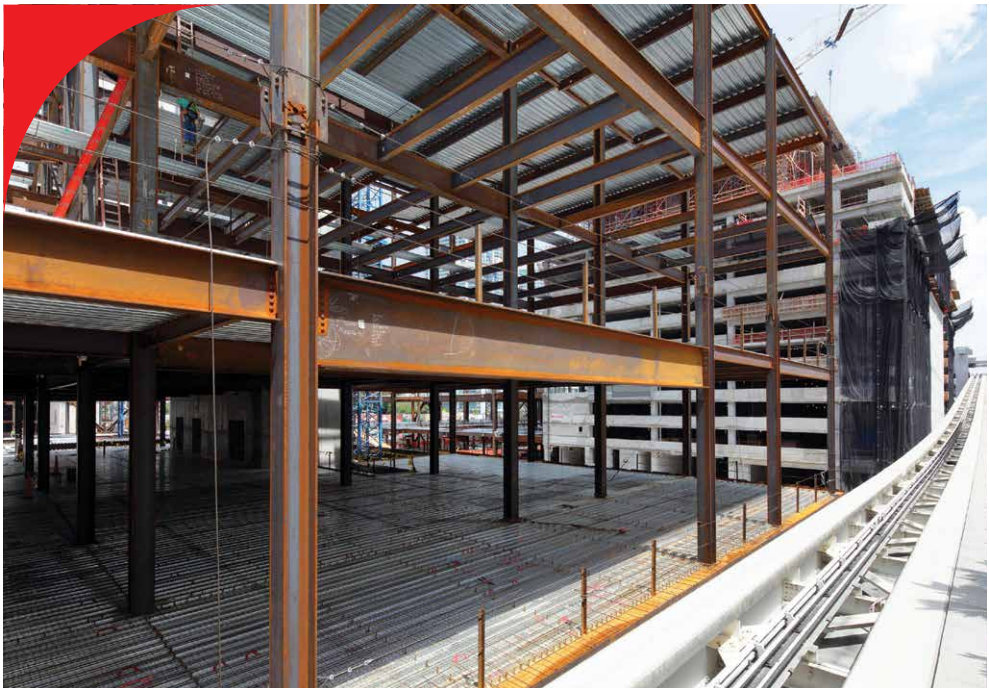
PARIS-CACHAN CAMPUS

MAJOR

Sustainable Materials & Structures

#BEHAVIOROFMATERIALS #SUSTAINABLEMATERIALS
#COMPOSITEMATERIALS #STRUCTURALDESIGN
#MODELINGANDSIMULATION #DYNAMICS #INNOVATIVETRANSPORT
#LIGHTENINGOFSTRUCTURES #CIVILENGINEERING #STRUCTURES

epf
ENGINEERING SCHOOL
Creating the future together



COURSE OBJECTIVES

The Sustainable Materials & Structures Major offers EPF students a wide range of modules covering the **study of structures in general, with more specific applications to the civil engineering and land transport sectors.** This major maintains the generalist approach of EPF by preparing multidisciplinary engineers who can work in a variety of sectors of activity.

The objective of this major is to enable you as a future graduate to implement innovative technical solutions in the design of complex sustainable structures with reduced environmental impact.

COURSE DESCRIPTION

The Major in Sustainable Materials & Structures spans two academic years structured around two academic semesters and two semesters of internships: a student-engineer internship in Year 4 and a 'final year project' internship in Year 5.

At the end of this major, you will have acquired a range of technical skills, will be familiar with industrial approaches and will be open to research.
The **teaching is diversified,** and the highly theoretical aspects of the course are complemented by practical work in laboratories, the use of digital simulation tools, lectures, visits to industrial sites, etc.

A large part of the course is devoted to projects or case studies that place students in a professional context.

YEAR 4 . COMPULSORY MODULES

Business organizations - Professions — 70 hours I 5 ECTS

- Risk Management & Control
- Statistics for engineers
- Business Game
- Conferences & visits
- English

Knowledge of the basic essential tools for engineers in Human & Social Sciences. Understanding of the business organisation and its environment, and project work.

Materials sciences — 75 hours I 5 ECTS

- General principles of polymeric materials
- Microscopic behavior I
- Materials characterization
- Shaping of materials
- Eco-designed materials

Knowledge and understanding of the types of behavior of materials and the parameters that define them to choose the right material for the element and the structure to be built.

Structural Mechanics — 75 hours I 5 ECTS

- Strength of advanced materials
- Structural dynamics
- Continuum mechanics I
- Transdisciplinary MOOC

Know how to model a structure, use calculation, structure and numerical simulation methods and use the appropriate digital tools to determine its stress and strain response.

Structural modeling and simulation — 80 hours I 5 ECTS

- Introduction to the Finite Element Method
- Modeling and simulation methods
- Design and modelling project

Know how to use the appropriate digital tools on specific and real-world cases.

Project — 150 hours I 5 ECTS

- Project management
- Semester land transport or BIM project

YEAR 4 . OPTIONAL MODULES

Introduction to civil engineering — 70 hours I 5 ECTS

- Dimensioning
- Introduction to civil engineering and engineering structures
- Construction materials

Know how to dimension a simple structure by adapting it according to sustainability, safety and cost criteria.

Introduction to transport — 70 hours I 5 ECTS

- Introduction to the transport sectors
- Automotive architecture
- Transport materials and products
- Certification/homologation

Using materials as a starting point, understand shaping methods and their use. Know how to carry out a study of the structural aspects of vehicles, and the aspects related to comfort and safety.

YEAR 5 . COMPULSORY MODULES

Business & networks	50 hours I 3 ECTS
• Building a post-graduate professional network • Employment law • Conferences & company visits	Acquire the skills required to develop a network and transition successfully into the world of work.
Advanced materials	**75 hours I 5 ECTS**
• Non-destructive testing • Composite materials • Metallurgy	Know how to analyze materials at different scales and be familiar with methods of material characterization.
Advanced structures	**75 hours I 5 ECTS**
• Continuum mechanics II • Fatigue - Reliability • Structural damage and ruin	Analyze ageing mechanisms and estimate the life span of a structure.

YEAR 5 . OPTIONAL MODULES . 1 TRACK TO BE CHOSEN FROM:

. SUSTAINABLE MATERIALS AND STRUCTURES FOR INNOVATIVE TRANSPORT TRACK

Transport engineering	80 hours I 6 ECTS
• Transport innovation • Hybridization and vehicle reconditioning • Experimental approval of structures • Transport acoustics	Knowledge of new materials and new technologies for the sustainability of structures. Practical case study of a sustainability problem.
Transport structure	**80 hours I 6 ECTS**
• Crash and impact • Structures lightened by composites • Structures lightened by additive manufacturing	Develop an understanding the range of technical issues encountered in the transport sector.
Transport materials and structures project	**150 hours I 5 ECTS**

. SUSTAINABLE MATERIALS AND STRUCTURES FOR CIVIL ENGINEERING TRACK

Civil Engineering	65 hours I 6 ECTS
• Soil mechanics and foundations • Concrete structures • Underground structures	Understand how a structure is fixed in the ground. Have a good understanding of geotechnics, knowledge of support methods and how to choose types of foundations.
Structures	**80 hours I 6 ECTS**
• Steel construction • Para-seismic Engineering • Experimental civil engineering studies	Knowledge of the dynamic effects on steel structures, know how to dimension them in compliance with regulatory requirements.
Sustainable materials and structures for civil engineering project	**150 hours I 5 ECTS**

YOUR FUTURE AFTER THE SUSTAINABLE STRUCTURES & MATERIALS MAJOR

GROWTH SECTORS

- Leading civil engineering, offshore or wind power structure contractors
- Project management for infrastructure projects (road, rail)
- Transport (design office, testing, etc.)
- Public or private research organisations in the materials sector
- Control and certification bodies
- Companies involved in industrial risk management

JOBS FOR THE FUTURE

- Civil engineering infrastructure design engineer
- Transport engineering studies engineer
- Design or eco-design engineer
- Materials and structures R&D engineer
- BIM manager
- Methods engineer
- Project management assistance
- Maintenance and rehabilitation engineer
- Technical control engineer
- Project management, risk management

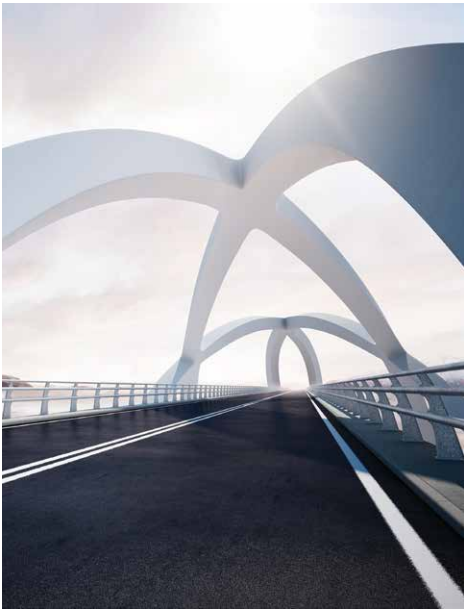
REAL-WORLD PROJECTS TO DEVELOP YOUR EMPLOYABILITY

The projects organized during the Major are designed for you to be able to put into practice project management and teamwork methods throughout the semester, on a real-life industrial or research problem, in a group, and under professional supervision.

▸ In Year 4, a choice of 3 themes is offered:

- Land transport project with a system engineering approach
- Structural project with a BIM approach
- Materials research project in conjunction with research laboratories

▸ In Year 5, the industrial projects carried out are related to your choice of track.



Émilie MARVIER

2021 Graduate

“ The Sustainable Materials & Structures Major has the advantage of being multi-purpose, opening up a wide range of fields. The range of subjects on offer enables you to develop knowledge in mechanics, structural calculations and materials that can be used in a wide variety of sectors ranging **from civil engineering to cosmetics and transport.** The comprehensive and varied classes given by professionals in their field allow students to discover the many aspects of mechanical engineering, and the projects allow them to apply the knowledge acquired in a realistic way. Personally, the classes taught in this course prepared me for my end-of-studies internship at GSea Design, a nautical company specializing in structural calculations. My internship consisted of setting up a new method of dimensioning the hulls of racing boats subjected to hydrodynamic impacts (impact of the hull on the water). ”

PRACTICAL DETAILS

- **Duration of studies:** 2 years
- **Location:** Paris-Cachan Campus

CONTACT US

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