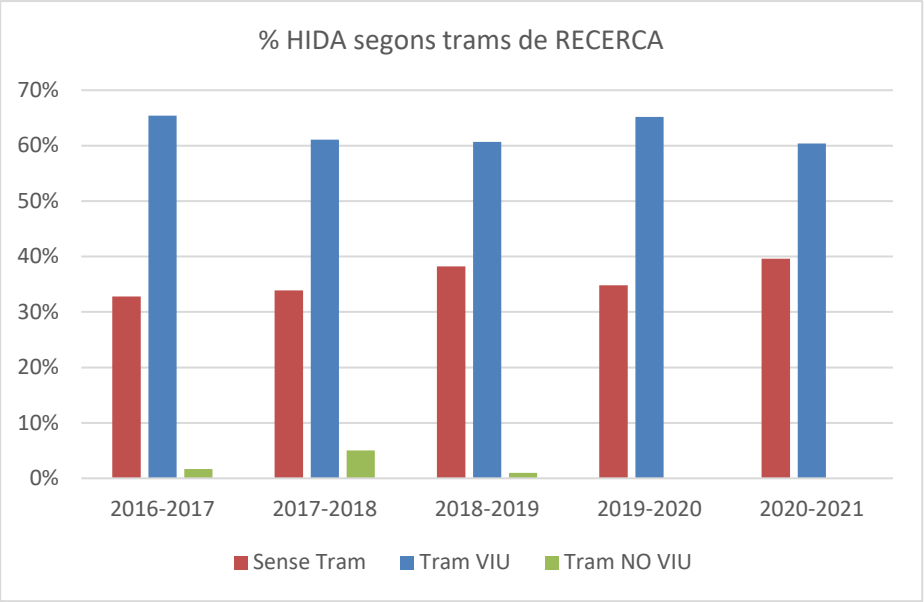

Figure 4.2.5. Percentage of teaching hours (HIDA) with regards to research yearly-increments.

As for scientific research and production, all the details can be seen at the UPC's Future portal (evidence 4.1).

Category	Amount	Total PAD	% teaching hours	Num. of teaching premiums	Num. of active teaching premiums	Num. of research premiums	Num. of active research premiums	Main researchers at leading projects	researchers at leading projects (Not main res.)	Director of PhD thesis
Associate professor	30	1796,97	21,5%	76	26	72	28	10	19	25
Adjunct professor Type 2	15	501,38	6,0%		0		0	3	0	2
Adjunct professor Type 3	1	47,87	0,6%		0		0	0	0	0
Adjunct professor Basic Type	71	1495,50	17,9%		0	1	0	17	0	4
Contracted full professor	11	422,38	5,1%	46	11	43	11	2	9	11
University School full professor	5	316,28	3,8%	30	3	21	4	2	2	3
University full professor	30	1513,87	18,1%	171	29	154	28	8	20	26
PhD lecturer	4	284,92	3,4%	15	4	1	1	2	0	1
Non-PhD lecturer	1	72,45	0,9%	3	1		0	1	0	0
Research director	1	25,40	0,3%		0		1	1	0	1
Assimilated research director	3	76,59	0,9%		0		0	3	0	1

Emeritus professor	3	93,13	1,1%	20	2	18	3	1	2	2
FPI fellowship – 4th year	1	2,05	0,0%		0		0	1	0	0
FPU fellowship – 4th year	1	12,00	0,1%		0		0	0	0	0
FPU fellowship – 3rd year	1	7,36	0,1%		0		0	0	0	0
Assimilated ordinary researcher	1	23,13	0,3%		0		0	0	1	1
FI AGAUR fellowship	1	1,80	0,0%		0		0	1	0	0
Ordinary researcher	1	24,33	0,3%		0		1	1	0	0
Juan de la Cierva postdoctoral researcher	1	3,00	0,0%		0		0	0	1	0
Juan de la Cierva researcher	1	1,50	0,0%		0		0	0	0	1
Assistant professor	10	369,22	4,4%		2	8	4	7	1	4
Marie Curie Postdoc	1	3,00	0,0%		0		0	0	1	0
Ramón i Cajal	1	32,85	0,4%		0		0	0	1	0
University school associate professor	3	93,32	1,1%		0		0	0	0	0
University associate professor	21	1138,37	13,6%	92	19	59	15	10	7	11

Table 4.1.5. Main indicators of the Teaching & Research Staff published at Futur UPC.

Observe that in the comparative study of the scientific publication of the UPC and our school vs. other international universities (evidence 4.2), the scientific output of the centre is among the highest.

The Master's degree only allows two tutors per student. One of the tutors must be from the Teaching & Research Staff at our school. In the event that the tutor does not teach any course in the Master's programme, the academic coordinator of the master's degree will act as tutor.

In the case of the Master's Degree in Civil Engineering, the tutor must evaluate and authorize the defence of the Master's Thesis before the period established for the deposit, which is published at the School's website, under Academic Procedures. This assessment is included in the 3B report, available at the Portal Camins website (evidence 4.3).

In the event that there is an external tutor, who must be an engineer, it is the internal tutor who validates the assignment of the Master's Thesis proposal and who receives from the external tutor a final report in the standard format available at the Portal Camins website (evidence 4.4).

Should the Master's Thesis be carried out within the framework of a mobility program, and whenever the destination university requests it, the student will have to look for an internal tutor.

The data shown in the tables above show that the professors of Barcelona School of Civil Engineering have extensive research and/or professional experience to supervise and evaluate the students' training. Our

Teaching & Research Staff are, in general, characterized by being accessible (77% of TRS are contracted full time) and have a high commitment to the quality of training and personal growth of students.

The work of the TRS is valued very positively in all the quality indicators, both teaching and research, as it is considered that the TRS of the master's programs taught at our School meets the requirements for the Master's academic qualification and has more than sufficient and valued teaching and research experience. Therefore, this substandard is considered to be widely met.

Master's Degree in Civil Engineering Staff

The TRS who participate in the Master's Degree in Civil Engineering have a high qualification that ensures the correct training and transmission of knowledge to students. In the 2020-2021 academic year the TRS was distributed in the following categories: 58.2% of Permanent (contracted full prof., university full prof., university school full prof., senior prof., assistant prof.), 26.3% of adjunct professors, 4.8 % permanent (university school associate prof. and lecturer), 4.7% assistant and the rest in other contractual forms. The assignment of teaching hours by professional category is detailed in Figure 35.

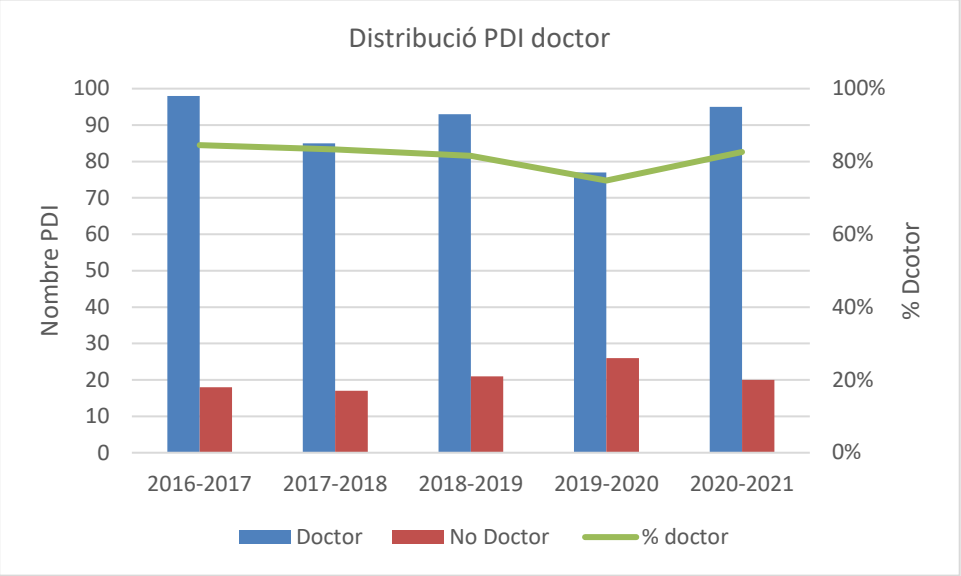

Figure 4.2.6. Distribution of MDCE's Teaching & Research Staff.

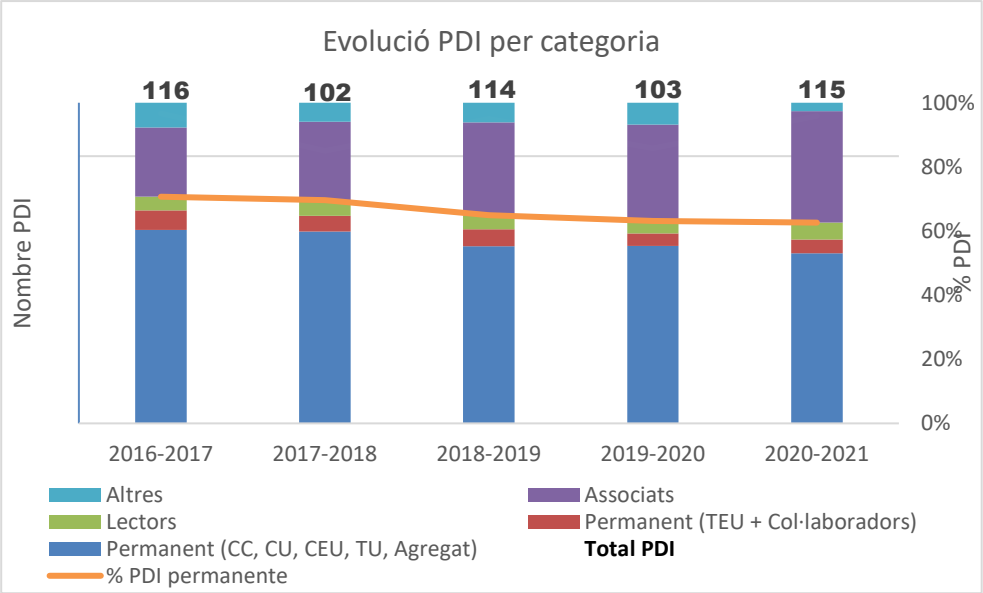

Figure 4.2.7. Distribution of MDCE's Teaching & Research Staff per category.

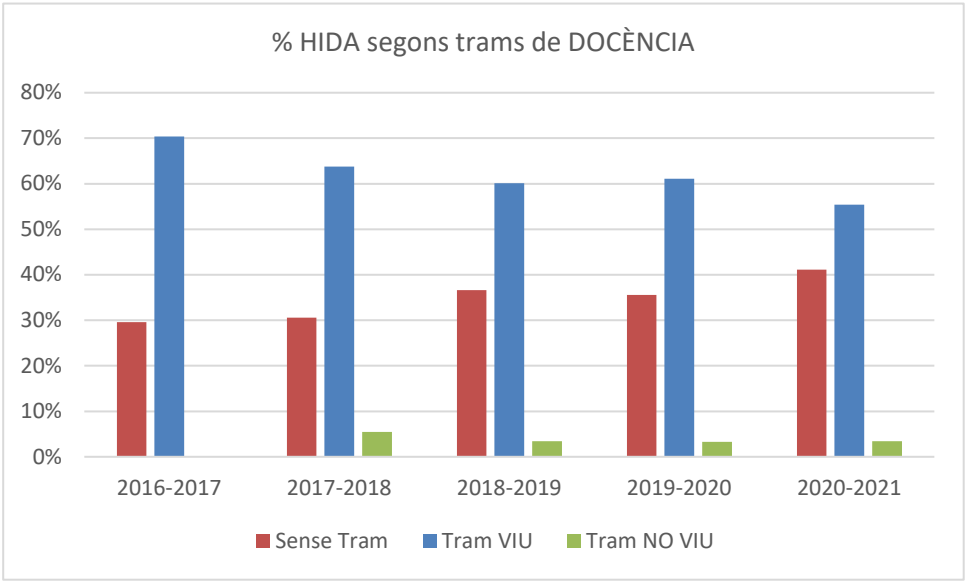

Figure 4.2.8. MDCE's percentage of teaching hours (HIDA) regarding the teaching yearly-increments.

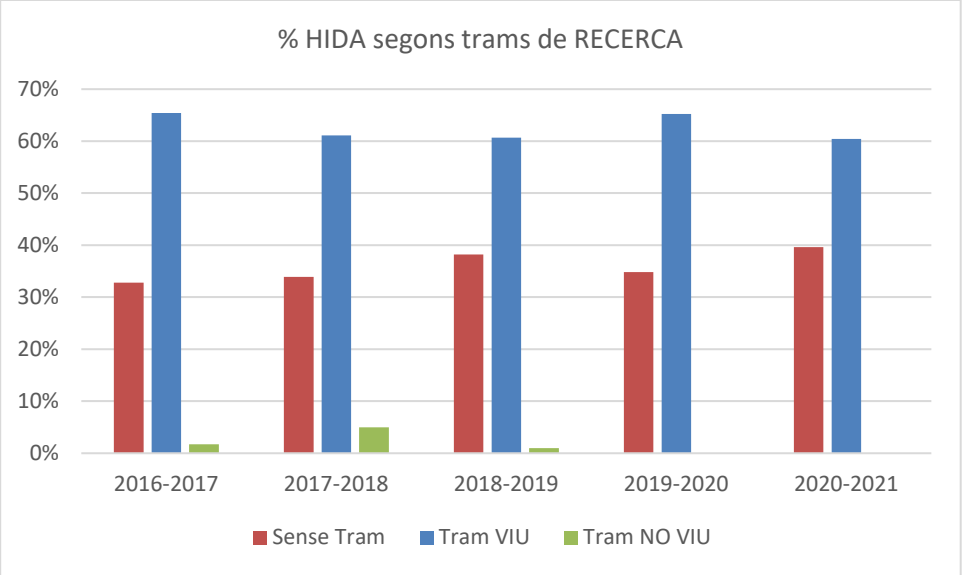

Figure 4.2.9. MDCE's percentage of teaching hours (HIDA) regarding the research yearly-increments.

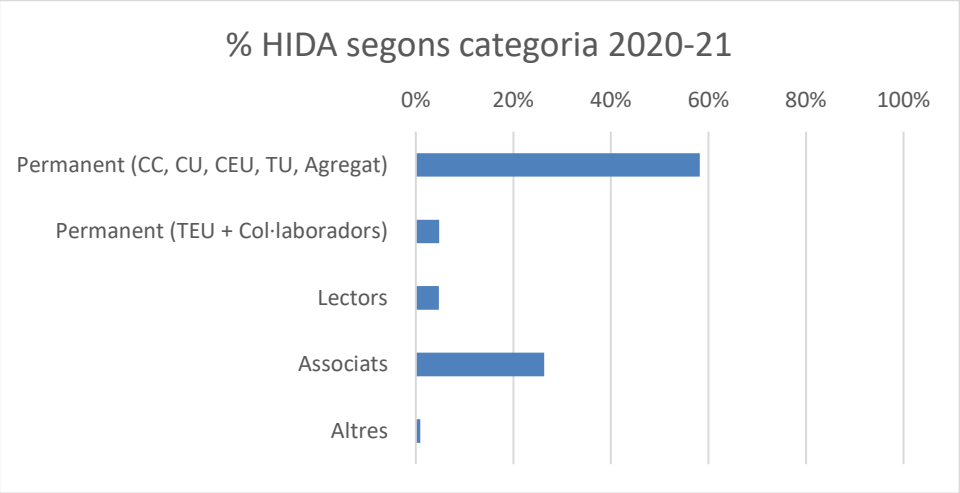

Figure 4.2.10. MDCE's percentage of teaching hours (HIDA) regarding the category for the 2020-2021 academic year.

Likewise, the dedication of the TRS to the teaching tasks of the MDCE is satisfactory, with ECT/TRS ECT ratios of 3.06 for the 2020-2021 academic year. This value has remained stable compared to previous years.

	2017-2018		**2018-2019**		**2019-2020**		**2020-2021**	
	Value	**% response**	**Value**	**% response**	**Value**	**% response**	**Value**	**% response**
Courses (Overall, I am satisfied with this course)	3,7	36,50	3,7	43	3,9	44,30	3,8	36,20
Professor (The professor who taught this subject is a good teacher)	4,1	37,20	4	37,90	4,1	31,80	4,1	27,50

Score on a maximum of 5.

Table 4.1.6. Student satisfaction with MDEC's teaching.

Overall these values can be considered good results. If we take into account the satisfaction of the studies

that give access to this Master's Degree, which are the Bachelor's Degree in Civil Engineering and the Bachelor's Degree in Public Works Engineering, we observe satisfaction rates that do not differ significantly from these. The population of this satisfaction study corresponds to the total number of students in the Master's degree evidence 1.1.2.

Master's Degree in Numerical Methods in Engineering Staff

The TRS who participate in the Master's Degree in Numerical Methods in Engineering have a high qualification that ensures the correct training and transmission of knowledge to students. In the 2020-2021 academic year the TRS was distributed in the following categories: 60% of Permanent (contracted full prof., university full prof., university school full prof., senior prof., assistant prof.), 28% of adjunct professors, 4 % permanent (university school associate prof. and lecturer), 8% assistant and the rest in other contractual forms.

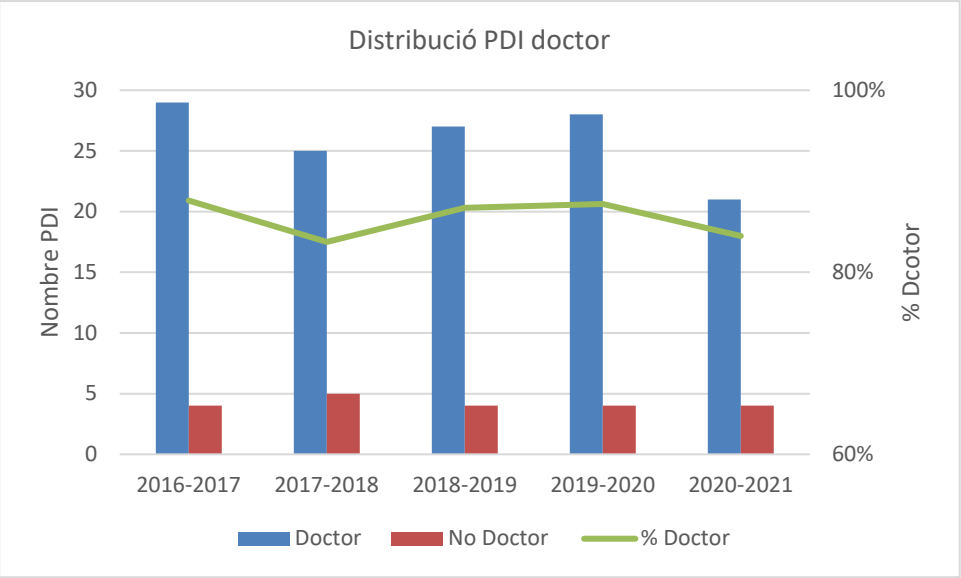

Figure 4.2.11. Distribution of MDNME's Teaching & Research Staff.

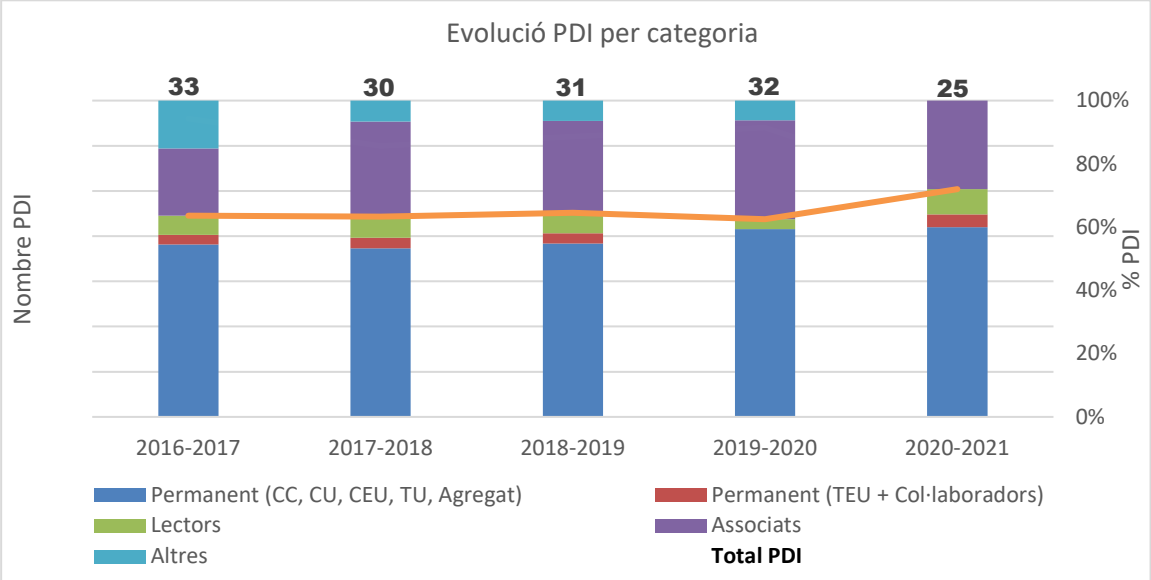

Figure 4.2.12. Distribution of MDNME's Teaching & Research Staff per category.

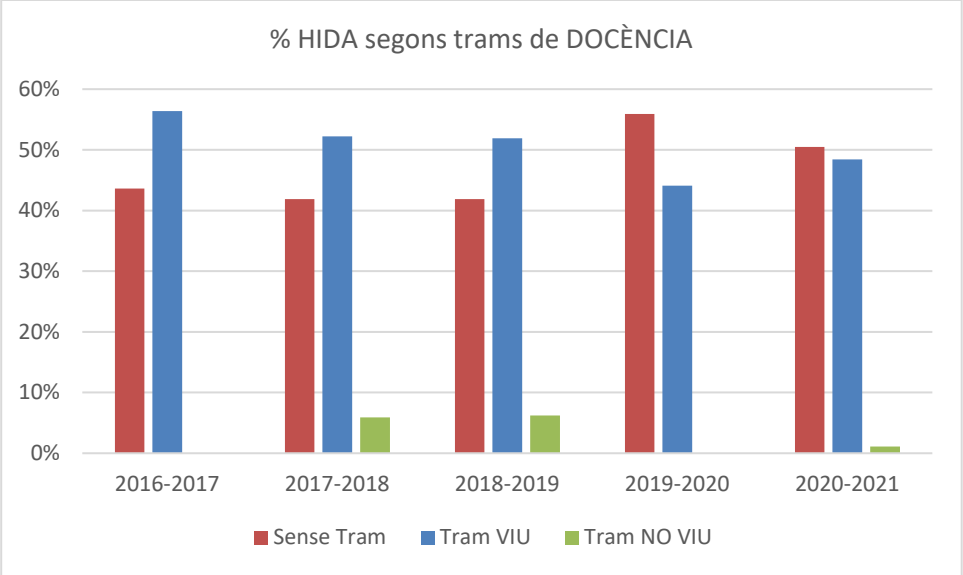

Figure 4.2.13. MDNME's percentage of teaching hours (HIDA) regarding the teaching yearly-increments.

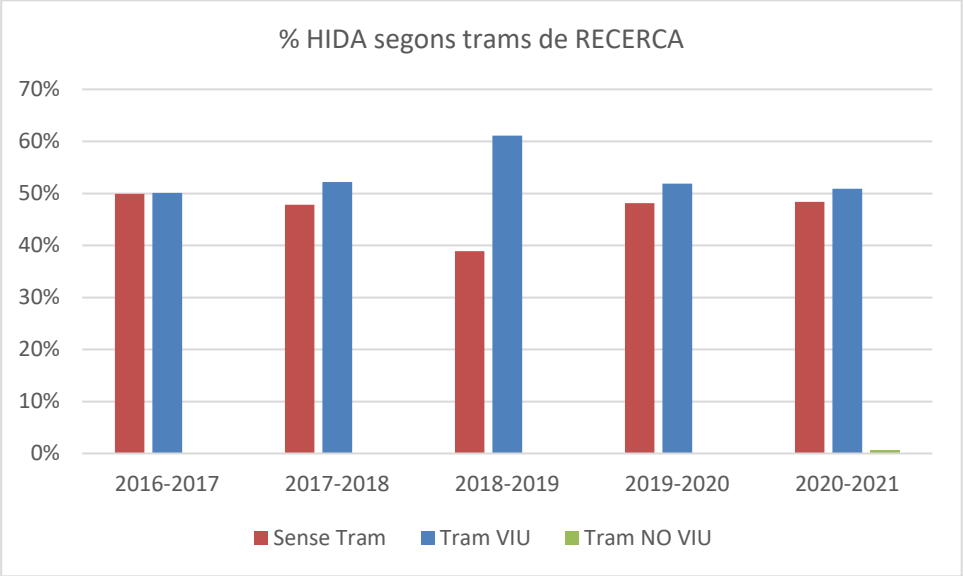

Figure 4.2.14. MDNME's percentage of teaching hours (HIDA) regarding the research yearly-increments.

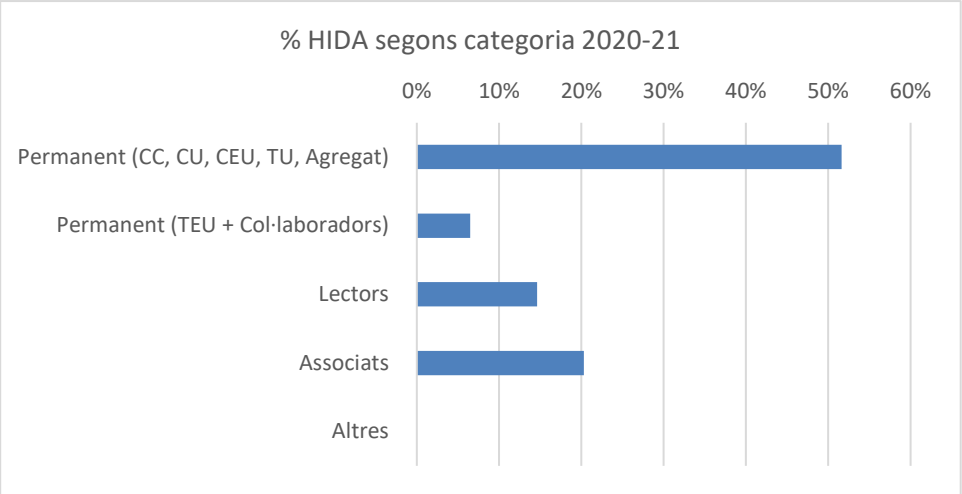

Figure 4.2.15. MDNME's percentage of teaching hours (HIDA) regarding the category for the 2020-2021 academic year.

	2016-2017		2017-2018		2018-2019		2019-2020		2020-2021	
	Value	**% response**	**Value**	**% response**	**Value**	**% response**	**Value**	**% response**	**Value**	**% response**
Courses (Overall, I am satisfied with this course)	3,8	18,20%	3,6	39,40%	3,9	36,50%	3,8	52,80%	3,7	32,90%
Professor (The professor who taught this subject is a good teacher)	4,3	27,50%	4,1	38,40%	4,3	32,60%	4,2	47,60%	3,9	26%

Score on a maximum of 5.

Table 4.1.7. Student satisfaction with MDNME's teaching

These satisfaction results (Table 4.1.7) show a high degree of student satisfaction (3.7 and 3.9 out of 5 in the 2020-2021 academic year). This satisfaction remains almost constant year after year (satisfaction indicators tab of evidence 1.1.4).

The research activity of the TRS of Barcelona School of Civil Engineering can be verified in the 2014-2018 bibliometric study "RecerCAMINS UPC" (evidence 4.5) which shows, by areas of knowledge, from the most cited publications and authors, to the institutions with which they collaborate in research. On the other hand, the CVs of each TRS can be accessed from the links included in the course guide at CaminsOpenCourseWare website.

It is considered that the TRS is quantitatively, as well as quantitatively, sufficient and adequate for the successful implementation of the programme. The staff qualification shows a very balanced profile range, from a clear majority of civil engineers and other engineers (together around 67%) to a 33% of all teaching staff having a background in natural sciences. Therefore, the school has also its own resources to cover the basic education needs of the studies. The student-TRS ratio in Barcelona School of Civil Engineering is about 1:6.6 based on the information from the SAR. It is considered to be a good ratio, especially in the Master's programmes, as it allows TRS to have a high availability for support and advice, in spite of the fact that all of them are teaching at several faculties. The number of university full professors ("catedráticos") and degree holders, is about 72% of all staff, and this ratio is considered also to be very positive. Also, the fact that more than 50 of all professors have supervised a PhD thesis shows a high level of qualification and also motivation. TRS try to transfer as much as possible from their investigation activities to their classes. Furthermore, student surveys show that they are satisfied with the quality of teaching, as well as

with the consultations offered on specific subjects, but also on the general course guide.

Criterion 4.2 Staff development

The School developed, jointly with the University, a plan for staff development which is implemented by the Institute for Education Sciences. The most important activity foci of the institute, which directly influence the further training offer, are “planning, organization and enhancement of teaching”, “communication tools for the classroom”, as well as “English for Teaching staff”. TRS use to show considerable motivation and express their appreciation of the activities in place.

The School itself focuses at further developing the digital competence of the teaching staff by offering courses on design and creation of online contents for the study platform CaminsOpenCourseWare but also for the teacher’s intranet. The School has created its own lab dedicated to the support of the teaching staff for implementing the digitalisation initiative.

The School pursues an internationalization policy, which is also very visible in the staff development. On the one hand, a considerable part of the TRS received their degree from internationally renowned Civil Engineering Centres and, on the other hand, the programmes for teacher’s mobility are very popular and in great demand. There is also a convincing range of international research projects where our School’s TRS is actively involved in, allowing also for stays abroad for research purposes only.

Another School-specific policy is that PhD students do not have a scholarship but a contract as a working investigator so that they are part of the TRS and their PhD can be considered as a part of the staff’s development.

The Institut de Ciències de l'Educació (ICE) of the UPC draws up a four-month proposal for a general offer of TRS training based on the needs it has detected and the proposals for improvement that are the result of the teacher evaluation process. The initial proposal includes the institutional assignments by the board of directors and those carried out by the basic units, as well as information on external training grants. With regard to the latter point, based on the requests of the teaching staff and in accordance with the available resources, the budget to be allocated to the different areas and the priority criteria to be used are determined. This set of planned actions forms the TRS Training Plan (evidence 4.2.1), which is approved by the ICE management. As this is not a closed plan, during its execution the additional assignments of the board of directors and/or of the units are incorporated. According to this evidence, 19 different TRS have participated in 101 activities for a total of 895 hours of training in different modalities: continuing education, innovation, ATENEA, initial training, occupational hazards, etc.

2020-2021			
Training programs	**Number of years**	**Number of attendees**	**Number of training hours**
Postgraduate programs: University studies in Sciences, Technology, Engineering and Mathematics (STEM)	44	772	1,840
Continuous education in the field of teaching	2	24	1,725
Training in ATENEA and ITC resources	40	823	3,704
Training in English for teaching	14	420	1,094
Training for research and Transference of Results	26	355	845
Training in direction and coordination	19	56	121
Training in university extension	6	59	695
Training in occupational health and safety, defibrillators and self-protection	14	210	1,754
Total	165	2,719	11,778

Last outdate: 08/07/2021

Table 4.2.1. Hours of training at the ICE of the Teaching and Research Staff.

Teaching staff and gender perspective

Online training has been offered on how to incorporate gender perspective in university teaching. Special events have been organised related to this topic at https://igualtat.upc.edu/ca/esdeveniments/la-perspectiva-de-genere-a-la-docencia.

Main figures related with gender perspective are available at the UPC gender dashboard (in Catalan, by default UPC global figures; at “Centre” select ETSECCP to see information on our School).

Furthermore, since 2019 a special leave-of-absence has been allowed in order to enhance research activities after maternity leave.

Criterion 4.3 Funds and equipment

Material Resources

The material resources available are appropriate to the number of students and the characteristics of the degree.

The management of material resources is included in process 250.1.4.1 Management of material resources of the School's IQAS (evidence 4.3.1).

The School has a variety of technological tools and resources for the university community at our School to use in support of teaching and learning (evidence 4.3.2).

Teaching classrooms (evidence 4.3.3)

Currently, the classrooms used by the School for teaching are part of 6 buildings of the North Campus intended exclusively as teaching classrooms and their use is shared with other schools located on Campus.

The 6 buildings of the North Campus dedicated to teaching currently contain 86 teaching classrooms and 2 drawing classrooms, with a total built area of 7,871 m^2 and a capacity for 13,400 students (6,700 simultaneous students in two morning and afternoon shifts).

The allocation of classrooms to the different units/schools is reviewed each academic year according to the type, equipment and capacity required for the teaching of the different degrees. Currently, Barcelona School of Civil Engineering has been assigned approximately two (2) classrooms (*Aulari 1* and *Aulari 2*), which have 24 classrooms of different types with a capacity for 2,247 students divided into morning and afternoon shifts. All these classrooms are provided with a video projector, projection screen, wireless network connection (Wi-Fi) and VCR.

Computer rooms (evidence 4.3.4)

Our School has 6 computer rooms with a total of 160 workstations equipped with audio-visual media (video projector and projection screen) so that there is 1 workstation for every 16 students, approximately.

All computer rooms have the software required for the teaching activities of each degree. These rooms are used to teach, subject to reservation by TRS, and are free to access when no teaching is assigned, during the established opening hours. One of these computer rooms is open 24 hours a day, 7 days a week and is exclusively for students to use and carry out their assignments. This computer room offers a printing service consisting of two laser printers.

All computer workstations have an Internet connection. There are also wireless connections in all the buildings and common spaces of the school accessible to students and the rest of the university community: campus classrooms, library, open spaces on campus, etc.

Laboratories (evidence 4.3.5)

Barcelona School of Civil Engineering has laboratories that are dedicated to research and teaching in the field of civil engineering, and are located in the departments that teach at the School. These laboratories and workshops have specialized equipment for teaching and research projects carried out in the surroundings of the school.

CaminsOpenCourseWare (evidence 4.3.6)

It is a website through which the School makes its teaching materials available to the internet community: TRS, students and self-taught people.

This system facilitates access to knowledge from anywhere at any time, and provides universal access to

knowledge based on people's training needs.

The school offers its educational contents online through this space.

ATENEA virtual campus (evidence 4.3.7)

Moodle teaching support platform. Through this platform you may exchange information and communicate to TRS and students; publish the course's materials and activities; access the information from mobile devices.

Library

Barcelona School of Civil Engineering has been assigned the Rector Gabriel Ferraté Library. All UPC's libraries offer users a wide range of library services and access to information from bibliographic collections as well as the digital library. Libraries provide extensive opening hours, Internet-connected computers, and individual and group workspaces.

UPC's libraries have the scientific and technical bibliographic resources specialized in the different areas of polytechnic knowledge that support all the university degrees. They also have electronic resources (mainly databases and electronic journals) that support e-learning and research (http://bibliotecnica.upc.edu).

Of particular relevance is the scientific production of the School which can be observed in the comparative study of the scientific publication of the UPC and our school vs. other international universities (2009-2018) (evidence 4.2). The report focuses on scientific publication specializing in our School's own subject area: civil engineering. Bibliometric indicators from the UPC and our school are compared with those from other international universities with significant research activity in the field of civil engineering.

Students have a high degree of satisfaction with the different spaces and documentary collections that provide UPC's libraries, as can be seen in the satisfaction surveys carried out by the library service (evidence 4.3.8)

In view of the above, in relation to the material resources available for teaching, teaching facilities are considered to be adequate for the number of students in the School and, taking into account the scores of the satisfaction surveys (evidence 4.3.9), are highly valued by its users.

Financial resources

UPC is a public Spanish university and is funded by the national and regional governments (see legal framework). Public universities are owned by the state but they still have a considerable level of independence when it comes to self-government. Public universities are subject to Spanish administrative law, just as any other public body within the state. Most of the public university staff, lecturers and professors have the status of civil servants, which means they have a tenure.

The UPC budget (evidence 4.3.10) is managed at two levels: a centralised budget and a delegated budget for each school and department. The UPC central administration manages the centralised budget. This budget includes the TRS salaries, major investments and financial operations for all the universities.

The schools are provided with a delegated budget for some current expenses like teaching and lab materials. Additionally, schools are allowed to keep a share of particular incomes, such as those from educational cooperation agreements or classroom rental. The Barcelona School of Civil Engineering Standing Committee approves the budget, which is published in the annual report.

Barcelona School of Civil Engineering has very well-equipped lab working spaces, which are quantitatively sufficient for the successful implementation of the programmes. Just to state those which are most relevant for the programmes under review, the School has labs for Structural Technology, for Construction Material, for Environmental Engineering, for Fluid Hydraulics and Dynamics, for Numeric Calculus, Geotechnics, Geophysics, and a Canal of Maritime Investigation and Experimenting.

The School offers a very international learning environment, starting from attracting a considerable number of international students and also sending its own students very actively to the partner institutions abroad, and a range of subjects taught in English, as well as a considerable number of TRS with foreign background (about 7%). Due to all these facts, currently the majority of the PhD theses are already written in English, the tendency is positive also in case of the Master's theses. The university runs five Erasmus Mundus programmes which attract additional international students from non-European countries. The School has 87 partnerships with foreign universities in 24 countries of Europe, Asia and America, 11 programmes of double degree, and is active in a range of international networks EUCEET (European Civil Engineering Education and Training), CLUSTER (Consortium Linking Universities of Science and Technology for Education and Research), TIME (Top Industrial Managers for Europe) etc., all of which contributes to the creation of and international educative setting and beneficial study conditions.

Another positive aspect about resources is the strong link between the teaching activities and the industry. Firstly, there are so called industrial chairs, i.e. chairs in a field which are especially interesting and lucrative for the industry and therefore sponsored by them. Secondly, there are many research projects conducted by our School's TRS on behalf of the industry. Thirdly, several potentially employing enterprises are actively involved in the staff development and offer courses at our School. Fourthly, these enterprises often support gifted students with special scholarships. Fifthly, an innovative programme of joint PhD supervision by industrial companies and our School is by now accepted and supported by the Administration of Catalonia. Finally, there is a School-specific initiative supporting the development of student start-ups, called Entrepreneurial Space of the Campus Nord (*Emprèn UPC, Espai d'emprenedoria del Campus Nord*).

The panel considered the relation between the employers/the industry and the School to be excellent and found the initiatives in place very laudable, being able to serve as an example of good practice.

9. Transparency and Documentation

Criterion 5.1 Module descriptions

Relevant information on the School's degrees may be found up to date and complete in the School's website (evidence 5.1.1) in three languages (Catalan, Spanish and English).

For students enrolled in the master's degree, there is a specific web page for each master's degree (evidence 1.3.1 for the MDCE, evidence 1.3.2, for the MDNME). It contains information on its specific organization (courses, Master's Thesis, tests, schedules, calendar). The information is updated before the start of the academic year. They also have an area of procedures, called SIAE - Student Information Office, where they can be informed and manage any aspect related to their academic record (evidence 5.1.2).

Enabled students also have access to different intranets for confidential information. They can access their enrolment form and present official certificates at what is known as *e-Secretaria*, which is managed by the UPC (evidence 5.1.3). Two intranets give them access to the virtual classrooms: ATENEA, hosted by the UPC (evidence 4.3.7), and CaminsOpenCourseWare (evidence 4.3.6), hosted by our School. They incorporate various educational tools adapted to the implementation of degrees within the EHEA (messages, grades, calendars and tasks).

In addition, the School also relies on other channels to provide information on their degrees and how they work:

- MediaCamins: audio-visual portal for the publication of teaching videos associated with courses and videos and photographs of the School's activities (evidence 5.1.4).
- YouTube institutional channel: complementary to MediaCamins to host all video content (evidence 5.1.6).

The information published on the web (curriculum, course guides, etc.) is highly valued by students. The average score obtained in the satisfaction surveys is 3.54 out of 5, taking into account that more than 60% of the answers are concentrated in the maximum scores 4 and 5 (evidence 2.4.4). The surveys belong to the 2016-2017 academic year because, according to the UPC survey calendar (evidence 5.1.5), a new student satisfaction survey is planned for this 2021-2022 academic year.

The school publishes information on academic and satisfaction results.

On the web page of each program and specifically in the section "More information" we find a link to the data of the degree and faculty in which we can see all the academic data and satisfaction surveys.

Both the Master's web pages and the CaminsOpenCourseWare portal contain all the relevant information for all groups of interest and allows a quick location of the degrees we offer. It is important to highlight the role of CaminsOpenCourseWare, in the sense of giving maximum transparency to aspects such as the generic and transversal competencies assigned to the different courses, contents and skills, training activities, all in accordance with the curriculum proposal that has been submitted to the verification process.

The Barcelona School of Civil Engineering website, includes a specific quality section where the Internal Quality Assurance System (IQAS) is published, the flow chart, the procedures implemented and the people that are in charge of those procedures.

The quality section has been expanded to include information on the current accreditation process, with special emphasis on the publication of degree monitoring reports and the incorporation of indicators at School level. The first group of indicators, *Memòria i xifres* (in English "General report and data"; "; evidence 5.1.6), refers to the main indicators of the School, while the second group, *Indicadors i enquestes* (in English "Indicators and surveys"; evidence 5.1.7), come from the UPC corporate management system and data analysis, and provides aggregate indicators of academic achievement and satisfaction about our School. These indicators complement those offered on the Master's Degrees pages, thus facilitating consultation

by the groups of interest.

Incident Management: Complaints, Suggestions and Congratulations

The 250.1.2.6 INCIDENT MANAGEMENT: CLAIMS, COMPLAINTS, SUGGESTIONS AND CONGRATULATIONS process (evidence 5.1.8) of the School's IQAS guarantees the reception of any kind of incident, which is recorded, where appropriate, informed, analysed and, if appropriate, solved on the basis of transparency and efficiency, by the School's management team. In any case, the School appreciates all suggestions, complaints, claims and congratulations.

You may open an incident form at the School's website (evidence 5.1.9).

Criterion 5.2 Master's Degree Certificate and Degree Supplement

At the end of each evaluation period, an automatic procedure checks the academic records of the student and closes the academic file of those who meet the requirements for graduation and are entitled to request the degree certificate.

Additionally, students who finish their credits any other time during the semester can request to check and close their academic files so that they can ask for the degree certificate.

At their request, they receive a receipt in order to pay the application fees of the certificate. Once there is electronic confirmation of the payment from the bank, the School issues a provisional degree certificate that will enable the student to obtain the Master's Degree Certificate.

A sample of the Master's Degree certificate in Catalan, Spanish & English (evidence 5.2.1), diploma supplement (evidence 5.2.2 & evidence 5.2.3) and transcript of records are available for both programmes.

Criterion 5.3 Relevant rules

The School has as a frame of reference the UPC Bachelor's and Master's Degrees regulations (NAGRAMA). The School, within the framework of the competencies that NAGRAMA grants to teaching centres and university research institutes, develops specific aspects of the university master's degrees that are taught within Barcelona School of Civil Engineering.

Our website contains a specific section on regulations, where they are published for each academic year and prior to enrolment. Evidence 5.3.1 shows the section of the web regarding academic regulations.

Barcelona School of Civil Engineering reviews and draws up regulations each academic year, with the aim of adapting them to higher-ranking regulations and as a result of the proposals for improvement that arise from the analysis of the processes to which it refers, and in accordance with the objectives of the degree. The regulations are finally approved by the Standing Committee, which is made up of members of the management team, faculty, students, and Administrative and Service Staff.

The regulatory framework of the UPC is quite flexible and allows, thanks to the specific regulations of each degree, the adaptation of the general academic regulations (NAGRAMA) to the singularities of each School and of each degree. Thus, the specific regulations drafted by Barcelona School of Civil Engineering have been a key element in positively regulating the particularities of the School's degrees: compulsory mobility, compulsory professional internships, annual enrolment, etc.

Academic regulations for Master's programmes:

- http://www.upc.edu/learning/courses/masters-degrees
- https://www.upc.edu/sga/ca/shared/fitxers-normatives/AcademicRegulations_EN/NAGRAMA/nagrama-2019-2020_en_definitiva_.pdf
- Specifics Academic regulations for Master's programmes BSCE

10. Quality Management: Quality Assessment and Development

Criterion 6 Quality management: quality assessment and development

Barcelona School of Civil Engineering has drawn up a Manual and a Quality System to guarantee the process of designing, implementing and developing new degrees adapted to the European Higher Education Area (AUDIT project). The Agency for the Quality of the University System of Catalonia (AQU Catalunya) has positively assessed the School's Internal Quality Assurance System (IQAS), which is part of the AUDIT program. The School IQAS is formally established and published in the Quality section of the School's website (evidence 6.1).

The monitoring reports, accreditation, as well as the verification reports of the degrees taught at our School can be found in the quality section of the School's website (evidence 6.2).

The IQAS implemented has facilitated the process of designing, approving, monitoring and getting the degrees accredited.

Barcelona School of Civil Engineering defined in 2000 a process-based operating model (NEO Project). Subsequently, in the 2007-2008 academic year, the School took part in a pilot phase for the UPC, the AUDIT project, to define a Quality Assurance System that would favour continuous improvement and guarantee a level of quality that met the expectations of the different groups of interest.

The manual and the Internal Quality Assurance System (IQAS) of the School were certified by AQU Catalunya in June 2009 (evidence 6.3).

Since the implementation of the Internal Quality Assurance System, the School has been adapting and improving the processes to facilitate the verification, monitoring, modification and accreditation of training programs. During this period, the processes that have been modified are those corresponding to the following guideline:

- to guarantee the quality of training programs, in order to incorporate the processes of verification, modification, monitoring and accreditation (evidence 6.4).

The guidelines for the procedures, which are managed globally by the University, on TRS and ASS matters have also been modified so that it shows the School's participation in the process.

The School values the efficiency of its Internal Quality Assurance System, as an effective and indispensable tool in the verification of its degrees.

In July 2014 (agreement 149/2014 of the Governing Council of the UPC), the modification of the regulations for the organization and operation of the School was approved to adapt to the new statutes of the UPC. This modification was used to simplify the decision-making bodies of the School: The Academic Evaluation Commission (CAA) was abolished as a delegated body of the School Board, passing its powers to the Standing Committee (CP), given that the members of both committees were almost the same and that in order to approve certain decisions it was often necessary to go through both bodies. This simplification has given more agility and fluidity to the approval of academic management decisions, which allows the School to adapt more efficiently to the actions needed to improve administrative and academic processes.

In addition, in September 2016, in the elections for School Director, the new management team created two new deputy directorates: "Planning and Academic Quality" and "Promotion of Studies". These two deputy directorates make it possible to concentrate actions on two of the most strategic areas that the School currently has on the table. Thus, a work plan is currently available for the promotion of studies, the first results of which are expected to be received. The Deputy Directorate of Planning and Academic Quality has been working since its inception on the restructuring and re-verification of the degree map offered at

the School. A new offer of degrees (Degree in Geological and Environmental Engineering and Degree in Marine Sciences and Technologies) saw the light in the 2018-2019 academic year. The work carried out by these two new Deputy Directorates is highly valued by the School.

The IQAS implemented guarantees the collection of information and results relevant to the efficient management of degrees, especially academic results and the satisfaction of the groups of interest.

The School has defined process 250.1.5.1: Analysis of results, which aims to define how it guarantees, measures and analyses the results of learning, the results of employment and the satisfaction of the groups of interest, as well as the mechanisms it establishes to improve the training it provides.

There are different bodies involved in coordinating quality management, but as stated in the quality manual (evidence 6.5), the chartered governing body, delegated by the School Board, to ensure the quality of the studies is the Standing Committee.

The mission of the Standing Committee is to efficiently manage the Internal Quality Assurance System in order to allow the continuous and systematic improvement of the degree. This committee carries out annually the review and evaluation of the procedures and tools common to all the degrees of the School, carrying out, if necessary, the opportune modifications that allow to adapt the degrees to the current university context.

The mission of the School's Quality Committee, which is made up of the members of the Management Team and the Technical Council, is to execute, monitor and propose improvements and submit them to the Standing Committee.

As for the degree's curriculum, the Heads of Studies, in collaboration with the Course and Line Coordinators, are responsible for organizing and coordinating, monitoring, providing information on the level of development of the degree and propose improvement actions at the end of the academic year. They are the heads of studies of the agents involved in the elaboration of the degrees' monitoring reports. These reports are submitted to the Standing Committee for approval.

Transversally, there is a person in charge of each of the processes of the Internal Quality Assurance System. This responsibility rests with the various members of the School's management team. This information is published in the Quality section of the School's website. The way the Internal Quality Assurance System operates has been synthetized in evidence 6.6.

The School Quality Committee, after analysing the results of the previous year and approving the improvement proposals, plans each and every one of the procedures incorporating the improvements and prepares the academic year: academic calendar, schedules, evaluation dates, teaching assignments, academic regulations, etc. and instructs the TRS responsible for the courses to update the course guides (at the CaminsOpenCourseWare website). All this is sent to the groups of interest and to the Standing Committee, and is submitted for approval. Once approved, the information is made public through the School's website and the Portal Camins website.

The implemented IQAS is periodically reviewed and generates an improvement plan that is used for the continuous improvement of the degree.

The School's director and her team are responsible for reviewing and updating the objectives and quality policy of the School (process 250.1.0.1 of the IQAS), and, should they consider that there are new elements that may affect the objectives established, for elaborating a proposal of redefinition of the policy of quality, that will be presented to the School Board for discussion and approval.

The Head of Management and Support Services/Quality Coordinator will prepare the draft of the new manual and propose the modifications of the procedures that, once validated by the management team, will be presented to the Standing Committee for discussion and approval.

Once the quality policy, the manual and the procedures derived from it have been approved, the School will make it public through process 250.1.6.1 del IQAS: Publication of information on the degrees. This information will be published through information leaflets, the School website and mail distribution to all

internal and external groups of interest.

CaminsOpenCourseWare

CaminsOpenCourseWare is the School's tool to openly publish course guides, including competencies, teaching methodologies, learning outcomes, training session planning, training activities, and study materials and support (evidence 5.1.4).

Portal Camins

Portal Camins is the School's intranet that includes a series of functionalities aimed at students, teachers and education-aimed help desks (grading and final thesis management, teaching staff activity, etc.) (evidence 6.7).

All this confirms that the actions implemented in the Improvement Plan seem to be effective in improving the degrees taught at Barcelona School of Civil Engineering.

Despite the previous description of the IQAS, the UPC is currently immersed in a global process of transformation of the university's IQAS, with the aim of obtaining institutional accreditation (Evidence 6.8), and thus drive and expand the efficiency and effectiveness of the system. At the moment, the transversal processes (Evidence 6.9) have been defined, as well as the quality manual (Evidence 6.10). Meanwhile we wait for the final assessment to this transformation, in order to adapt our IQAS to that of the university with regards to cross and specific procedures.

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D. Continuous improvement process

Continuous improvement process assessment

The process of performed improvement plans is being monitored, some of them have already concluded and some others still in progress. The current analysis in the accreditation process performs new improvement plans for each degree programme.

Below we summarise the suggested changes and the status of the old and new improvement plans for each degree programme.

Master Degree in Civil Engineering (MDCEI)

250.M.155.2016 - Dinamitzar l'oferta de pràctiques de l'Escola pels estudiants de Màster de Camins, Canals i Ports
250.M.156.2016 - Creació d'una Comissió d'Avaluació Curricular del Màster en Enginyeria de Camins, Canals i Ports
250.M.176.2022 - Modificació de les condicions d'accés al MECCP

Master Degree in Numerical Methods in Engineering (MDNME)

250.M.171.2020 - Canvi d'obligatorietat en les pràctiques externes

Cross-disciplinary or common changes

250.M. 99.2014 - Incorporar curso a curso la innovación fruto de la investigación en los programes de las asignaturas
250.M.100.2014 - Incorporar curso a curso nuevas herramientas de diseño/proyecto que aparecen en el mercado
250.M.101.2014 - Mejorar la información para los estudiantes de nuevo acceso
250.M.105.2014 - Promover el desarrollo y actualización de materiales audiovisuales para ofrecer en abierto a través de Camins OCW
250.M.107.2014 - Promover, sistematizar y facilitar la gestión por procesos, en los procesos que forman parte del Sistema de Garantia de Calidad de la Escola de Camins
250.M.110.2014 - Definir un cuadro de clasificación funcional que permita la clasificación y posterior archivo de los documentos que genera la Escuela y diseñar una herramienta informática para su gestión; que permita entre otros: control de versiones, perfiles de acceso, etc.
250.M.111.2014 - Mostrar al público de interés la composición por categorias de los profesores que imparten docencia
250.M.118.2014 - Incorporación de nuevas modalidades de movilidad en los acuerdos del nuevo programa Erasmus +.
250.M.127.2014 - Analizar trabajos finales de grado y master con objeto de estudiar la tipología, los contenidos y los sistemas de evaluación
250.M.168.2019 - Redefinició dels enllaços del web del centre, per a cada titulació, amb l'objectiu de facilitar i millorar l'accés tant a professorat, com a resultats relacionats amb cada programa formatiu impartit al centre

Through the following link you can consult the files of the improvements: improvement plan

E. Evidences

Title	Address
minutes of the School Board session	https://bit.ly/3lpLISs
Degree dashboard	https://bit.ly/3wjtXlu
E.0.1. Outgoing students	https://bit.ly/3lrQgb8
E.0.2. Incoming Students	https://bit.ly/3wn7kN9
E.0.4. School website of International Rankings	https://camins.upc.edu/en/school/rankings?set_language=en
E.05. UPC website of International Rankings	https://www.upc.edu/ranquings/en
Competencies of the MDCE	https://camins.upc.edu/en/Studies/master/civil-engineering
Competencies of the MDNME	https://camins.upc.edu/en/Studies/master/numerical-methods-in-engineering
MDCE Program Verification Report	https://camins.upc.edu/ca/escola/qualitat/pdf/meccp/sol-verificacio-meccp-2011-2012.pdf
MDNME Program Verification Report	https://camins.upc.edu/ca/escola/qualitat/pdf/mmne/sol-verificacio-mmne-2011-2012.pdf
1.1.1. Improvement plan	https://camins.upc.edu/ca/evidencies2021/plamillora.pdf
MDCE indicators	https://bit.ly/37Lny8t
MDMNE indicators	https://bit.ly/3tptMTJ
1.1.2 MDCE student satisfaction	https://bit.ly/3trPCGq
1.1.3 Employment outcomes for MDCE graduates	https://bit.ly/3u5Po6E
1.1.4 MDNME student satisfaction	https://bit.ly/3CWpAOp
1.1.5 Employment outcomes for MDNME graduates	https://bit.ly/3KTQOYO
1.1.6 Study “Acces to the labour market for graduates of Master's degrees from Catalan universities”	https://camins.upc.edu/ca/evidencies2021/inserciolaboralmasters20-en.pdf
1.3.1 Curriculum of MDCE	https://camins.upc.edu/en/Studies/master/civil-engineering/civil-engineering?set_language=en
1.3.2 Curriculum of MDNME	https://camins.upc.edu/en/Studies/master/numerical-methods-in-engineering
UPC general admission criteria for master’s	https://www.upc.edu/en/masters/access-and-admission
Specific criteria admission for MDCE	https://camins.upc.edu/en/Studies/master/civil-engineering/civil-engineering?set_language=en
1.4.1 Dashboard of MDCE	https://bit.ly/36brcbf
1.4.2 Criteria and requirements for admission at MDCE	https://camins.upc.edu/ca/pdf/pdf-estudis/masters/master-enginyeria-camins-canals-i-ports/admissio
1.4.3 Admission resolution of MDCE	https://camins.upc.edu/ca/estudis/master/meccp/acces-admissio/resolucio-provisional-admissio-meccp-20_21.doc
1.4.4 Amendment of MDCE	https://camins.upc.edu/ca/evidencies2021/14-2-aprovacio-de-lactualitzacio-de-la-programacio-universitaria-curs-2020-2021.pdf
Specific criteria admission for MDNME	https://camins.upc.edu/en/Studies/master/numerical-methods-in-engineering/prueba?set_language=en
1.4.5 Dashboard of MDNME	https://bit.ly/3ijKLR6
1.4.6 Criteria and requirements for admission at MDNME	https://camins.upc.edu/en/Studies/master/numerical-methods-in-engineering/prueba?set_language=en
1.4.7 Admission resolution of MDNME	https://camins.upc.edu/ca/estudis/acces/acces-masters/arxius/resolucions/mmne_resolucio-q1-20_21-prioritzada.pdf
2.1.1 Line & course coordinators	https://camins.upc.edu/en/school/structure-organization/field-and-course-coordinators
2.1.2 Rules of coordinate degrees in pandemic	https://camins.upc.edu/ca/evidencies2021/aspectesdocenciacurs2020_eng.pdf

2.1.3 Curriculum of MDCE in CaminsOpenCourseware	https://portal.camins.upc.edu/ocw/home?p_idIdioma=3&p_codiPrograma=872&p_apartat=masterECCP
2.1.4 Modification of MDNME	https://camins.upc.edu/ca/evidencies2021/modificacion_mmne_2020.pdf
2.1.5 Curriculum of MDNME in CaminsOpenCourseware	https://portal.camins.upc.edu/ocw/home?p_idIdioma=3&p_codiPrograma=874&p_apartat=masterMNE
2.1.6 Employment indicators (AQU Catalunya)	https://bit.ly/36D2BMw
2.1.7 rules of exams in pandemic	https://camins.upc.edu/ca/evidencies2021/protocolexamens2020_eng.pdf
2.2.1 Distribution of hours by topic	https://portal.camins.upc.edu/public/guia?codiUpcUd=250401&curs=2021&idIdioma=3
2.2.2 survey of students on non-face-to-face teaching in a pandemic	https://www.upc.edu/qualitat/ca/enquestes-de-satisfaccio/enquestes-a-estudiantat-de-grau-i-master/enquestes-actuacio-docent-i-assignatures/consulta-2020-21-1q/etseccpb_resultatsconsultaest20201_blocespecif.pdf
2.2.3 UPC academic regulations	https://www.upc.edu/sga/ca/shared/fitxers-normatives/NormativesAcademiques/NAGRAMA/2021-2022-normativa-academica-estudis-grau-i-master.pdf/@@download/file/Modificacio%CC%81%20NAGRAMA%20curs%202021-2022_acord%20CG%2022%2002%202022%20.pdf
2.2.4 Survey about modifications of teaching methodologies in pandemic	https://www.upc.edu/qualitat/ca/enquestes-de-satisfaccio/enquestes-a-estudiantat-de-grau-i-master/enquestes-actuacio-docent-i-assignatures/consulta-2020-21-1q/etseccpb_resultatsconsultaest20201_blocespecif.pdf
2.4.1 Services guide for students	https://camins.upc.edu/en/services/guide-of-students-services-at-our-school?set_language=en
2.4.2 Tutoring action plan	https://camins.upc.edu/ca/evidencies2021/manual_pat.pdf
2.4.3 Final report of tutoring action plan	https://camins.upc.edu/ca/evidencies2021/informe_final-pat.pdf
2.4.4 Student satisfaction survey	https://camins.upc.edu/ca/escola/qualitat/acreditacio/evidencies2017/enquestesestudiants.pdf
2.4.5 MOU-TE (mobility information program)	https://bit.ly/3qkY2NT
2.4.6 website of information for incoming students	https://camins.upc.edu/ca/incoming-students
2.4.7 Professional guidance section	https://camins.upc.edu/en/industry/placements?set_language=en
2.4.8 Futur Civil website	https://futurcivilcamins.upc.edu/
2.4.9 UPC Alumni website	https://alumni.upc.edu/
2.4.10 Student Survey on pandemic resources and assistance	https://www.upc.edu/qualitat/ca/enquestes-de-satisfaccio/enquestes-a-estudiantat-de-grau-i-master/enquestes-actuacio-docent-i-assignatures/consulta-2020-21-1q/etseccpb_resultatsconsultaest20201_bloccomu.pdf
3.1 Course guide of mechanics of continua	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250401&idioma=3
3.2 Exam tests of mechanics of continua	https://camins.upc.edu/ca/evidencies2021/250401-mechanics-of-continua.zip
3.3 Course guide of water engineering	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250408&idioma=3
3.4 Exam tests of water engineering	https://camins.upc.edu/ca/evidencies2021/250408-water-engineering.zip
3.5 Course guide of urban hydrology	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250430&idioma=3
3.6 Exam tests of urban hydrology	https://camins.upc.edu/ca/evidencies2021/250430-urban-hydrology.zip
3.7 Course guide of Interaction between groundwater and civil works	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250422&idioma=3
3.8 Exam tests of Interaction between groundwater and civil works	https://camins.upc.edu/ca/evidencies2021/250422-interaction-between-groundwater-and-civil-works.zip
3.9 Course guide of Building structures	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250470&idioma=3
3.10 Exam tests of Building structures	https://camins.upc.edu/ca/evidencies2021/250470-building-structures.zip
3.11 Course guide of Machine learning and models for decision making	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250443&idioma=3
3.12 Exam tests of Machine learning and models for decision making	https://camins.upc.edu/ca/evidencies2021/250443-machine-learning-and-models-for-decision-making.zip
3.13 Course guide of Urban Mobility	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250450&idioma=3
3.14 Exam tests of Urban Mobility	https://camins.upc.edu/ca/evidencies2021/250450-urban-mobility.zip
3.15 Course guide of Life-Cycle Analysis	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250462&idioma=3

and Sustainability Assessment	
3.16 Exam tests of Life-Cycle Analysis and Sustainability Assessment	https://camins.upc.edu/ca/evidencies2021/250462-life-cycle-analysis-and-sustainability-assessment.zip
3.17 Course guide of Master's Thesis	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250499&idioma=3
3.18 Evidence of Master's Thesis	https://camins.upc.edu/ca/evidencies2021/250499-master-thesis.zip
3.19 Course guide of Numerical methods for PDEs	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250950&idioma=3
3.20 Exam tests of Numerical methods for PDEs	https://camins.upc.edu/ca/evidencies2021/250950-numerical-methods-for-pdes.zip
3.21 Course guide of Finite element	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250951&idioma=3
3.22 Exam tests of Finite element	https://camins.upc.edu/ca/evidencies2021/250951-finite-element.zip
3.3 Course guide of Master's Thesis	https://portal.camins.upc.edu/ocw/guia.htm?codiUpcUd=250968&idioma=3
3.4 Evidences of Master's Thesis	https://camins.upc.edu/ca/evidencies2021/250968-master-thesis.zip
4.1 UPC's Future portal	http://futur.upc.edu/ETSECCPB
4.2 Comparative study of the scientific publication of the UPC and Barcelona School of Civil Engineering vs. other international universities (2009-2018)	https://upcommons.upc.edu/handle/2117/174947
4.3 Rubric of TFM evaluation	https://camins.upc.edu/ca/evidencies2021/seguiment-del-tfm-informe-3b.pdf
4.4 Tutor assessment for external tutor	https://camins.upc.edu/ca/evidencies2021/seguiment-del-tfm-informe-3b.pdf
4.5 The research activity of the TRS of Barcelona School of Civil Engineering	https://bibliotecnica.upc.edu/en/brgf/serveis/estudis-bibliometrics#estudis-recercamins-upc
4.2.1 TRS training plan	http://www.upc.edu/ice/ca/professorat-upc
4.3.1 Management of material resources of the School's IQAS	https://camins.upc.edu/ca/pdf/pdf-escola/qualitat/processos-del-sistema-de-qualitat/gestio-dels-recursos-materials
4.3.2 Resources for the university community	https://camins.upc.edu/ca/serveis/recursos-docencia
4.3.3 Teaching classrooms	https://camins.upc.edu/ca/serveis/recursos-docencia/aularisCN
4.3.4 Computer rooms	https://caminstech.upc.edu/ca/serveis/aulesinformatiques
4.3.5 Laboratories	https://deca.upc.edu/en/laboratories/laboratories?set_language=en
4.3.6 CaminsOpenCourseWare	https://portal.camins.upc.edu/ocw/home.htm?execution=e5s1
4.3.7 Atenea virtual campus	https://atenea.upc.edu/login/index.php?lang=en
4.3.8 Satisfacton surveys of the Library services	https://upcommons.upc.edu/handle/2117/168249
4.3.9 Scores of the satisfaction surveys	https://camins.upc.edu/ca/evidencies2021/satisfaccioestudiantat.pdf
4.3.10 UPC budget	https://www.upc.edu/ca/la-upc/la-institucio/fets-i-xifres/pressupost
5.1.1 Barcelona School of Civil Engineering website	https://camins.upc.edu/
5.1.2 Academic procedures	https://camins.upc.edu/en/Studies/academic-procedures?set_language=en
5.1.3 e-Secretaria	https://prisma-nou.upc.edu/apl/home_estudiants.php?idioma=3
5.1.4 MediaCamins: audiovisual portal	https://media.caminstech.upc.edu/
5.1.5 UPC survey calendar	https://www.upc.edu/qualitat/ca/enquestes-de-satisfaccio/calendari-denquestes
5.1.6 General report and data of Barcelona School of Civil Engineering	https://camins.upc.edu/ca/escola/xifres/xifres?set_language=ca
5.1.7 Indicators and surveys	https://bit.ly/3D0w1A3
5.1.8 Incident management: claims, complaints, suggestions and congratulations	https://camins.upc.edu/ca/pdf/pdf-escola/qualitat/processos-del-sistema-de-qualitat/gestio-de-reclamacions-queixes-i-suggeriments
5.1.9 Incident form at the School's website	https://camins.upc.edu/ca/escola/bustia-oberta
5.2.1 Master's degree certificate	https://camins.upc.edu/ca/evidencies2021/cap-meccp.pdf
5.2.2 Diploma supplement of MDCE	https://camins.upc.edu/ca/evidencies2021/set-mdce.pdf
5.2.3 Diploma supplement of MDNME	https://camins.upc.edu/ca/evidencies2021/set-mdnme.pdf
5.3.1 Academic regulations	https://bit.ly/3CWfe0W

6.1 Internal Quality Assurance System	https://bit.ly/3JtETR4
6.2 Quality website of the School	https://camins.upc.edu/en/school/quality
6.3 Certified manual of the IQAS	https://camins.upc.edu/ca/pdf/pdf-escola/qualitat/certificacio-de-qualitat-de-lescola-de-camins
6.4 Process of verification, modification, monitoring and accreditation	https://camins.upc.edu/ca/pdf/pdf-escola/qualitat/manual-de-qualitat/garantia-de-qualitat-dels-programes-formatius
6.5 Quality manual of School	https://camins.upc.edu/ca/escola/qualitat/sgiq
6.6 Synthetized way of the IQAS	https://camins.upc.edu/ca/escola/qualitat/acreditacio/evidencies/s3-esquema-procesos-calidad/@@download/file/PDCA.jpg
6.7 Portal Camins (School's intranet)	https://camins.upc.edu/ca/serveis/portals-intranets-camins
6.8 UPC quality institutional website	https://www.upc.edu/qualitat/ca/qualitat-institucional
6.9 Transversal procedures	https://www.upc.edu/qualitat/ca/qualitat-institucional/sigq-upc/processos-transversals
6.10 UPC quality manual	https://www.upc.edu/qualitat/ca/qualitat-institucional/sigq-upc/manual-de-qualitat
Improvement Plan	https://camins.upc.edu/ca/evidencies2021/plamillora.pdf

F. Annex 1 - SSC - Program competencies

Subject-Specific Criteria (SSC) for Civil Engineering, Geodesy and Architecture.

ASSIN-1 They can analyze demanding tasks of the building industry, such as: analysis of carrying structures, infrastructure measures (concerning roads, bridges, sewage systems, etc.), flood protection measures, construction procedures, etc.

ASSIN-2 They can identify required information and data, determine available sources of such information, and evaluate data at a stage when the task itself is still not clear enough.

ASSIN-3 They can provide novel and complex designs, constructions and developments (design), e.g. construction of buildings, development of new building products and components, development of new construction methods, design of wastewater systems, planning and development of transport facilities, etc.

ASSIN-4 They are capable to develop new, challenging and innovative methods for documented evidence and forecasting, such as methods for verifying stability, energy efficiency, noise protection, flood protection, water supply etc.

ASSIN-5 They can independently create plans and concepts in the work field of civil engineering and determine by their own the requirements for overall responsible control and man-agement of complex processes.

ASSIN-6 They are able to face complex projects in an interdisciplinary and holistic way in light of sustainability, environmental, ecological and economic aspects, and to operate them responsibly by the help of contributions of other disciplines.

ASSIN-7 They are capable to acquire autonomously the current state of scientific knowledge re-lating a research question and to examine to what extent this helps to describe, analyse and solve problems.

ASSIN-8 They have the capacity to participate in the practical, methodical and scientific, theoreti-cal development of the subject, to follow it, as well as to analyze, evaluate and commu-nicate critically, in writing and orally their own or other's research results or information.

ASSIN-9 They are able to describe and to analyze independently by scientific means new, obscure and unusual tasks in civil engineering facing the current scientific discussion. They can test and develop methods and evaluate them concerning their effectiveness and range.

ASSIN-10 They are able to create solution strategies for complex, undefined or novel duties on the basis of scientific methods and current research results, to reflect on them and repre-sent them to others.

ASSIN-11 They are able to integrate interdisciplinary research and development processes in plan-ning and concepts.

ASSIN-12 They are able to guide others professionally concerning the analysis of new, unclear and untypical tasks.

ASSIN-13 They are able to establish quality management systems based on scientific methods, to support and develop them further and by this to evaluate their own activities and the activities of others.

ASSIN-14 They have the capacity to undertake leading management responsibilities.

ASSIN-15 They have adapted scientific, technical and social competences (ability to abstract, sys-tem-analytical thinking, teamwork and communication skills, international and intercul-tural experience, etc.) and are therefore especially prepared to take over management responsibilities.

ASSIN-16 They acquired skills to work independently in a scientifically oriented way and to organ-ize complex projects, implement and manage them.

Master Degree in Civil Engineering competencies

In the following table we can see the crossover of competencies between SCC and the competencies defined for the master degree in civil engineering.

	ASSIN-1	ASSIN-2	ASSIN-3	ASSIN-4	ASSIN-5	ASSIN-6	ASSIN-7	ASSIN-8	ASSIN-9	ASSIN-10	ASSIN-11	ASSIN-12	ASSIN-13	ASSIN-14	ASSIN-15	ASSIN-16
BASIC																
CB6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CB7	X	X	X	X		X	X	X	X	X	X	X	X		X	X
CB8	X	X	X	X		X	X	X	X	X	X	X			X	X
CB9					X	X		X	X	X		X		X	X	X
CB10		X					X				X		X	X		X
GENERAL																
CG1	X	X	X	X		X	X		X	X	X	X	X	X	X	X
CG2	X	X	X	X	X	X	X	X		X	X	X	X			
CG3			X		X	X	X			X				X	X	X
CG4			X		X	X	X		X	X				X	X	X
CG5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CG6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CG7	X	X	X	X		X	X	X	X	X	X	X	X			
CG8	X	X	X	X		X	X	X	X	X	X	X	X			
CG9	X	X	X	X		X	X	X	X	X	X	X	X			
CG10	X	X	X	X		X	X	X	X	X	X	X	X			
CG11	X	X	X	X		X	X	X	X	X	X	X	X			
CG12	X	X	X	X		X	X	X	X	X	X	X	X			
CG13	X	X	X	X		X	X	X	X	X	X	X	X			
CG14	X	X	X	X		X	X	X	X	X	X	X	X			
CG15	X	X	X	X		X	X	X	X	X	X	X	X			
CG16	X	X	X	X		X	X	X	X	X	X	X	X			
CG17				X	X	X	X			X	X	X	X			
CG18	X	X	X	X		X	X	X	X	X	X	X	X			
CROSS-DISCIPLINARY																
G1	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
G2	X		X	X		X		X			X		X	X	X	X
G3						X	X	X	X	X				X	X	X
G4		X				X		X			X	X	X	X	X	X
G5	X		X			X	X	X	X	X	X	X	X	X	X	X
G6	X		X	X	X	X		X	X	X	X	X	X	X	X	X

Específicas																
AFC1		X		X		X	X	X	X	X	X	X	X			
AFC2	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec1	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec2	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec3	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec4	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec5	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec6	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec7	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec8	X	X	X	X		X	X	X	X	X	X	X	X			
CienTec9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CienTec10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TFM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Basic competències

CB6 Possessing and understanding knowledge that provides the basis or opportunity to be original in the development and/or application of ideas, often in a research context.

CB7 For students to know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

CB8 For students to be able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB9 For students to know how to communicate their conclusions (and the knowledge and ultimate reasons that support them) to specialized and non-specialized audiences in a clear and unambiguous way.

CB10 For students to possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

General competencies

CG1 Scientific-technical and methodological training for the continuous recycling of knowledge and the exercise of the professional functions of assessment, analysis, design, calculation, project, planning, direction, management, construction, maintenance, conservation and exploitation in the field of Civil Engineering.

CG2 Understanding of the multiple technical, legal and property conditions that arise when projecting a public work, and the ability to establish different valid alternatives, choose the optimal one and translate it properly, anticipating construction issues, and employing the most appropriate methods and technologies, both traditional and innovative, with the purpose of achieving the highest efficiency and favoring progress and a sustainable and environmentally friendly development of society.

CG3 Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Civil Engineer.

CG4 Knowledge of the history of civil engineering and training to analyze and value public works in particular and construction in general.

CG5 Knowledge of the profession of Civil Engineering and of the activities that can be carried out in the field of civil engineering.

CG6 Knowledge to apply technical and managerial skills in R+D+i activities within the field of civil

engineering.

CG7 Ability to plan, project, inspect and direct infrastructure works for land (roads, railways, bridges, tunnels and urban roads) or maritime (port works and facilities) transportation.

CG8 Knowledge of the issues in the design and construction of the different elements of an airport and of the conservation and operation methods.

CG9 Ability to plan and manage hydraulic and energy resources, including the management of the whole water cycle.

CG10 Ability to carry out studies on land planning, the coastal environment, coastal planning and defense, and environmental aspects related to infrastructures.

CG11 Capacity for the design, execution and inspection of structures (bridges, buildings, etc.), foundation works and underground works for civil use (tunnels, parking lots), and the diagnosis of their integrity.

CG12 Ability to plan, design and manage infrastructures, as well as their maintenance, conservation and exploitation.

CG13 Ability to plan, carry out studies and design surface or underground water reservoirs (dams, pipes, pumps).

CG14 Ability to carry out studies, land and urban planning plans and urbanization projects.

CG15 Ability to evaluate and environmentally condition infrastructure works in projects, construction, rehabilitation and conservation.

CG16 Ability to plan and execute water purification treatments, including their desalination, and purification. Collection and treatment of waste (urban, industrial or even dangerous).

CG17 Ability to apply business management techniques and labor legislation.

CG18 Adequate knowledge of the scientific and technological aspects of mathematical, analytical and numerical methods in engineering, fluid mechanics, continuous media mechanics, structural calculation, civil engineering, maritime engineering, hydraulic works and uses and linear works.

Cross disciplinary competències

G1 INNOVATION, EMPLOYABILITY, DEVELOPMENT & RESEARCH. Ability to develop creativity and the tendency to innovation, in a way that affects the development and progress of society. Ability to work on a research topic. Employability at a management level in all types of companies and administrations, with initiative and decision-making skills.

G2 SUSTAINABILITY & ENVIRONMENT. Ability to develop engineering within the framework of globalization, sustainability and environmental protection. Ability to analyze the complete life cycle of an engineering project.

G3 THIRD LANGUAGE AT A SCIENTIFIC-TECHNOLOGICAL DEVELOPMENT LEVEL. Knowing a third language, which will be English due to its global nature, fluently not only orally but also in writing and in line with the needs of graduates studying a master's degree. In particular, being able to prepare a technical or scientific article for international publication.

G4 USE OF INFORMATION RESOURCES AT AN INTERNATIONAL LEVEL. Ability to acquire information in both general and specialized international databases. Ability to access the most innovative and recent proposals, ability to carry out comparative studies as well as to detect strengths and weaknesses.

G5 CAPACITY TO DEVELOP KNOWLEDGE. Ability to develop new analysis methodologies and processes at all levels from conception, to project and development. Ability to propose and develop engineering specifications, regulations and standards, following criteria of safety, efficiency and sustainable use of resources.

G6 CAPACITY FOR THE PROMOTION & MANAGEMENT OF ENGINEERING PROJECTS. Ability to study the needs of society and their transformation into infrastructure and service projects. Ability to draft, develop and implement projects based on knowledge of basic subjects and technologies, decision making, directing the activities that are the object of the projects, assessing the social and

environmental impact of the technical solutions adopted, estimation of economic, material and human resources involved in a project.

Specific competències

AFC1 Ability to tackle and solve advanced mathematical engineering problems, from problem statement to formulation development and implementation in a computer program. In particular, the ability to formulate, program and apply advanced analytical and numerical calculation models to the project, planning and management, as well as the ability to interpret the results obtained, in the context of civil engineering.

AFC2 Understanding and mastery of the laws of thermo-mechanics of continuous media and the ability to apply them in areas of engineering such as mechanics of fluids and materials, theory of structures, etc.

CienTec1 Application of the knowledge of the mechanics of soils and rocks for the development of the study, project, construction and exploitation of foundations, slides, embankments, tunnels and other constructions carried out on or through the ground, whatever the nature and its status, and whatever the purpose of the work in question.

CienTec2 Knowledge and capacity for structural analysis by applying the methods and programs of design and advanced calculation of structures, based on the knowledge and understanding of the demands and their application to the structural typologies of civil engineering. Ability to perform structural integrity assessments.

CienTec3 Knowledge of all types of structures and their materials, and ability to design, project, execute and maintain civil works structures and buildings.

CienTec4 Ability to project, evaluate, build and maintain hydraulic works.

CienTec5 Ability to perform the calculation, evaluation, planning and regulation of water resources, both in surface and underground.

CienTec6 Ability to design and size water purification and treatment systems, as well as waste.

CienTec7 Knowledge and skills that allow understanding the dynamic phenomena of the ocean-atmosphere-shore environment and being able to provide answers to the problems posed by the coastline, ports and shores, including the impact of interventions in the coastline. Ability to carry out maritime works studies and projects.

CienTec8 Knowledge of transportation engineering and planning, transportation functions and modes, urban transport, management of public transport services, demand, costs, logistics and financing of transport infrastructures and services.

CienTec9 Ability to analyze and diagnose the social, cultural, environmental and economic conditions of a territory, as well as to carry out land and urban planning projects from the perspective of sustainable development.

CienTec10 Ability to plan, manage and exploit infrastructures related to civil engineering.

TFM Elaboration, presentation and defense, once all the credits of the study plan have been completed, of an original dissertation carried out individually before a university court, consisting of a comprehensive Civil Engineering project professional in nature and in which the competencies acquired in the classroom are synthesized.

Master Degree in Numerical Methods in Engineering

In the following table we can see the crossover of competencies between SCC and the competencies defined for the master degree in Numerical Methods in Engineering.

	ASSIN-1	ASSIN-2	ASSIN-3	ASSIN-4	ASSIN-5	ASSIN-6	ASSIN-7	ASSIN-8	ASSIN-9	ASSIN-10	ASSIN-11	ASSIN-12	ASSIN-13	ASSIN-14	ASSIN-15	ASSIN-16
BASIC																
CB6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CB7	X	X	X	X		X	X	X	X	X	X	X	X		X	X
CB8	X	X	X	X		X	X	X	X	X	X	X			X	X
CB9					X	X		X	X	X		X		X	X	X
CB10		X					X				X		X	X		X
CROSS-DISCIPLINARY																
CT1	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
CT2	X		X	X		X		X			X		X	X	X	X
CT3						X	X	X	X	X				X	X	X
CT4			X	X	X	X		X		X	X	X	X	X	X	
CT5	X	X	X	X		X				X	X	X	X	X	X	
CT6		X				X		X			X	X	X	X	X	X
CT7					X		X	X	X	X	X	X	X	X		X
GENERAL																
CG1		X			X		X	X	X	X	X	X	X	X	X	X
CG2		X			X		X	X	X	X	X	X	X	X	X	X
CG3		X			X		X	X	X	X	X	X	X	X	X	X
CG4		X			X		X	X	X	X	X	X	X	X	X	X
CG5		X			X		X	X	X	X	X	X	X	X	X	X
CG6		X			X		X	X	X	X	X	X	X	X	X	X
CG7		X			X		X	X	X	X	X	X	X	X	X	X
CG8		X			X		X	X	X	X	X	X	X	X	X	X
CG9		X			X		X	X	X	X	X	X	X	X	X	X
SPECIFIC																
CE1		X			X		X	X	X	X	X	X	X	X	X	X
CE2		X			X		X	X	X	X	X	X	X	X	X	X
CE3		X			X		X	X	X	X	X	X	X	X	X	X
CE4		X			X		X	X	X	X	X	X	X	X	X	X
CE5		X			X		X	X	X	X	X	X	X	X	X	X
CE6		X			X		X	X	X	X	X	X	X	X	X	X
CE7		X			X		X	X	X	X	X	X	X	X	X	X

Basic competencies

CB6 Possessing and understanding knowledge that provides the basis or opportunity to be original in the development and/or application of ideas, often in a research context.

CB7 For students to know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

CB8 For students to be able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB9 For students to know how to communicate their conclusions (and the knowledge and ultimate reasons that support them) to specialized and non-specialized audiences in a clear and unambiguous way.

CB10 For students to possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

General competencies

CG1 Knowledge of numerical methods and solution mechanisms. Complete and consolidate the basic student training in solving problems using numerical and computational methods, reinforcing their knowledge of the basics, as well as of the specific applications.

CG2 Knowledge of the theories and applications of numerical methods. Ability to acquire advanced knowledge and understanding of the theories and applications of numerical methods in solving engineering problems.

CG3 Experience in solving problems using numerical methods. Ability to acquire experience and criteria in the application of numerical methods through the use of calculation programs, pre and post graphic processors, programming languages and scientific calculation libraries.

CG4 Consolidation of the application criteria of numerical methods. Complete and consolidate the knowledge, criteria and critical spirit to propose conventional solutions and as well as to analyze the results in characteristic numerical modeling problems.

CG5 Knowledge of social networks in the field of numerical methods. Knowing and acquiring a critical awareness about the avant-garde of the Spanish, European and international community of numerical methods in engineering.

CG6 Numerical modeling of real problems. In depth ability to solve real engineering problems through numerical modeling by identifying the underlying mathematical model, the most appropriate calculation method and the critical interpretation of the results.

CG7 Independence to question. Acquire the ability to autonomously use their knowledge and understanding of computational engineering to design solutions to new or unfamiliar problems, incorporating theoretical and practical knowledge and know-how, if necessary, from other disciplines of engineering and basic sciences, and designing new original resolution methods appropriate to the set of final objectives.

CG8 Knowledge of the scope of numerical methods. Understand the applicability and limitations of numerical modeling and existing calculation technologies.

CG9 Independence to research. Acquire experience and autonomy in the search, analysis, compilation and synthesis of cutting-edge scientific and technical information.

Cross-disciplinary competencies

CT1 CAPACITY FOR ENTREPRENEURSHIP & INNOVATION. Knowing and understanding the mechanisms on which scientific research is based, as well as the mechanisms and instruments for transferring results between the different socio-economic agents involved in R+D+I processes, acquiring thus the ability to lead a work team made up of various professional profiles and disciplines.

CT2 SUSTAINABILITY & SOCIAL COMMITMENT. Being able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and

choices.

CT3 THIRD LANGUAGE. Having English as a third language, at an appropriate level in oral and written form, so as to being able to work and communicate effectively in international and intercultural environments.

CT4 EFFECTIVE ORAL AND WRITTEN COMMUNICATION. Improving communication skills: oral presentations, preparation of professional and scientific reports in a clear and concise way to communicate their conclusions, the knowledge and ultimate reasons that support it, to specialized and non-specialized audiences in a clear and unambiguous way.

CT5 TEAM WORK. Being able to work as a member of an interdisciplinary team, not only as a member, but also to perform management tasks in order to contribute to developing projects with pragmatism and a sense of responsibility, assuming commitments considering the resources and time available. Obtaining a good knowledge of the community of numerical methods in engineering at a national and international level.

CT6 SOLVENT USE OF INFORMATION RESOURCES. Managing the acquisition, structuring, analysis and visualization of data and bibliographic and computer information of a scientific and technical nature and critically assess the results of this management.

CT7 SELF-EMPLOYED LEARNING. Detecting gaps in one's own knowledge and overcome them through critical reflection and the choice of the best action to expand this knowledge and motivate oneself to continue training throughout their professional life.

Specific competencies

CE1 Knowledge of practical numerical modeling. Ability to acquire knowledge in advanced numerical modeling applied to different areas of engineering such as: Civil and environmental engineering, Mechanical and aerospace engineering, Nano-engineering and bioengineering, Naval and marine engineering, etc.

CE2 Knowledge of the state of the art in numerical algorithms. Ability to catch up on the latest numerical technologies to solve engineering and applied science problems.

CE3 Knowledge of modeling materials. Ability to acquire knowledge related to modern physical models in material science (advanced constitutive models) in solid and fluid mechanics.

CE4 Knowledge of validation and verification criteria. Management capacity of numerical simulation quality control techniques (validation and verification).

CE5 Experience in numerical simulations. Acquisition of fluency in modern numerical simulation tools and their application to multidisciplinary engineering and applied science problems.

CE6 Interpretation of numerical models. Understanding the applicability and limitations of different computer calculation techniques.

CE7 Experience in programming calculation methods. Ability to acquire training in the development and use of existing calculation programs, as well as pre and post processors, knowledge of programming languages and standard calculation libraries.