

# Professional Master's Degree Infrastructure and Civil Engineering



## Professional Master's Degree Infrastructure and Civil Engineering

- » Modality: online
- » Duration: 12 months
- » Certificate: TECH Technological University
- » Dedication: 16h/week
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtute.com/us/engineering/professional-master-degree/master-infrastructure-civil-engineering](http://www.techtute.com/us/engineering/professional-master-degree/master-infrastructure-civil-engineering)

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# 01

# Introduction

This highly qualified program is a state-of-the-art study of the latest technologies applied to the development of civil engineering works and projects. A high-intensity tour describing the advanced technology machinery used in the execution of the works, which allows the construction of state-of-the-art infrastructures. In the field of Engineering and Infrastructure design, a review will be made of the currently existing software, which provides greater computing power every day, achieving a complete learning path, which will provide the student with the maximum capacity to intervene in this area with quality and vanguard.





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*This program will take you in an intensive way to acquire new knowledge in Civil Engineering and Infrastructure development, incorporating the most interesting novelties in this field in the international panorama”*

The Civil Engineering sector is one of the main pillars of world economies, both because of the investment it requires and the economic impact of this investment, as well as for the structuring of the territory, which is essential for modern economies to develop at the pace imposed by the world economic order.

Civil Engineering is constantly evolving, both technologically and geographically. Moreover, this sector is not exempt from the digitalization that is being imposed in all business areas, so, in order to train the professional in this field, special emphasis is placed on both the need to implement digitalization within the business structures, as well as on the knowledge of the new tools offered by the new technology sectors, to achieve the digitalization that is essential in these times.

Another aspect that has been highlighted in recent years as being of vital importance for construction businesses is internationalization. Thus, this program will explore the opportunities offered by the international market, through multilateral tenders financed by guarantor entities.

As it is an online specialisation 100%'s degree, the student is not bound by fixed schedules or the need to move to another physical location, rather, they can access the content at any time of the day, balancing their professional or personal life with their academic life.

This **Professional Master's Degree in Infrastructure and Civil Engineering** contains the most complete and up-to-date educational program on the market. Highlights of the update include:

- ◆ The development of case studies, presented by experts in Infrastructure and Civil Engineering
- ◆ The graphic, schematic, and eminently practical contents with which they are created, provide scientific and practical information on the essential disciplines for professional practice
- ◆ Practical exercises where the self-assessment process can be carried out to improve learning
- ◆ Special emphasis on innovative methodologies in Infrastructure and Civil Engineering
- ◆ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ◆ Content that is accessible from any fixed or portable device with an Internet connection



*The construction of quality elements that are resistant to the passage of time requires the mastery of the new forms of intervention that have burst into this field"*

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*This Professional Master's Degree is the best investment you can make in the selection of an up-to-date program in the field of Civil Engineering. We offer you quality and free access to content"*

It includes, in its teaching staff, professionals belonging to the field of Civil Engineering, who contribute their work experience in this update, as well as recognized specialists from prestigious reference societies and universities.

Its multimedia content, developed with the latest educational technology, will allow the professional a situated and contextual learning, that is, a simulated environment that will provide an immersive update, programmed to train in real situations.

The design of this program is based on Problem-Based Learning, by means of which the professional must try to solve the different situations of professional practice that arise throughout the academic program. To do so, the professional will be assisted by an innovative interactive video system, created by renowned and experienced experts in Infrastructure and Civil Engineering.

*A complete process of professional growth, which includes the processing of Civil Engineering data through BIM, an inevitable necessity for the sector.*

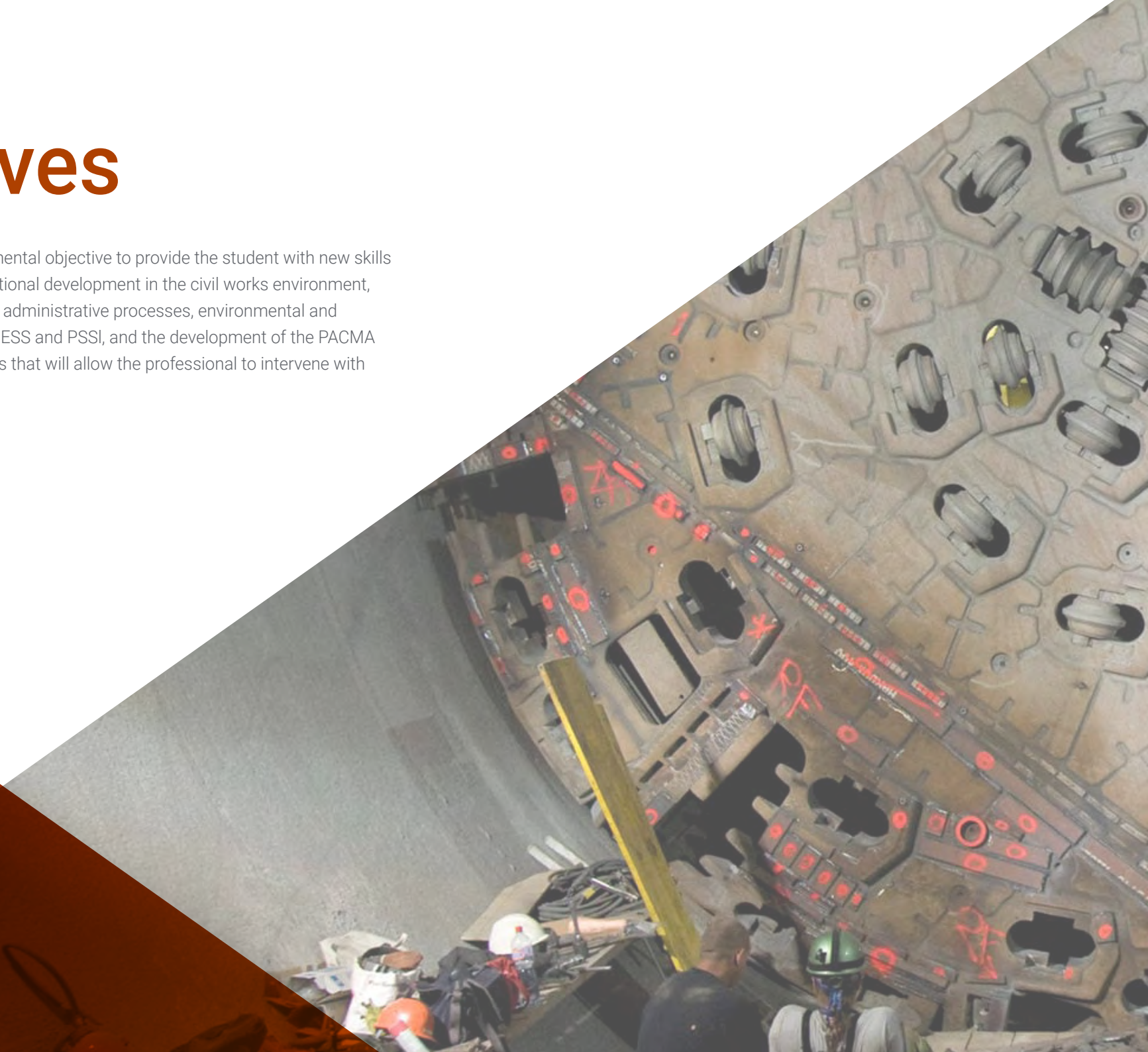
*Intensive, high-quality training designed to optimize the time spent by students in the program.*





# 02 Objectives

In this training we have as a fundamental objective to provide the student with new skills in the analysis, complete and operational development in the civil works environment, including the regulatory framework, administrative processes, environmental and occupational safety considerations ESS and PSSI, and the development of the PACMA document, among many other areas that will allow the professional to intervene with quality and solvency in this field.







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*All the knowledge and protocols you need to know to carry out any infrastructure project in civil works, structured in a Professional Master's Degree with a high educational impact"*



## General Objectives

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- ◆ Acquire new knowledge in Civil Engineering and Infrastructures
- ◆ Acquire new skills in terms of new technologies, latest machinery and software, knowledge of next steps and recycling
- ◆ Extrapolate this knowledge to other sectors of the industry, focusing on those fields that require more trained and qualified personnel year after year
- ◆ Processing the data generated in Civil Engineering activities, through the BIM environment, a mandatory reality for the drafting, construction, management and operation of infrastructures



*Learn how to implement digitization and the tools offered by new technologies, which will mean considerable progress in the businesses working in this field of Civil Engineering development”*





## Specific Objectives

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### Module 1. Design and Engineering

- ◆ Know the stages in the development of an engineering project
- ◆ Know in detail the latest IT tools available in the market, for the optimization of resources, for the drafting of projects
- ◆ Study the current regulatory framework
- ◆ Know the tools for the realization of project pre-designs, in order to determine solutions with potential clients
- ◆ Acquire the skills to analyze and use the documents provided by other businesses for the drafting of the project
- ◆ Approach to the latest technologies for the collection of field data necessary for the drafting of the project
- ◆ Get to know the BIM environment for the drafting of projects

### Module 2. Contracting and Preliminary Phases of Work

- ◆ Analyze the types of contracts existing in the world of Civil Engineering
- ◆ Have knowledge of the solvency analysis of each business
- ◆ Acquire skills for the preparation of technical and economic offers
- ◆ Study the use of the most suitable software for the preparation of bids
- ◆ Study in depth the role of the Contract Manager
- ◆ Prepare the necessary processes for the administrative start-up of a construction site and the latest developments in this regard

- ◆ Know the documents in the field of Health and Safety, environmental measures and waste management, necessary for the development of the work
- ◆ Have the necessary knowledge for the correct implementation of auxiliary site installations
- ◆ Know the internationalization of the business in which the student develops his/her functions

### Module 3. Linear Works

- ◆ Develop knowledge of the latest earthmoving machinery available for earthmoving operations
- ◆ Train students in earthwork construction processes for linear works
- ◆ Provide training on the necessary analysis, prior to the start of the works, in terms of hydrology and hydraulics, to optimize the drainage of the work
- ◆ Training for the analysis of existing geotechnical engineering for the optimization of existing foundations
- ◆ Analyze the different types of structures that exist in linear works, such as underpasses, overpasses and viaducts
- ◆ Have knowledge of the signage required for the execution of the linear work
- ◆ Development of the type of signaling installed in different types of railway projects (ERTMS)
- ◆ Training on existing track devices on the market



#### **Module 4. Hydraulic Works**

- ♦ Training on the wide range of hydraulic works in the field of Civil Engineering
- ♦ Know the appropriate machinery and construction processes for gravity and pressure piping works
- ♦ Access to the special parts available on the market for application in pipeline works
- ♦ Training on the particularities, appropriate machinery and construction processes of canals and dams
- ♦ Know the particularities, suitable machinery and construction processes of channeling works
- ♦ Know the particularities, appropriate machinery and construction processes of WWTP, DWTP and irrigation works

#### **Module 5. Maritime, Airport, Industrial and Renewable Energy Works and Other Sectors**

- ♦ Know the theory of maritime climate
- ♦ Execute works in ports
- ♦ Construction of Vertical Dikes
- ♦ Construction of Breakwater dikes
- ♦ Understand beach dynamics
- ♦ Know the equilibrium profiles on beaches
- ♦ Execution of works on the coast

- ♦ Training in the dredging industry
- ♦ Know the machinery and construction processes in the dredging sector
- ♦ Develop issues related to the particularities of the execution of works at airports, both from a technical and operational point of view
- ♦ Focus on the development of works in the industrial and renewable energy sectors.
- ♦ Present the latest trends in the field of R&D&I
- ♦ Training in the industrialization sector of the civil works sector

#### **Module 6. Construction Planning (PMP)**

- ♦ Know the figure of the PMP
- ♦ Training on project management from the time, organization, economic and human resources perspectives.
- ♦ Have the necessary training to improve the professional's communication with customers and suppliers
- ♦ Acquire the skills for proper purchasing management
- ♦ Analytical capacity to optimize results in the development of each project
- ♦ Know the appropriate software tools for planning, monitoring and closing of construction sites



**Module 7. Settlement and Closure of Work**

- ◆ Prepare the necessary documentation for the preparation of the liquidation and closing of the work
- ◆ Training in general construction site measurements
- ◆ Know the latest tools available for the realization of field measurements. field measurements
- ◆ Develop knowledge of the methods for closing open nonconformities during the course of the project
- ◆ Detect and create conflicting prices
- ◆ Training in negotiation, facing the discussion with the client for the economic closing of the work
- ◆ Follow up and open additional files in addition to the work itself, such as price revisions

**Module 8. Infrastructure Conservation and Maintenance**

- ◆ Study conservation and maintenance contracts in greater depth
- ◆ Drafting bids for maintenance and conservation contracts, both from a technical and economic point of view
- ◆ Training in the performance of maintenance tasks
- ◆ Coordinate human and machinery teams for the optimal development of the conservation and maintenance contract
- ◆ Know the details in the conservation and maintenance of roads, railroads and ports.
- ◆ Have the guidelines for the economic management of the contract
- ◆ Study in depth the specific machinery for road and railroad maintenance and conservation tasks

**Module 9. Infrastructure Repair**

- ◆ Knowledge of the infrastructure repair sector
- ◆ Know the necessary guidelines for carrying out inventories of infrastructures susceptible to repair, applying the latest technologies such as drones for the analysis of infrastructures
- ◆ Know which are the new IT tools for the decision-making process of action in some infrastructures or others
- ◆ Study the pathologies that can be found in bridges and tunnels
- ◆ Training on infrastructure fault monitoring, both from the point of view of data collection in the field and from the point of view of data processing
- ◆ Know the methods for the execution of the repair work itself
- ◆ Take a tour around the equipment necessary for the development of this type of repair work

# 03 Skills

The criterion for the elaboration of this program is to promote the real acquisition of competencies among the students who complete it, so that the theoretical knowledge is applicable in practice in an immediate, solvent, safe and accurate way. With a methodology focused on efficient progress, it will take the student to the highest levels in their activity.





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*This program will help you acquire the skills you need to excel in your daily work”*





## General Skill

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- ◆ Participate or direct all the activities present throughout the different phases, from the location of contracts and preparation of bids for bidding and awarding, to the operation during the execution of the same and their closing, using the latest technologies and the most innovative techniques currently available in the market
- ◆ Identify and repair infrastructures using innovative methods
- ◆ Design and manage the application of new technologies to the management of civil infrastructures, designing and implementing computerized and automated control systems

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*Improve your skills in the field of Civil Engineering will allow you to give your CV a more competitive profile and to opt for better job opportunities"*







## Specific Skills

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- ◆ Draft construction projects with the use of the latest computer tools
- ◆ Apply all the latest knowledge and techniques for the execution of contracts, following all relevant administrative processes
- ◆ Develop linear works following the current regulations and choosing the specific and most appropriate machinery for each case
- ◆ Apply all the necessary tools for the construction of hydraulic works
- ◆ Develop maritime works, taking into account the peculiarities of each construction and the latest trends in R+D+i
- ◆ Perform budget, cost, purchasing, planning and certification control of a project
- ◆ Perform the necessary tasks for the completion of the project (settlement and closure of the work), as well as the follow-up of the project
- ◆ Perform maintenance and preservation contracts
- ◆ Identify and repair possible damage to infrastructures

04

# Course Management

In TECH we have professionals specialized in each area of knowledge, who pour into our specializations the experience of their work. In this way, a contextualized, realistic and close vision of the reality of the profession is offered, with a form of learning focused on the aspects that the student will really encounter when carrying out their work in this field.







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*The teachers of this training are professionals with extensive experience in Civil Engineering and related fields. This gives the Professional Master's Degree an added value of professional reality of the highest interest"*

## Management



### Mr. Uriarte Alonso, Mario

- ♦ Civil Engineer from the University of Cantabria
- ♦ Professional Master's Degree in Oceanographic Engineering
- ♦ 17 years of experience in the field of construction execution, having worked as construction manager in works of highways, airports, ports, canals, railways and hydroelectric works
- ♦ In the engineering field, he is the CEO of Candois Ingenieros Consultores S.L., a business dedicated to the drafting of projects and construction management



### Mr. Torres Torres, Julián

- ♦ Civil Engineer, University of Granada
- ♦ Professional Master's Degree in Structures
- ♦ 14 years of experience in the field of construction execution, having worked as construction manager in road, urbanization and WWTP works
- ♦ In the engineering field, he has developed his work as an independent freelance and as technical director at Candois Ingenieros Consultores S.L



## Professors

### Mr. Gámiz Ruíz, Juan José

- ◆ Civil Engineer, University of Granada
- ◆ Professional Master's Degree in Structural Calculation
- ◆ 12 years of experience in the engineering field providing services for the administration and developing engineering works as independent freelance in projects and construction management

### Mr. Gómez Martín, Carlos

- ◆ Civil Engineer of Roads, Canals and Ports
- ◆ Professional Master's Degree in Civil Engineering BIM
- ◆ 13 years of experience in the field of construction execution, executing airport and industrial works
- ◆ Develops specialized work with the BIM environment

### Mr. López Puerta, Miguel Ángel

- ◆ Civil Engineer of Roads, Canals and Ports
- ◆ Professional Master's Degree in Structural Calculation
- ◆ 2 years of experience in the field of Engineering specialized in the drafting of projects

### Mr. Ruíz Megía, Alejandro

- ◆ Civil Engineer, Universidad Alfonso X el Sabio de Madrid
- ◆ Master's Degree in Occupational Risk Prevention
- ◆ 15 years of experience in the field of construction execution, having worked as construction manager in highway works, urbanizations, coastal and port works, airports and singular construction



05

# Structure and Content

A syllabus based on the latest and most current knowledge in this field of professional intervention, which includes all the processes that the project sets in motion from the moment it begins until its completion. With the most interesting updates on the international scene and a dynamic structure created to maintain the motivation and progress of our students throughout the update.







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*A complete syllabus efficiently structured to create a dynamic and complete learning process, which drives you in a constant and methodical way without losing motivation"*



## Module 1. Design and Engineering

- 1.1. Stages in the Design and Engineering of a Project
  - 1.1.1. Analysis of Problems
  - 1.1.2. Solution Design
  - 1.1.3. Analysis of the Regulatory Framework
  - 1.1.4. Solution Engineering and Drafting
- 1.2. Knowledge of the Problem
  - 1.2.1. Coordination With the Client
  - 1.2.2. Study of the Physical Environment
  - 1.2.3. Social Environment Analysis
  - 1.2.4. Economic Environment Analysis
  - 1.2.5. Analysis of the Environmental Setting (EIS)
- 1.3. Solution Design
  - 1.3.1. Conceptual Design
  - 1.3.2. Study of Alternatives
  - 1.3.3. Pre-Engineering
  - 1.3.4. Preliminary Economic Analysis
  - 1.3.5. Coordination of the Design with the Client (cost-sales)
- 1.4. Client Coordination
  - 1.4.1. Land Ownership Study
  - 1.4.2. Economic Feasibility Study of the Project
  - 1.4.3. Environmental Feasibility Analysis of the Project
- 1.5. Pre-start-up Engineering
  - 1.5.1. Site or Layout Study
  - 1.5.2. Study of Typologies to Be Used
  - 1.5.3. Pre-Packaging Study of the Solution
  - 1.5.4. Realization of the Project Model
  - 1.5.5. Adjusted Economic Analysis of the Project
- 1.6. Analysis of the Tools to Be Used
  - 1.6.1. Personal Team in Charge of the Work
  - 1.6.2. Equipment Materials Necessary
  - 1.6.3. Software Required for the Drafting of the Project
  - 1.6.4. Subcontracting Necessary for the Drafting of the Project

- 1.7. Field Work Topography and Geotechnics
  - 1.7.1. Determination of the Necessary Surveying Works
  - 1.7.2. Determination of Geotechnical Works Required
  - 1.7.3. Subcontracting Topography and Geotechnical Works
  - 1.7.4. Follow-up Topography and Geotechnical works
  - 1.7.5. Analysis of Results of Topography and Geotechnical Works
- 1.8. Drafting of the Project
  - 1.8.1. DIA Newsroom
  - 1.8.2. Writing and Calculation of the Solution in Geometric Definition (1)
  - 1.8.3. Drafting and Calculation of the Structural Calculation Solution (2)
  - 1.8.4. Drafting and Calculation of the Solution in the Adjustment Phase (3)
  - 1.8.5. Drafting of Annexes
  - 1.8.6. Drawing up of Plans
  - 1.8.7. Drafting of Specifications
  - 1.8.8. Budget Preparation
- 1.9. BIM Model Implementation in Projects
  - 1.9.1. BIM Model Concept
  - 1.9.2. BIM Model Phases
  - 1.9.3. Importance of the BIM Model
  - 1.9.4. The Need for BIM for the Internationalization of Projects

## Module 2. Contracting and Preliminary Phases of Work

- 2.1. Choice of Type of Contracts to Be Offered and Location of Contracts
  - 2.1.1. Identification of Contracting Objectives
  - 2.1.2. Contracting Platforms
  - 2.1.3. Customer Knowledge and Analysis
  - 2.1.4. Financial Solvency Analysis
  - 2.1.5. Technical Solvency Analysis
  - 2.1.6. Choice of Contracts to Be Offered
- 2.2. Analysis of Required Solvency
  - 2.2.1. Financial Solvency Analysis
  - 2.2.2. Technical Solvency Analysis
  - 2.2.3. Analysis of the Need for Joint Venture Partners
  - 2.2.4. UTE Training Negotiation



- 2.3. Preparation of the Financial Offer
  - 2.3.1. Project Budget Breakdown
  - 2.3.2. Request for Quotations for Study
  - 2.3.3. Hypothesis Statement
  - 2.3.4. Closing of Economic Offer / Risk
- 2.4. Technical Drafting of Bids
  - 2.4.1. Study of Bidding Terms and Conditions and Basic Bidding Project
  - 2.4.2. Technical Report Writing
  - 2.4.3. Drafting of Work Program
  - 2.4.4. SYS and PACMA Documents
  - 2.4.5. Improvement
- 2.5. Contract Analysis (Contract Manager)
  - 2.5.1. Figure of the Contract Manager
  - 2.5.2. Opportunities for the Figure of the Contract Manager
  - 2.5.3. Training of the Contract Manager
- 2.6. Drafting of PSS and Opening of Work Center
  - 2.6.1. PSS Newsroom
  - 2.6.2. PSS Approval and Opening of the Work Center
  - 2.6.3. The Incident Book
- 2.7. Drafting of the PACMA and Waste Management Plan
  - 2.7.1. Analysis of Environmental Documentation of the Project
  - 2.7.2. Analysis of the Environmental Characteristics of the Area of Action
  - 2.7.3. Adjustment of the PACMA of the Business to the Project
  - 2.7.4. Elaboration of the Plan for the Management of SDWRs
- 2.8. Site Installations, Logistics, Site Layout
  - 2.8.1. Needs Analysis for Stockpiling Areas and Facilities
  - 2.8.2. Study of Materials and Facilities Required for the Implementation Area
  - 2.8.3. Implementation.
  - 2.8.4. Topographic Survey of the Site
  - 2.8.5. Drones and Surveying
  - 2.8.6. In-Cabinet Verification of Topographic Data
  - 2.8.7. Signing of the Staking Out Report

- 2.9. Multilateral International Tenders
  - 2.9.1. Multilateral Organizations
  - 2.9.2. Advantages of Multilateral Bidding
  - 2.9.3. Search for Opportunities in the Multilateral Market
  - 2.9.4. Implementation for Multilateral Bidding
    - 2.9.4.1. Countries of Interest
    - 2.9.4.2. Regulatory Framework.
    - 2.9.4.3. Local *Partner*
    - 2.9.4.4. Technical and Economic Solvency with a View to Internationalization
    - 2.9.4.5. Development of International Contracts
    - 2.9.4.6. Risks of Business Internationalization
- 2.10. Internationalization of the Business
  - 2.10.1. Countries of Interest
  - 2.10.2. Regulatory Framework.
  - 2.10.3. Local *Partner*
  - 2.10.4. Technical and Economic Solvency with a View to Internationalization
  - 2.10.5. Development of International Contracts
  - 2.10.6. Risks of Business Internationalization

### Module 3. Linear Works

- 3.1. Types of Linear Works
  - 3.1.1. Road Works
  - 3.1.2. Railroad Works
  - 3.1.3. Bridges
  - 3.1.4. Tunnels.
- 3.2. Earthwork
  - 3.2.1. Soil Analysis
  - 3.2.2. Dimensioning of the Necessary Machinery
  - 3.2.3. Control and Monitoring Systems
  - 3.2.4. Quality Control
  - 3.2.5. Standards of Good Execution
- 3.3. Longitudinal and Transverse Drainage
  - 3.3.1. Project Drainage Review
  - 3.3.2. Recalculation and Optimization of Project Drainage
  - 3.3.3. Execution of Cost Savings Study
- 3.4. Foundations
  - 3.4.1. Analysis of the Geotechnical Study of the Project
  - 3.4.2. Recalculation of Project Foundations
  - 3.4.3. Preparation of the New Geotechnical Study
  - 3.4.4. Discussion of the New Geotechnical Study with the D.O.
- 3.5. Underpasses
  - 3.5.1. Analysis of Existing Underpasses in the Project
  - 3.5.2. Redimensioning in Terms of Drainage and Structural Capacity
  - 3.5.3. Optimization of the Calculation
  - 3.5.4. Optimization of Underpass
  - 3.5.5. Discussion of the New Structure with the D.O.
- 3.6. Overpasses
  - 3.6.1. Analysis of Existing Overpasses in the Project
  - 3.6.2. Redimensioning in Terms of Drainage and Structural Capacity
  - 3.6.3. Optimization of the Calculation
  - 3.6.4. Optimization of Overpass
  - 3.6.5. Discussion of New Structure with the D.O.
- 3.7. Viaducts
  - 3.7.1. Analysis of the Existing Viaducts in the Project
  - 3.7.2. Redimensioning in Terms of Drainage and Structural Capacity
  - 3.7.3. Optimization of the Calculation
  - 3.7.4. Optimization of Viaducts
  - 3.7.5. Discussion of New Structure with the D.O.
- 3.8. Vertical and Horizontal Signage, Fenders and Additional Elements
  - 3.8.1. Analysis of the Type and Quantity of Existing Signage in Project
  - 3.8.2. Optimization of Existing Signage
  - 3.8.3. Analysis of Existing Defences and their Optimization
  - 3.8.4. Noise Shield Analysis and Optimization
  - 3.8.5. Preparation of a Report on the Optimization Performed
  - 3.8.6. Discussion of Optimization Report with the D.O.



- 3.9. Railway Signaling and Track Equipment
  - 3.9.1. Introduction to Railway Signaling
  - 3.9.2. Signaling Systems Currently in Use
  - 3.9.3. Introduction to Track Devices
  - 3.9.4. Welded Long Bar
  - 3.9.5. Track on Plate
  - 3.9.6. Specific Machinery for Railway Works
- 3.10. Environmental, Social and Cultural Measures
  - 3.10.1. Analysis of the Measures Included in the Project
  - 3.10.2. Adequacy of PACMA
  - 3.10.3. Analysis of Social and Archaeological Measures

#### Module 4. Hydraulic Works

- 4.1. Types of Hydraulic Works
  - 4.1.1. Pressure Piping Works
  - 4.1.2. Severity Pipeline Works
  - 4.1.3. Canal Works
  - 4.1.4. Dam Works
  - 4.1.5. Works of Actions in Watercourses
  - 4.1.6. WWTP and DWTP Works
- 4.2. Earthwork
  - 4.2.1. Soil Analysis
  - 4.2.2. Dimensioning of the Necessary Machinery
  - 4.2.3. Control and Monitoring Systems
  - 4.2.4. Quality Control
  - 4.2.5. Standards of Good Execution
- 4.3. Severity Pipeline Works
  - 4.3.1. Survey Data Collection in the Field and Data Analysis in the Office
  - 4.3.2. Re-study of the Project Solution
  - 4.3.3. Piping Assembly and Manhole Execution
  - 4.3.4. Final Testing of Pipelines
- 4.4. Pressure Piping Works
  - 4.4.1. Analysis of Piezometric Lines
  - 4.4.2. Execution EBARS
  - 4.4.3. Piping and Valve Assembly
  - 4.4.4. Final Testing of Pipelines
- 4.5. Special Valve and Pumping Elements
  - 4.5.1. Types of Valves
  - 4.5.2. Types of Pumps
  - 4.5.3. Boilermaking Elements
  - 4.5.4. Special Valves
- 4.6. Canal Works
  - 4.6.1. Types of Channels
  - 4.6.2. Execution of Channels of Excavated Sections in the Ground
  - 4.6.3. Type of Rectangular Cross-Section
  - 4.6.4. Desanders, Sluice Gates and Loading Chambers
  - 4.6.5. Auxiliary Elements (Gaskets, Sealants and Treatments)
- 4.7. Dam Works
  - 4.7.1. Types of Dams
  - 4.7.2. Earth Dams
  - 4.7.3. Concrete Dams
  - 4.7.4. Special Valves for Dams
- 4.8. Actions in the Channels
  - 4.8.1. Types of Works in Watercourses
  - 4.8.2. Channeling
  - 4.8.3. Works for Channel Defences
  - 4.8.4. River Parks
  - 4.8.5. Environmental Measures in River Works
- 4.9. WWTP and DWTP Works
  - 4.9.1. Elements of a WWTP
  - 4.9.2. Elements of a WWTP
  - 4.9.3. Water and Sludge Lines
  - 4.9.4. Sludge Treatment
  - 4.9.5. New Water Treatment Systems

- 4.10. Irrigation Works
  - 4.10.1. Study of the Irrigation Network
  - 4.10.2. Execution EBAR
  - 4.10.3. Piping and Valve Assembly
  - 4.10.4. Final Testing of Pipelines

### Module 5. Maritime, Airport, Industrial and Renewable Energy Works and Other Sectors

- 5.1. Port Works
  - 5.1.1. Marine Climate
  - 5.1.2. Ports Executed with Sunken Caissons
  - 5.1.3. Breakwater Dikes
  - 5.1.4. Marinas
- 5.2. Coastal Works
  - 5.2.1. Coastal Dynamics
  - 5.2.2. Coastal Sediment Transport
  - 5.2.3. Beach Equilibrium Profile
  - 5.2.4. Exempt Dams on Coasts
- 5.3. Maritime Dredging and Earthmoving Works
  - 5.3.1. Need for Dredging Works in Coasts and Ports
  - 5.3.2. Machinery for the Execution of Dredging Works
  - 5.3.3. Execution of Dredging Works
- 5.4. Work on Airports, Runways and Taxiways
  - 5.4.1. Operation of Airport Works
  - 5.4.2. Airport Signage
  - 5.4.3. Restrictions on Work at Airports
- 5.5. Works at Terminal Airports
  - 5.5.1. Execution Project Analysis
  - 5.5.2. BIM Analysis of the Project
  - 5.5.3. Airport Terminal Project Work Team
- 5.6. Works in the Industrial Sector
  - 5.6.1. Industry Sectors of Reference
  - 5.6.2. Civil works in the Industrial Sector

- 5.6.3. Application of BIM Methodology in the Industrial Sector
- 5.6.4. Working Methods in Industrial Projects
- 5.7. Works for Renewable Energy Projects: Solar Farms
  - 5.7.1. Design and Calculation of the Drainage Network
  - 5.7.2. Design and Calculation of Roadways
  - 5.7.3. Design and Calculation of Foundations
  - 5.7.4. Preparation of Reports Applied to Energy Projects
- 5.8. Works for Renewable Energy Projects: Wind Farms
  - 5.8.1. Design and Calculation of the Drainage Network
  - 5.8.2. Design and Calculation of Roadways
  - 5.8.3. Design and Calculation of Foundations
  - 5.8.4. Preparation of Reports Applied to Energy Projects
- 5.9. R&D&I Projects
  - 5.9.1. Areas of Study for R&D&I Projects
  - 5.9.2. Methodology of Work
  - 5.9.3. Advantages of Project Development in the R&D&I Field
  - 5.9.4. Added Value of R&D&I Projects for the Business
- 5.10. Industrialization of Civil Engineering
  - 5.10.1. Current Status of the Industrialization of Civil Engineering
  - 5.10.2. Sector Projection
  - 5.10.3. Technologies Applicable to Civil Engineering Industrialization
  - 5.10.4. Future and Prospects of Civil Engineering Industrialization

### Module 6. Construction Planning (PMP)

- 6.1. Introduction and Life Cycle
  - 6.1.1. Project Definition and Project Management
  - 6.1.2. Areas of Expertise
  - 6.1.3. Life Cycle
  - 6.1.4. Interested Parties
  - 6.1.5. Management Influence
- 6.2. Management Processes
  - 6.2.1. Operation and Maintenance Project Management Processes
  - 6.2.2. Management Process Groups
  - 6.2.3. Interactions between Processes

- 6.3. Integration Management
  - 6.3.1. Development of the Articles of Incorporation
  - 6.3.2. Development of the Scope Statement
  - 6.3.3. Development of the Management Plan
  - 6.3.4. Project Management
  - 6.3.5. Work Supervision and Control
  - 6.3.6. Integrated Change Control
  - 6.3.7. Project Closing
- 6.4. Scope Management
  - 6.4.1. Scope Planning
  - 6.4.2. Scope Definition
  - 6.4.3. Creation of WBS
  - 6.4.4. Scope Verification
  - 6.4.5. Scope Closure
- 6.5. Time Management
  - 6.5.1. Definition of Activities
  - 6.5.2. Establishment of a Sequence of Activities
  - 6.5.3. Estimated Resources
  - 6.5.4. Estimated Duration
  - 6.5.5. Schedule Development
- 6.6. Cost Management
  - 6.6.1. Cost Estimates
  - 6.6.2. Preparation of a Cost Estimate
  - 6.6.3. Control of Costs and Variances
- 6.7. Human Resources Management
  - 6.7.1. Schedule Control
  - 6.7.2. Human Resources Planning
  - 6.7.3. Team Training
  - 6.7.4. Team Development
  - 6.7.5. Human Resources Management
  - 6.7.6. Human Resources Organizational Models
  - 6.7.7. Theories on the Organization of Human Resources

- 6.8. Communications in Management
  - 6.8.1. Communications Planning
  - 6.8.2. Distribution of Information
  - 6.8.3. Performance Reporting
  - 6.8.4. Stakeholder Management
- 6.9. Risk Management.
  - 6.9.1. Risk Management planning
  - 6.9.2. Risk Identification
  - 6.9.3. Qualitative Risk Analysis
  - 6.9.4. Quantitative Risk Analysis
  - 6.9.5. Risk Response Planning
  - 6.9.6. Risk Monitoring and Control
- 6.10. Procurement Management
  - 6.10.1. Purchasing and Procurement Planning
  - 6.10.2. Recruitment Planning
  - 6.10.3. Solicit Responses from Vendors
  - 6.10.4. Contract Administration
  - 6.10.5. Contract Closure

## Module 7. Settlement and Closure of Work

- 7.1. Pre-Completion Work
  - 7.1.1. Monthly Follow-up of Work Measurements
  - 7.1.2. Monthly Follow-up of Nonconformities
  - 7.1.3. Monthly Follow-up of New Project Items
  - 7.1.4. Administrative Management in the Event of Modifications
- 7.2. Final Measurement of the Work
  - 7.2.1. Participants in the Final Measurement of the Work
  - 7.2.2. Planning for the Final Measurement of the Work
  - 7.2.3. Coordination of Site Measurements
  - 7.2.4. Discussion with the Client of the Final Measurement of the Work.



- 7.3. Review of Final Construction Plans
  - 7.3.1. Control of Current Plans
  - 7.3.2. Final Drawing of Plans
  - 7.3.3. Presentation of As Built Plans
- 7.4. Review of Non-Conformities
  - 7.4.1. Follow-up and Closure of Nonconformities throughout the Development of the Work
  - 7.4.2. Importance of Nonconformities
  - 7.4.3. Final Review of Nonconformities Generated During the Construction Work
- 7.5. Negotiation of Contradictory Prices
  - 7.5.1. Definition of Contradictory Pricing
  - 7.5.2. Negotiation of Contradictory Price
  - 7.5.3. Contradictory Price Closing
- 7.6. Negotiation of Economic and Legal Closing of the Work
  - 7.6.1. Summary of Data for Site Closure
  - 7.6.2. Economic Negotiation for the Closing of the Work
  - 7.6.3. Legal and Administrative Closing of Work
  - 7.6.4. Current Records in Process
- 7.7. Adequacy of Affected Areas of the Construction Site
  - 7.7.1. Definition of Areas Affected During the Development of Works
  - 7.7.2. Measures Taken Throughout the Execution of the Works
  - 7.7.3. Measures in Affected Areas for the Closure of the Construction Site
  - 7.7.4. Final Restoration of the Work
- 7.8. Minutes of Receipt
  - 7.8.1. Works Acceptance Ceremony
  - 7.8.2. Figure of the Controller
  - 7.8.3. Works Acceptance Report
- 7.9. Removal and Cleaning of Installation Areas
  - 7.9.1. Withdrawal of Installations Area
  - 7.9.2. Cleaning of Areas Affected by the Works
  - 7.9.3. Removal of Site Equipment

- 7.10. Subsequent Files (Price Revisions and Possible Claims)
  - 7.10.1. Types of Files after the Works Have Been Received
  - 7.10.2. Price Revisions
  - 7.10.3. Claim Files
  - 7.10.4. Final Closure of the Work File

## Module 8. Infrastructure Conservation and Maintenance

- 8.1. Road Maintenance and Upkeep
  - 8.1.1. Analysis of the Initial Situation
  - 8.1.2. Customer Needs Analysis
  - 8.1.3. Analysis of Routine and Special Tasks
  - 8.1.4. Economic Monitoring of the Contract
- 8.2. Railroad Maintenance and Upkeep
  - 8.2.1. Analysis of the Initial Situation
  - 8.2.2. Customer Needs Analysis
  - 8.2.3. Analysis of Routine and Special Tasks
  - 8.2.4. Economic Monitoring of the Contract
- 8.3. Port Operation
  - 8.3.1. Figures Involved in the Operation of Ports
  - 8.3.2. Conservation Tasks
  - 8.3.3. Maintenance Tasks
  - 8.3.4. Engineering Works
  - 8.3.5. Commercial Management of the Port
- 8.4. Port Conservation and Maintenance
  - 8.4.1. Maintenance and Upkeep of Roads
  - 8.4.2. Maintenance and Upkeep of Docks
  - 8.4.3. Conservation and Maintenance of Port Facilities
  - 8.4.4. Maintenance and Upkeep of Office Buildings
- 8.5. Economics of the Conservation and Maintenance Contract
  - 8.5.1. Economic studies of Public Services
  - 8.5.2. Economic Engineering Applied to Public Services
  - 8.5.3. Regulation of the Service Fee
  - 8.5.4. Economic Planning of Conservation and Maintenance Works

- 8.6. Specific Machinery and Personnel for Road Maintenance and Upkeep
  - 8.6.1. Sizing of the Human Resources Team
  - 8.6.2. Dimensioning of the Necessary Machinery
  - 8.6.3. Specific Machinery Requirements
  - 8.6.4. New Technologies Applied to Conservation and Maintenance
- 8.7. Machinery and Specific Personnel and Railway Maintenance and Upkeep
  - 8.7.1. Sizing of the Human Resources Team
  - 8.7.2. Dimensioning of the Necessary Machinery
  - 8.7.3. Specific Machinery Requirements
  - 8.7.4. New Technologies Applied to Conservation and Maintenance

## Module 9. Infrastructure Repair

- 9.1. Works Related to the Maintenance and Repair of Infrastructures
  - 9.1.1. Introduction to the State of Preservation of Infrastructures
  - 9.1.2. Importance of Infrastructure Maintenance
  - 9.1.3. Infrastructure Maintenance
  - 9.1.4. Infrastructure Repair
- 9.2. Opportunities in the Bridge and Tunnel Repair Industry
  - 9.2.1. Status of the Bridge Network
  - 9.2.2. Status of the Tunnel Network
  - 9.2.3. Status of Work in this Sector
  - 9.2.4. Future of the Infrastructure Maintenance and Repair Sector
- 9.3. Infrastructure Inventory
  - 9.3.1. Field Work
  - 9.3.2. Field Data Processor in Cabinet
  - 9.3.3. Analysis of Processed Data
  - 9.3.4. Coordination with the Customer of Priority Works
- 9.4. Bridge Pathology Analysis
  - 9.4.1. Analysis of Processed Data on Bridge Pathologies
  - 9.4.2. Types of Pathologies Detected
  - 9.4.3. Decision to Act

- 9.5. Tunnel Pathology Analysis
  - 9.5.1. Analysis of Processed Data on Tunnel Pathologies
  - 9.5.2. Types of Pathologies Detected
  - 9.5.3. Decision to Act
- 9.6. Infrastructure Monitoring
  - 9.6.1. Importance of Infrastructure Monitoring
  - 9.6.2. Infrastructure Monitoring Application Technology
  - 9.6.3. Monitoring Data Analysis
  - 9.6.4. Decision-Making for Action
- 9.7. Bridge Repair Work
  - 9.7.1. Preparation for Bridge Repair Work
  - 9.7.2. Frequent Pathologies
  - 9.7.3. Action According to the Pathology
  - 9.7.4. Documentation of the Proceedings
- 9.8. Repair Work in Tunnels
  - 9.8.1. Preparation for Tunnel Repair Work
  - 9.8.2. Frequent Pathologies
  - 9.8.3. Action According to the Pathology
  - 9.8.4. Documentation of the Proceedings
- 9.9. Equipment for Bridge Repair Work
  - 9.9.1. Personal Team in Charge of the Work
  - 9.9.2. Machinery for the Execution of Works
  - 9.9.3. New Technologies Applied to Bridge Repair
- 9.10. Equipment for Tunnel Repair Work
  - 9.10.1. Personal Team in Charge of the Work
  - 9.10.2. Machinery for the Execution of Works
  - 9.10.3. New Technologies Applied to Bridge Repair

06

# Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.







“

*Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"*

## Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

“

*At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"*



*You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.*



*The student will learn to solve complex situations in real business environments through collaborative activities and real cases.*

### A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

“*Our program prepares you to face new challenges in uncertain environments and achieve success in your career”*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

## Relearning Methodology

TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

*In 2019, we obtained the best learning results of all online universities in the world.*

At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.





In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

*Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.*

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.



This program offers the best educational material, prepared with professionals in mind:



### Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.



### Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.



### Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





**Case Studies**

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.



**Interactive Summaries**

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".



**Testing & Retesting**

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.





07

# Certificate

The Professional Master's Degree in Infrastructure and Civil Engineering guarantees you, in addition to the most rigorous and updated training, access to a Professional Master's Degree issued by TECH Technological University.



“

*Successfully complete this program  
and receive your university degree  
without travel or laborious paperwork”*

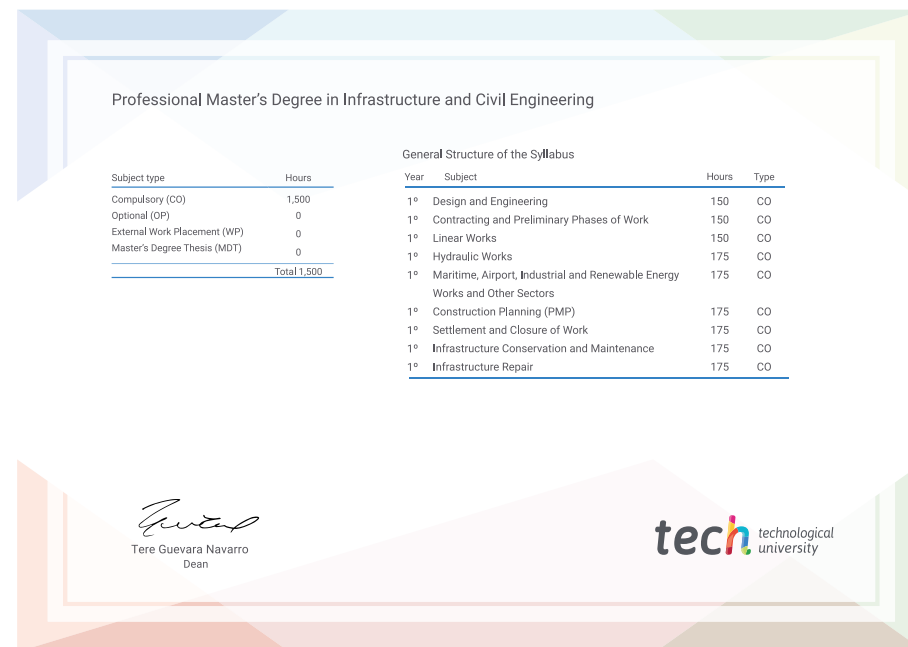
This **Professional Master's Degree in Infrastructure and Civil Engineering** contains the most complete and updated scientific program on the market.

After the student has passed the assessments, they will receive their corresponding **Professional Master's Degree** issued by **TECH Technological University** via tracked delivery\*.

The diploma issued by **TECH Technological University** will express the qualification obtained in the Professional Master's Degree, and will meet the requirements commonly demanded by job exchanges, competitive examinations and career evaluation committees.

Title: **Professional Master's Degree in Infrastructure and Civil Engineering**

Official N° of hours: **1,500 h.**



\*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.



future

health confidence people

education information tutors

guarantee accreditation teaching

institutions technology learning

community commitment

**tech** technological  
university

personalized service innovation

knowledge present quality

**Professional Master's  
Degree**

Infrastructure and Civil  
Engineering

development language

virtual classroom

- » Modality: online
- » Duration: 12 months
- » Certificate: TECH Technological University
- » Dedication: 16h/week
- » Schedule: at your own pace
- » Exams: online

# Professional Master's Degree Infrastructure and Civil Engineering

