

# Professional Master's Degree

## Road Construction, Maintenance and Operation





## Professional Master's Degree Road Construction, Maintenance and Operation

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

Website: [www.techtute.com/in/engineering/professional-master-degree/master-road-construction-maintenance-operation](http://www.techtute.com/in/engineering/professional-master-degree/master-road-construction-maintenance-operation)

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# 01

# Introduction

Highways are an indispensable part of the transportation network, both for people and goods. These transportation routes have been indispensable since the origins of civilization, since they have made possible the progress of peoples. In this sense, highway engineering is advancing by leaps and bounds, and this makes it essential for professionals working in this area to keep their knowledge up to date in order to offer a quality service adapted to the standards of the sector. Therefore, this TECH program focuses on providing students with in depth knowledge that will enable them to develop in any of the three areas of construction, maintenance or operation of the road, both from a management perspective, as well as from a leadership perspective towards digital transformation in work processes.





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*Highway engineering is advancing by leaps and bounds. This makes it necessary for professionals working in the highway sector to constantly update their knowledge in order to remain at the forefront of the industry"*

Roads, an indispensable part of the transportation network, have been a necessity since the origins of civilization, as they promote the progress of peoples. The global pandemic caused by COVID19 has once again highlighted the importance of roads as a means of communication for supplying the population.

With this in mind, TECH has prepared this Professional Master's Degree in Highway Construction, Maintenance and Operation, which aims to help students address any work scenario in the field of highways. In this way, the student will be ready to work in any of the three areas of Construction, Maintenance or Operation of the highway, but will also be ready to do so, both from a management perspective and trained to lead the Digital Transformation in their next job challenges.

The student will acquire a deep and fresh knowledge of technologies that are not widespread in the industry. This will provide them with a critical and constructive point of view, i.e., they will be able to develop an educated opinion on the use of them.

As main tools to achieve this objective, the topics that make up each module have updated technical information, real and very interesting case studies. Always without losing sight of the digital transformation we are all undergoing and in which the world of roads is no exception.

Furthermore, and this is what makes this Master's Degree better than others, the concept of roads itself will be addressed, which has been evolving over time and it is necessary to work on the next step of this evolution.

The program includes a special emphasis on innovative technologies that improve current processes and, in many cases, even achieve objectives that would have been unthinkable before.

In addition, as it is a 100% online Professional Master's Degree, it provides the student with the ease of being able to study it comfortably, wherever and whenever they want. All you need is a device with internet access to take your career one step further. A modality in accordance with the current times with all the guarantees to position the professional in a highly demanded area such as road construction.

This **Professional Master's Degree in Highway Construction, Maintenance and Operation** contains the most complete and up to date syllabus on the market. The most important features of the program include:

- ◆ Case studies presented by experts in Highway Engineering
- ◆ A deeper understanding of the management of resources for highway projects
- ◆ The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- ◆ Practical exercises where self assessment can be used to improve learning
- ◆ Its special emphasis on innovative methodologies
- ◆ 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



*If you were looking for a program that would allow you to expand your knowledge in the area of highway engineering, then you are in the right place"*



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*Throughout the Professional Master's Degree, innovative contents about highway construction and maintenance will be addressed, which will provide the student with in depth knowledge of this sector"*

The program's teaching staff includes professionals from sector who contribute their work experience to this training program, as well as renowned specialists from leading societies and prestigious universities.

The multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide an immersive training program designed to train in real situations.

This program is designed around Problem Based Learning, whereby the professional must try to solve the different professional practice situations that arise during the academic year. For this purpose, the professional will be assisted by an innovative interactive video system created by renowned and experienced experts.

*Don't miss this great academic opportunity. It's the most complete on the market.*

*As it is an online program, you can study wherever and whenever you want. You will only need an electronic device with internet access.*



# 02

# Objectives

The Professional Master's Degree in Highway Construction, Maintenance and Operation is aimed at providing students with the in depth skills necessary to undertake various functions related to the management and design of projects in the area of highways. To this end, we offer a comprehensive syllabus with quality content and highly qualified management that will seek to help the professional achieve all their objectives, therefore, improving not only their qualifications, but also their rank in the sector.







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*Your goals and TECH's goals materialize and become one with this program"*



## General Objectives

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- ♦ Master the different life phases of a highway, and the associated contracts and administrative procedures
- ♦ Develop detailed knowledge of how a company is managed and the most important management systems
- ♦ Analyze the different phases in the construction of a highway and the different types of bituminous mixes
- ♦ Detailed knowledge of the factors that affect the safety and comfort of the road, the parameters that measure it and the possible actions for its correction
- ♦ Gain an in depth understanding of the different tunnel construction methods, the most frequent pathologies, and how to establish a maintenance plan
- ♦ Analyze the singularities of each type of structure, and how to optimize its inspection and maintenance
- ♦ Gain in depth knowledge of the different electromechanical and traffic installations in tunnels, their function, operation and the importance of preventive and corrective maintenance
- ♦ Analyze the assets that comprise a road, what factors should be taken into account in inspections, and what are the actions associated with each one of them
- ♦ Accurately understand the life cycle of the road and associated assets
- ♦ In-depth breakdown of the factors that affect occupational risk prevention
- ♦ Understand how a predictive traffic model is performed and its applications
- ♦ Mastering the fundamental factors that affect Road Safety
- ♦ Understand precisely how winter maintenance is organized and managed
- ♦ Analyze the operation of a Tunnel Control Center and how the different incidents are managed
- ♦ Know in detail the structure of the Operation Manual and the actors involved in tunnel operation
- ♦ Break down the conditions for defining the minimum conditions under which a tunnel can be operated, and how to establish the associated methodology for fault resolution
- ♦ In-depth understanding of BIM methodology and how to apply it to each phase: design, construction and maintenance and operation
- ♦ Make a comprehensive analysis of the most current trends in terms of society, environment and technology: connected vehicle, autonomous vehicle, Smart Roads
- ♦ Have a firm grasp on the possibilities that some technologies are offering. In this way, combined with the student's experience, it can be the perfect alliance when designing the actual application or improving existing processes



*Broaden your professional horizons  
by studying this Professional Master's  
Degree that TECH puts at your disposal"*



## Specific Objectives

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### Module 1. Contract and Business Management

- ◆ Analyze the different management systems used for the management of the different assets: pavements, structures, electrical and traffic installations and other elements of the road and the most relevant indicators
- ◆ Develop a deeper understanding of the contractual structure related to roads
- ◆ Develop business management concepts
- ◆ Discover the guidelines that will enable entrepreneurship in the sector
- ◆ Establish how to achieve more sustainable policies by minimizing the resources used and taking advantage of new technologies

### Module 2. Layout, Grading and Execution of Pavements

- ◆ Acquire in depth knowledge in the design and layout of roads, understanding the importance of the different phases and stages for the realization of the same
- ◆ Acquire the necessary knowledge regarding the different operations related to earth moving. Developing the different existing types, with a practical approach, which allows to know their costs, yields, etc., depending on the different terrains and typology of the works to be executed
- ◆ Know, in detail, from a current and practical point of view, the constituent elements of bituminous pavements
- ◆ Develop, in a comprehensive manner, the different types of existing pavements, with special emphasis on which situations to use each one of them. All this from an objective vision based on experience, without forgetting to strengthen the knowledge from the point of view of the design of each of the different types of pavement
- ◆ Accurately understand the day to day operation of a bituminous mix manufacturing facility. From the dosing and quality marking of the different mixtures, to the study of manufacturing costs and their maintenance



### Module 3. Tunnels and road works

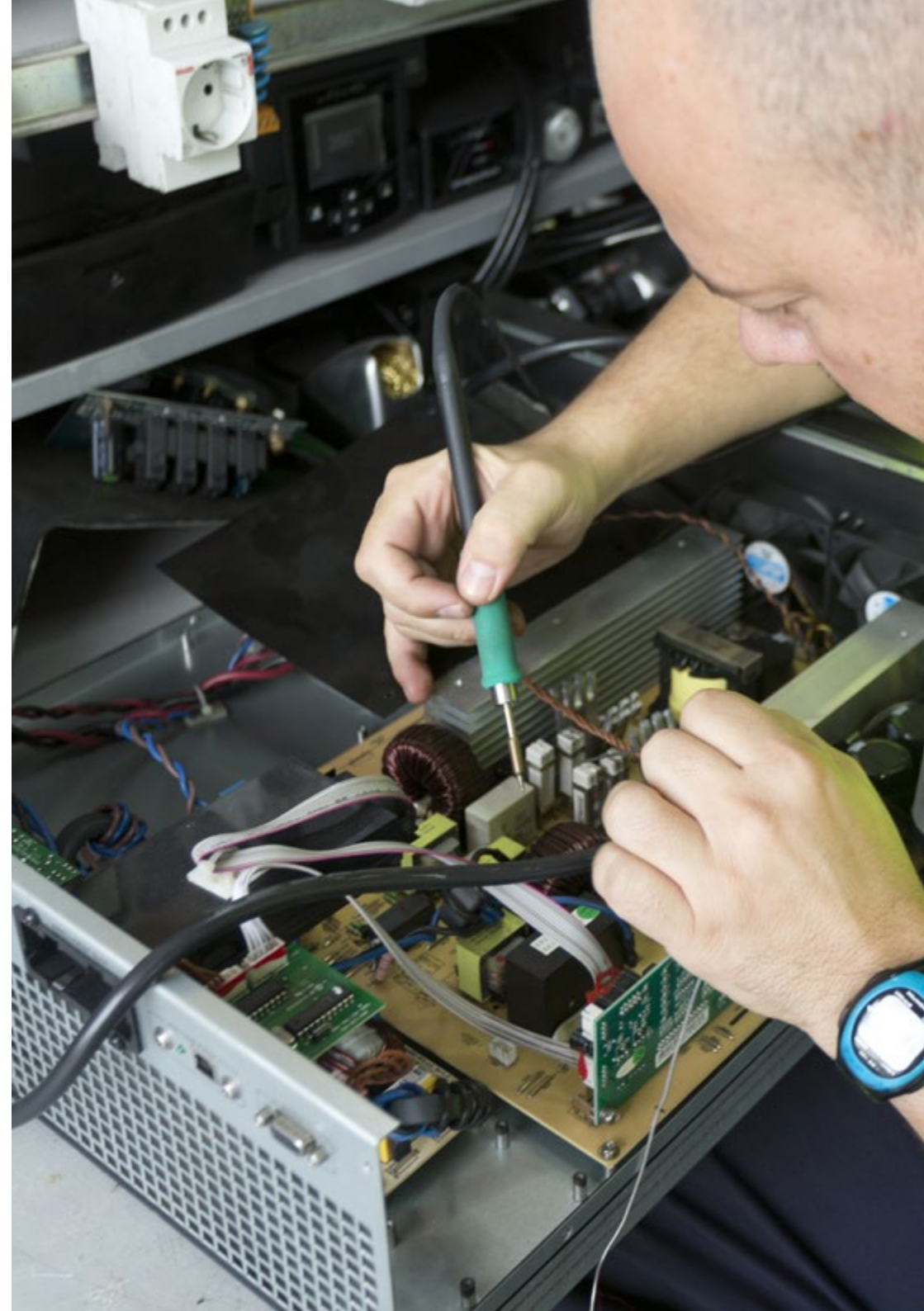
- ◆ Analyze the different tunnel construction systems and identify the most common pathologies depending on the construction system used
- ◆ Master the inspection methods, deepen in data collection through destructive and non-destructive techniques, and know how to perform condition assessment
- ◆ Make a comprehensive analysis of the different types of tunnel structural maintenance: ordinary, extraordinary, renovations, rehabilitations and reinforcements and how each is managed
- ◆ Understand the parameters that accurately measure the safety, comfort, capacity and durability of a pavement
- ◆ In-depth knowledge of pavement monitoring and inspection systems
- ◆ Discuss the actions that can be taken to correct the various parameters of pavements in detail

### Module 4. Structures and masonry

- ◆ Analyze how the life cycle of structures is managed through structure management systems
- ◆ Understand, in detail, the different types of structural inspection, which players are involved, what methods are used and how the severity index is assessed
- ◆ Establish the different types of structural maintenance and how they are managed
- ◆ Gain an in depth understanding of some of the unique maintenance operations

### Module 5. Electro-mechanical installations

- ◆ Analyze the differences between opencast and tunnel lighting systems
- ◆ In depth breakdown of the operation and function of the various installations involved in tunnel operation: power supply, ventilation, pumping stations, PCI systems
- ◆ Perform effective maintenance of the facilities based on a combination of corrective and preventive maintenance, with emphasis on predictive maintenance



**Module 6. Traffic installations**

- ◆ Establish the various systems for detecting incidents in tunnels
- ◆ Know precisely which systems are involved in incident signaling
- ◆ As well as the systems used to communicate with the user in the event of an incident
- ◆ Know in detail how the communication between the Control Center and the field equipment is structured and the elements involved
- ◆ Perform effective maintenance of traffic facilities based on a combination of corrective and preventive maintenance, with emphasis on predictive maintenance

**Module 7. Other highway elements**

- ◆ Gain in-depth knowledge of the existing signaling, beaconing and containment elements on the road, the existing typologies and how their inspection and maintenance is carried out
- ◆ Break down the different enclosure elements and their components, and how they are inspected and maintained
- ◆ Analyze the elements involved in road drainage, and how their inspection and maintenance is carried out
- ◆ Discuss, in detail, the different slope protection systems, and how to check their condition and their maintenance

**Module 8. Operation**

- ◆ Master traffic restrictions and how to manage special transport or sporting events
- ◆ Understand precisely how predictive modeling is performed and how traffic data is exploited
- ◆ Understand what factors influence traffic accidents and how road safety audits contribute to maximizing the safety of systems and elements
- ◆ Analyze some of the most relevant ISO management systems in road maintenance

- ◆ Delve into the structure of the winter maintenance plan, the necessary means and the differences between preventive and corrective treatments
- ◆ Analyze how a tunnel control center works, and how traffic and facility management is carried out
- ◆ Understand the importance of action plans
- ◆ Know in detail the basic document in the operation of a tunnel: The Operational Manual; and the actors involved
- ◆ Understand the need to establish the minimum conditions under which an infrastructure can be operated and how to plan actions in a degraded situation

**Module 9. BIM in highways**

- ◆ Gain insight into the BIM concept and distinguish it from simply deciding which commercial software to use
- ◆ Delve into the different levels of implementation
- ◆ Be prepared to address BIM implementation in both projects and pre existing infrastructure
- ◆ Analyze the technologies that complement the BIM philosophy

**Module 10. The highway of the future**

- ◆ Understand precisely how social equity measures enhance competitiveness
- ◆ Prepare for the change in direction that the roadside professional faces in the immediate future
- ◆ Further study of the changes that new technologies will force on the infrastructure or the vehicle
- ◆ Discover how to lead environmentally responsible policies through detailed knowledge of new trends



# 03 Skills

The structure of this Professional Master's Degree has been designed with the fundamental objective of enabling the professional to understand and master the knowledge, techniques and technologies involved in highway construction and maintenance. To achieve this objective, TECH guarantees students a quality syllabus in accordance with their expectations, giving them the opportunity to stand out in this sector. Therefore, they will be able to perform various functions within the field of highway construction in a solid and effective manner.







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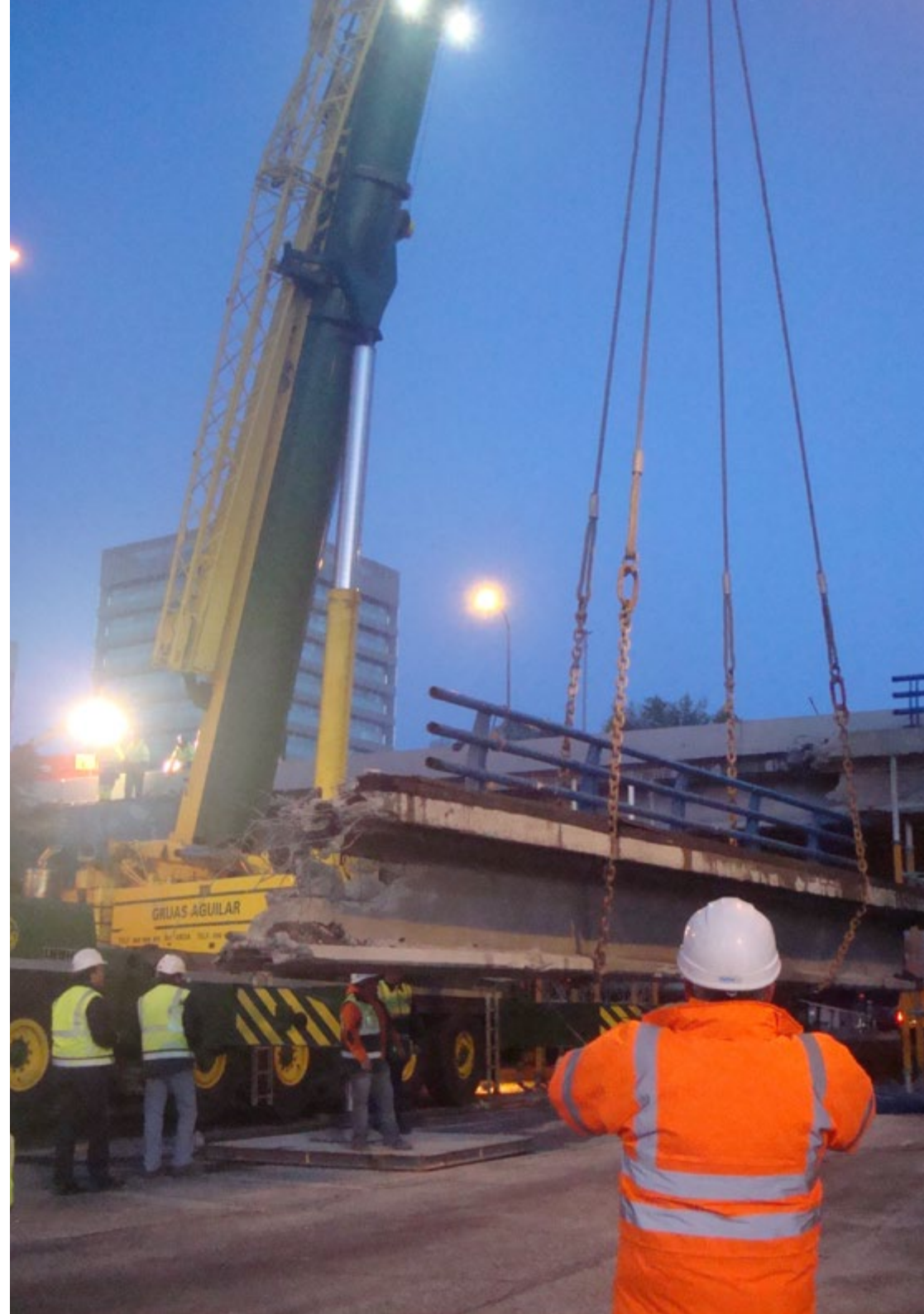
*Welcome to the program that will multiply your professional skills, subtract your weaknesses and add to your experience"*



## General Skills

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- ◆ Master the global environment of highway construction, maintenance and operation, from the international context, markets, to project development, operation and maintenance plans and sectors such as insurance and asset management
- ◆ Apply acquired knowledge and problem solving skills in current or unfamiliar environments within broader contexts related to road construction
- ◆ Be able to integrate knowledge and get a deep insight into the different procedures used in road construction
- ◆ Know how to communicate design, development and management concepts of different engineering systems
- ◆ Understand and internalize the scope of digital and industrial transformation applied to road construction systems for efficiency and competitiveness in today's market
- ◆ Be able to perform critical analysis, evaluation and synthesis of new and complex ideas related to the field of engineering
- ◆ Be able to promote, in professional contexts, technological, social or cultural progress within a knowledge based society





## Specific Skills

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- ◆ Know the management systems used for the management of the different assets: pavements, structures, electrical and traffic installations and other elements of the road and the most relevant indicators
- ◆ Manage the contractual structure related to roads
- ◆ Master the design and layout of roads, understanding the importance of the different phases and stages for their realization
- ◆ Have the necessary knowledge of the different operations related to earthmoving. Developing the different existing types, with a practical approach, which allows to know their costs, yields, etc., depending on the different terrains and typology of the works to be executed
- ◆ Handle, from a current and practical point of view, the constituent elements of bituminous pavements
- ◆ Analyze the different tunnel construction systems and identify the most common pathologies depending on the construction system used
- ◆ Master the inspection methods, deepen in data collection through destructive and non-destructive techniques, and know how to perform condition assessment
- ◆ Understand how the life cycle of structures is managed through structure management systems
- ◆ Understand, in detail, the different types of structural inspection, which players are involved, what methods are used and how the severity index is assessed
- ◆ Understand the differences between opencast and tunnel lighting systems
- ◆ Know how to set up the various systems for detecting incidents in tunnels
- ◆ Know the existing signaling, beaconing and containment elements on the road, the existing typologies and how their inspection and maintenance is carried out
- ◆ Know how to work with the different enclosure elements and their components, and how their inspection and maintenance is carried out
- ◆ Know how to work with traffic restrictions and how to manage special transport or sporting events
- ◆ Master the BIM concept and distinguish it from the mere decision of which commercial software to use
- ◆ Understand precisely how social equity measures enhance competitiveness
- ◆ Know how to adapt to the management process that the road professional will face in the immediate future



*In a competitive world of work, training is the only tool at the service of the professional when it comes to expanding their knowledge"*



# 04

# Course Management

The management and teaching staff that TECH has assembled for this Professional Master's Degree program are renowned professionals who bring their years of experience in this field to this refresher program. In this way, and by acquiring the knowledge of professionals with so much experience, the student will ensure that they will have the guarantees offered by learning from recognized experts when it comes to specializing in a sector that is constantly being updated.





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*Learn from the best and develop the skills you need to perform road design, maintenance and operation tasks"*



## Management



### Mr. Barbero Miguel, Héctor

- ♦ Head of Safety, Operations and Maintenance at Empresa Mantenimiento y Explotación M30, (API Conservación, Dragados-IRIDIUM and Ferroviaal Servicios)
- ♦ Somport Bi-national Tunnel Operations Manager
- ♦ Head of COEX in one of the Areas of the Provincial Council of Bizkaia
- ♦ COEX technician in Salamanca for the maintenance of the roads of the Junta de Castilla y León
- ♦ Civil Engineer, Alfonso X el Sabio University
- ♦ Technical Engineer in Public Works from the University of Salamanca
- ♦ Professional Certificate in Spanish in Digital Transformation by MIT. Partner of EJE&CON
- ♦ He has held various positions in the road maintenance sector under the jurisdiction of the different Administrations

## Professors

### Ms. Suárez Moreno, Sonia

- ♦ Production Manager at Empresa Mantenimiento y Explotación M30, S.A. (API Conservación, Dragados-IRIDIUM and Ferroviaal Servicios)
- ♦ EJE&CON's "Talent without Gender" award for the company's talent development and communication policies
- ♦ Member of the Conservation Committee of the Technical Road Association (ATC)
- ♦ Civil Engineer from the European University of Madrid.
- ♦ Public Works Engineer, Universidad Politécnica de Madrid
- ♦ Senior Technician in Occupational Risk Prevention. Occupational Safety and Ergonomics and Applied Psychosociology

### Mr. Fernández Díaz, Álvaro

- ♦ Area delegate at trabajos Bituminosos SLU
- ♦ Civil Engineering at the E.T.S.I. de Caminos, C. y P. of the Polytechnic University of Madrid
- ♦ Course on occupational risk prevention for managers of construction companies. Taught by the Construction Labor Foundation
- ♦ Motivation, teamwork and leadership course. Delivered by Fluxá Training and Development



**Ms. Hernández Rodríguez, Lara**

- ◆ Specialist in international railway tenders. In the International Contracting Department of OHL Construction, Barcelona
- ◆ Production Manager at Nuevos Accesos Ampliación Sur. Phase 1A. Port of Barcelona
- ◆ Production Manager. Work on the abutments of the Barranco de Pallaresos viaduct on the Madrid-French border high speed railway line
- ◆ Degree in Civil Engineering from the Polytechnic University of Madrid. Madrid
- ◆ Expert in Port and Coastal Engineering from the University of Las Palmas de Gran Canaria

**D. Navascués Rojo, Maximiliano**

- ◆ Works Group Leader at the multinational company DRAGADOS
- ◆ Civil Engineer by the Polytechnic University of Madrid and Master in Tunnels and Underground Works by the Spanish Association of Tunnels and Underground Works
- ◆ Master's Degree in E-business and E-Commerce from the Comillas Pontificia University ICAI-ÍCADE
- ◆ Executive MBA from Business School
- ◆ PMP (Project Management Professional) certificate by the Project Management Institute

**Dr. García García, Antonio**

- ◆ Staff Engineer Network Intelligence & Automation en COMMSCOPE/ARRIS
- ◆ Member of the EMEA Network Intelligence & Automation Solution group within the Professional Services business unit
- ◆ He has developed his professional career in different companies in the communications sector at European level such as ONO, Netgear, Telenet, Telindus or Vodafone
- ◆ Computer Systems Technical Engineer Pontifical University of Salamanca

**D. Ferrán Íñigo, Eduardo**

- ◆ Opening and management of business centers in Madrid, under a franchise system
- ◆ Creation from scratch of a company that installs electric vehicle recharging points Pioneer brand in the market with more than 4 years of life and wide implantation in Madrid and national presence
- ◆ Degree in Business Administration from the University of Salamanca
- ◆ Master's Degree in Business Administration

05

# Structure and Content

The structure of the contents of this program has been designed by a team of professionals in the area of highway engineering who pour their years of experience into this Professional Master's Degree. So, from ten modules that have valuable, unique and innovative information on the design and construction of highways, the student will be able to acquire knowledge, tools and skills to practice in a booming sector with total success.







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*TECH puts the most comprehensive collection of content on the market at your fingertips. You only have to bring your enthusiasm to study”*



## Module 1. Contract and Business Management

- 1.1. Phases in the Life of the Road
  - 1.1.1. Plan
  - 1.1.2. Project
  - 1.1.3. Construction
  - 1.1.4. Conservation
  - 1.1.5. Operation
  - 1.1.6. Financing
- 1.2. Types of Contract
  - 1.2.1. Road Works
  - 1.2.2. Services
  - 1.2.3. Grants
- 1.3. The Contract
  - 1.3.1. Bidding
  - 1.3.2. Allocation
  - 1.3.3. Contractual Structure
  - 1.3.4. Completion Deadlines
  - 1.3.5. Changes to the Contract
  - 1.3.6. Social Clauses
  - 1.3.7. Progress Clause
- 1.4. Management Systems
  - 1.4.1. Integrated Management System
  - 1.4.2. Other Systems Regulated in ISO Standards
  - 1.4.3. Bridge Management System
  - 1.4.4. Pavement Management System
  - 1.4.5. CMMS
  - 1.4.6. Management Indicators
- 1.5. Relevant Aspects at the Construction Site
  - 1.5.1. Health and Safety
  - 1.5.2. Outsourcing
  - 1.5.3. Environment
  - 1.5.4. Quality Control
- 1.6. Business and Entrepreneurship
  - 1.6.1. Strategy and Strategic Analysis
  - 1.6.2. Corporate Models
  - 1.6.3. Human Resources
  - 1.6.4. Business Models and Marketing
- 1.7. Business Management
  - 1.7.1. Analysis Tools and Models
  - 1.7.2. Certifications and Compliance
  - 1.7.3. Competitive Advantages
  - 1.7.4. Optimization and Digitization
- 1.8. Financial Management
  - 1.8.1. Risk Analysis
  - 1.8.2. Private Works, Negotiation and Bidding
  - 1.8.3. Cost Analytics
- 1.9. Internationalization of the Sector
  - 1.9.1. Main Markets
  - 1.9.2. Contracting Models
  - 1.9.3. How to Be Competitive Abroad
- 1.10. Technology at the Service of Sustainability
  - 1.10.1. Access to Databases
  - 1.10.2. The Use of Artificial Intelligence Techniques
  - 1.10.3. Drones on the Road

## Module 2. Layout, Grading and Execution of Pavements

- 2.1. Road Planning and Design
  - 2.1.1. Development and Evolution of Materials
  - 2.1.2. Preliminary Study and Preliminary Design
  - 2.1.3. The Project
- 2.2. The Layout
  - 2.2.1. Plan Layout
  - 2.2.2. Elevation Plotting
  - 2.2.3. Cross Section
  - 2.2.4. Drainages
- 2.3. Earth Moving, Excavation and Blasting
  - 2.3.1. Earthwork
  - 2.3.2. Excavations
  - 2.3.3. Ripping and Blasting
  - 2.3.4. Singular Actions
- 2.4. Pavement Sizing
  - 2.4.1. Esplanade
  - 2.4.2. Road Surface Sections
  - 2.4.3. Analytical Calculation
- 2.5. Constituent Elements of Bituminous Pavements
  - 2.5.1. Aggregates
  - 2.5.2. Bitumens and Binders
  - 2.5.3. Filler
  - 2.5.4. Additives
- 2.6. Hot Mix Asphalt
  - 2.6.1. Conventional Bituminous Mixes
  - 2.6.2. Discontinuous Bituminous Mixtures
  - 2.6.3. Bituminous Mixes type SMA
- 2.7. Management of an Asphalt Plant
  - 2.7.1. Plant Organization
  - 2.7.2. Dosing of Mixtures: Working Formulas
  - 2.7.3. Quality Control: CE Marking
  - 2.7.4. Site maintenance

- 2.8. Cold Asphalt Mixtures
  - 2.8.1. Bituminous Slurries
  - 2.8.2. Gravel Irrigation
  - 2.8.3. Cold Agglomerate
  - 2.8.4. Complementary Techniques: Crack Sealing, etc.
- 2.9. Rigid Sidewalks
  - 2.9.1. Design
  - 2.9.2. On site Installation
  - 2.9.3. Maintenance of Rigid Pavements
- 2.10. On site Installation
  - 2.10.1. Transportation and Paving
  - 2.10.2. Compaction
  - 2.10.3. Good Practices

## Module 3. Tunnels and road works

- 3.1. Recycling and In Situ Stabilization of Pavements with Cement and/or Lime
  - 3.1.1. Stabilized in Situ with lime
  - 3.1.2. Stabilized in Situ with Cement
  - 3.1.3. In situ Recycling of Concrete Pavements
- 3.2. Recycling of Bituminous Mixtures
  - 3.2.1. Recycling Machinery
  - 3.2.2. In situ Cold Recycling with Bituminous Emulsion Coatings
  - 3.2.3. Recycling at Plant (RAP)
- 3.3. Pavement Monitoring
  - 3.3.1. Deterioration Assessment
  - 3.3.2. Surface Regularity
  - 3.3.3. Pavement Adhesion
  - 3.3.4. Deflections
- 3.4. Maintenance Operations on Pavements
  - 3.4.1. Repair of Damage
  - 3.4.2. Surface Rejuvenation and Renewal of the Wearing Course
  - 3.4.3. CRT Correction
  - 3.4.4. IRI Correction
  - 3.4.5. Pavement Rehabilitation

- 3.5. Singular Actions
  - 3.5.1. Asphalt Operation in Urban Areas
  - 3.5.2. Actions on High Capacity Roads
  - 3.5.3. Use of Geogrids and/or Geocomposites
- 3.6. Tunnels. Regulations
  - 3.6.1. International
- 3.7. Tunnel Typology
  - 3.7.1. Open Air
  - 3.7.2. In Mine
  - 3.7.3. With Tunnel Boring Machine
- 3.8. General Characteristics of the Tunnel
  - 3.8.1. Excavation and Support
  - 3.8.2. Waterproofing and Coating
  - 3.8.3. Tunnel Drainage
  - 3.8.4. International Singularities
- 3.9. Tunnel Inventory and Inspection
  - 3.9.1. Inventory
  - 3.9.2. Laser Scanners
  - 3.9.3. Thermography
  - 3.9.4. Geo Radar
  - 3.9.5. Passive Seismic
  - 3.9.6. Refraction Seismic
  - 3.9.7. Pits
  - 3.9.8. Drilling and Coring
  - 3.9.9. Coating Coring
  - 3.9.10. Condition Assessment
- 3.10. Tunnel Maintenance
  - 3.10.1. Ordinary Maintenance
  - 3.10.2. Extraordinary Maintenance
  - 3.10.3. Renovation Operations
  - 3.10.4. Rehabilitation
  - 3.10.5. Reinforcements

## Module 4. Structures and masonry

- 4.1. Evolution of Structures
  - 4.1.1. Roman Engineering
  - 4.1.2. Evolution of Materials
  - 4.1.3. Evolution of Structural Design
- 4.2. Passage Works
  - 4.2.1. Pontoon
  - 4.2.2. Bridge
  - 4.2.3. Singular Works for the Preservation of Wildlife
- 4.3. Other Structures
  - 4.3.1. Walls and Retaining Elements
  - 4.3.2. Footbridges
  - 4.3.3. Porticos and Banners
- 4.4. Small Masonry and Drainage Works
  - 4.4.1. Spouts
  - 4.4.2. Culverts
  - 4.4.3. Sewers
  - 4.4.4. Drainage Elements in Structures
- 4.5. Bridge Management System
  - 4.5.1. Inventory
  - 4.5.2. Systematization of Structure Management
  - 4.5.3. Severity Rates
  - 4.5.4. Planning of Actions
- 4.6. Inspection of Structures
  - 4.6.1. Routine Inspections
  - 4.6.2. General Major Inspections
  - 4.6.3. Detailed Major Inspections
  - 4.6.4. Special Inspections





- 4.7. Structural Maintenance
  - 4.7.1. Ordinary Maintenance
  - 4.7.2. Renovation Operations
  - 4.7.3. Rehabilitation
  - 4.7.4. Reinforcements
- 4.8. Singular Maintenance Actions
  - 4.8.1. Expansion Joints
  - 4.8.2. Support
  - 4.8.3. Concrete Walls
  - 4.8.4. Adequacy of Containment Systems
- 4.9. Singular Structures
  - 4.9.1. By Design
  - 4.9.2. For its Light
  - 4.9.3. For its Materials
- 4.10. The Value of Structures
  - 4.10.1. Asset Management
  - 4.10.2. Collapse. Unavailability Costs
  - 4.10.3. Equity Value

## Module 5. Electro mechanical installations

- 5.1. Roadside Facilities
  - 5.1.1. Fundamental Concepts
  - 5.1.2. Open Air
  - 5.1.3. In Tunnel
  - 5.1.4. Predictive Maintenance
- 5.2. Open-air Lighting
  - 5.2.1. Installation
  - 5.2.2. Preventative Maintenance
  - 5.2.3. Corrective Maintenance
- 5.3. Tunnel Lighting
  - 5.3.1. Installation
  - 5.3.2. Preventative Maintenance
  - 5.3.3. Corrective Maintenance

- 5.4. Power Supply
  - 5.4.1. Installation
  - 5.4.2. Preventative Maintenance
  - 5.4.3. Corrective Maintenance
- 5.5. Generator Sets and UPS
  - 5.5.1. Installation
  - 5.5.2. Preventative Maintenance
  - 5.5.3. Corrective Maintenance
- 5.6. Ventilation
  - 5.6.1. Installation
  - 5.6.2. Preventative Maintenance
  - 5.6.3. Corrective Maintenance
- 5.7. Pumping Stations
  - 5.7.1. Installation
  - 5.7.2. Preventative Maintenance
  - 5.7.3. Corrective Maintenance
- 5.8. PCI Systems
  - 5.8.1. Installation
  - 5.8.2. Preventative Maintenance
  - 5.8.3. Corrective Maintenance
- 5.9. Particulate and Gas Filtering Stations
  - 5.9.1. Installation
  - 5.9.2. Preventative Maintenance
  - 5.9.3. Corrective Maintenance
- 5.10. Other Facilities
  - 5.10.1. On the Evacuation Route
  - 5.10.2. Engines
  - 5.10.3. Transformer Station
  - 5.10.4. Corrosion Control

## Module 6. Traffic installations

- 6.1. The Fourth Technician
  - 6.1.1. Description
  - 6.1.2. Documentation
  - 6.1.3. Maintenance
- 6.2. CCT Equipment
  - 6.2.1. Control Software
  - 6.2.2. Application Integration
  - 6.2.3. Decision Support System
- 6.3. ERU/PLC
  - 6.3.1. Installation
  - 6.3.2. Preventative Maintenance
  - 6.3.3. Corrective Maintenance
- 6.4. CCTV/DAI
  - 6.4.1. Installation
  - 6.4.2. Preventative Maintenance
  - 6.4.3. Corrective Maintenance
- 6.5. SOS and Radio Communication Poles
  - 6.5.1. Installation
  - 6.5.2. Preventative Maintenance
  - 6.5.3. Corrective Maintenance
- 6.6. Variable Signage
  - 6.6.1. Installation
  - 6.6.2. Preventative Maintenance
  - 6.6.3. Corrective Maintenance
- 6.7. Access Equipment
  - 6.7.1. Installation
  - 6.7.2. Preventative Maintenance
  - 6.7.3. Corrective Maintenance
- 6.8. Detection of Atmospheric Conditions
  - 6.8.1. Installation
  - 6.8.2. Preventative Maintenance
  - 6.8.3. Corrective Maintenance

- 6.9. Traffic Stations
  - 6.9.1. Installation
  - 6.9.2. Preventative Maintenance
  - 6.9.3. Corrective Maintenance
- 6.10. Other Facilities
  - 6.10.1. Public Address
  - 6.10.2. Thermal Cameras
  - 6.10.3. Fire Detection

## Module 7. Other highway elements

- 7.1. Vertical Signage
  - 7.1.1. Types of Vertical Signage
  - 7.1.2. Inspections
  - 7.1.3. Performance
- 7.2. Horizontal Signage
  - 7.2.1. Types of Road Markings
  - 7.2.2. Auscultation
  - 7.2.3. Performance
- 7.3. Beacons, Traffic Islets and Curbs
  - 7.3.1. Types of Beacons
  - 7.3.2. Inspections
  - 7.3.3. Performance
- 7.4. Containment Systems
  - 7.4.1. Types of Containment Systems
  - 7.4.2. Inspections
  - 7.4.3. Performance
- 7.5. Enclosures
  - 7.5.1. Components
  - 7.5.2. Inventory and Inspection
  - 7.5.3. Maintenance
- 7.6. Drainages
  - 7.6.1. Drainage Elements
  - 7.6.2. Inventory and Inspection
  - 7.6.3. Maintenance

- 7.7. Slopes and Vegetation
  - 7.7.1. Slope Protection Systems
  - 7.7.2. Inventory and Inspection
  - 7.7.3. Maintenance
- 7.8. Level Crossings
  - 7.8.1. Road FFCC
  - 7.8.2. Road Airport
  - 7.8.3. Road Bike Lane
- 7.9. RRLL Prevention
  - 7.9.1. Industry Idiosyncrasy
  - 7.9.2. Good Practices
  - 7.9.3. The Importance of Training
  - 7.9.4. Technology at the Service of Sustainability
- 7.10. The Lifecycle
  - 7.10.1. Construction and Start-Up
  - 7.10.2. Maintenance and Operation
  - 7.10.3. End of Useful Life

## Module 8. Operation

- 8.1. Use and Defence
  - 8.1.1. Road Defence
  - 8.1.2. Road Use
- 8.2. Traffic Studies
  - 8.2.1. Traffic Forecasts for the Project
  - 8.2.2. The Traffic Model Based on The Information
  - 8.2.3. Exploitation of Traffic Data
- 8.3. Road Safety
  - 8.3.1. Skills
  - 8.3.2. Road Safety Agents
  - 8.3.3. The Importance of Training and Information
  - 8.3.4. Road Safety Audit
  - 8.3.5. International Experiences



- 8.4. International Experiences
  - 8.4.1. Asset Management
  - 8.4.2. Road Safety Management Systems
  - 8.4.3. Energy Efficiency
  - 8.4.4. Other Management Systems
- 8.5. Winter Road Maintenance
  - 8.5.1. Winter Road Plan
  - 8.5.2. Machinery
  - 8.5.3. Fluxes
- 8.6. The Control Center
  - 8.6.1. Traffic Management
  - 8.6.2. Facility Management
  - 8.6.3. Incident Response
- 8.7. The Operating Manual
  - 8.7.1. Operating Actors: Administrative Authority, Tunnel Manager, Safety Manager, Operator
  - 8.7.2. Review and Approval
  - 8.7.3. On the Structure of the Operating Manual
- 8.8. Minimum Operating Conditions
  - 8.8.1. Atmospheric
  - 8.8.2. CCTV
  - 8.8.3. Ventilation
  - 8.8.4. PCI
  - 8.8.5. Lighting
  - 8.8.6. Hydrants
  - 8.8.7. Networks
  - 8.8.8. Other Facilities
- 8.9. The Tunnel Operator
  - 8.9.1. Control Center Operator
  - 8.9.2. Maintenance Operator
  - 8.9.3. Incident Response Operator

## Module 9. BIM in highways

- 9.1. Origins of Information
  - 9.1.1. Project Documentation
  - 9.1.2. Network Inventory
  - 9.1.3. CMMS
  - 9.1.4. ITS
- 9.2. BIM at the conceptual level
  - 9.2.1. Applicable Regulations
  - 9.2.2. Description of BIM Methodology
  - 9.2.3. BIM Advantages
- 9.3. Implementation of the BIM Methodology in an In-Service Infrastructure.
  - 9.3.1. Coding Assets
  - 9.3.2. Documentation Coding
  - 9.3.3. Attribute Dictionary
  - 9.3.4. IFCs
- 9.4. The BIM Model in Maintenance and Operation
  - 9.4.1. Integration of the Different Platforms
  - 9.4.2. The Importance of Document Management
  - 9.4.3. Knowledge of the State of the Infrastructure
- 9.5. BIM Experiences in other Infrastructures
  - 9.5.1. BIM in Railroads
  - 9.5.2. BIM in Building
  - 9.5.3. BIM in Industry
- 9.6. Software BIM
  - 9.6.1. Plan
  - 9.6.2. Open BIM
  - 9.6.3. Modeling
- 9.7. BIM Management
  - 9.7.1. ISO 19650
  - 9.7.2. BIM manager
  - 9.7.3. The Role of the BIM

## 9.8. Digital Twin

9.8.1. Description

9.8.2. Operation

9.8.3. Advantages

## 9.9. Other Skills to be Developed by the Roadside Professional

9.9.1. Databases

9.9.2. Python Programming

9.9.3. Big Data

## 9.10. New Technologies

9.10.1. 3D Printing

9.10.2. Virtual Reality, Augmented Reality

9.10.3. Point Cloud

# Module 10. The highway of the future

## 10.1. Social Equity

10.1.1. Remote work Possibilities

## 10.2. Environment

10.2.1. Circular Economy

10.2.2. Energy Autonomy of the Road

10.2.3. Energy Use of the Subsoil

10.2.4. New Projects under Development

## 10.3. Present Continuous

10.3.1. RSC

10.3.2. Administration Liability

10.3.3. The Road in Pandemic

## 10.4. From Passive to Active Information

10.4.1. The Hyperconnected User

10.4.2. Cross Information with Other Modes of Transportation

10.4.3. RRSS

## 10.5. Operation

10.5.1. Variable Speed Management

10.5.2. Pay Per Use

10.5.3. Dynamic Electric Recharging

## 10.6. 5G Networks

10.6.1. Network Description

10.6.2. Network Deployment

10.6.3. Utilities

## 10.7. The Connected Vehicle

10.7.1. Road - Vehicle

10.7.2. Vehicle - Road

10.7.3. Vehicle - Vehicle

## 10.8. Autonomous Vehicle

10.8.1. Fundamental Principles

10.8.2. How Does It Affect the Road?

10.8.3. Services Required

## 10.9. Smart Roads

10.9.1. Solar Roads

10.9.2. Roads that Decarbonize

10.9.3. Road and Solar Energy

10.9.4. Asphalt of the Future

## 10.10. Applications at your Fingertips

10.10.1. Artificial Intelligence: Image Recognition

10.10.2. Drones on the Road: From Surveillance to Inspection

10.10.3. Robotics in the Service of Occupational Safety

06

# Methodology

This training program offers 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"*

## At TECH we use the Case Method

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

“

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



*We are the first online university to combine Harvard Business School case studies with a 100% online learning system based on repetition.*



### A learning method that is different and innovative.

This intensive Engineering program at TECH Technological University prepares you to face all the challenges in this field, both nationally and internationally. We are committed to promoting your personal and professional growth, the best way to strive for success, that is why at TECH Technological University you will use Harvard case studies, with which we have a strategic agreement that allows us, to offer you material from the best university in the world.

“

*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 by 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.

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



## Relearning Methodology

TECH is the first university in the world to combine Harvard University case studies with a 100% online learning system based on repetition, which combines 8 different didactic elements in each lesson.

We enhance Harvard case studies 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 university 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.



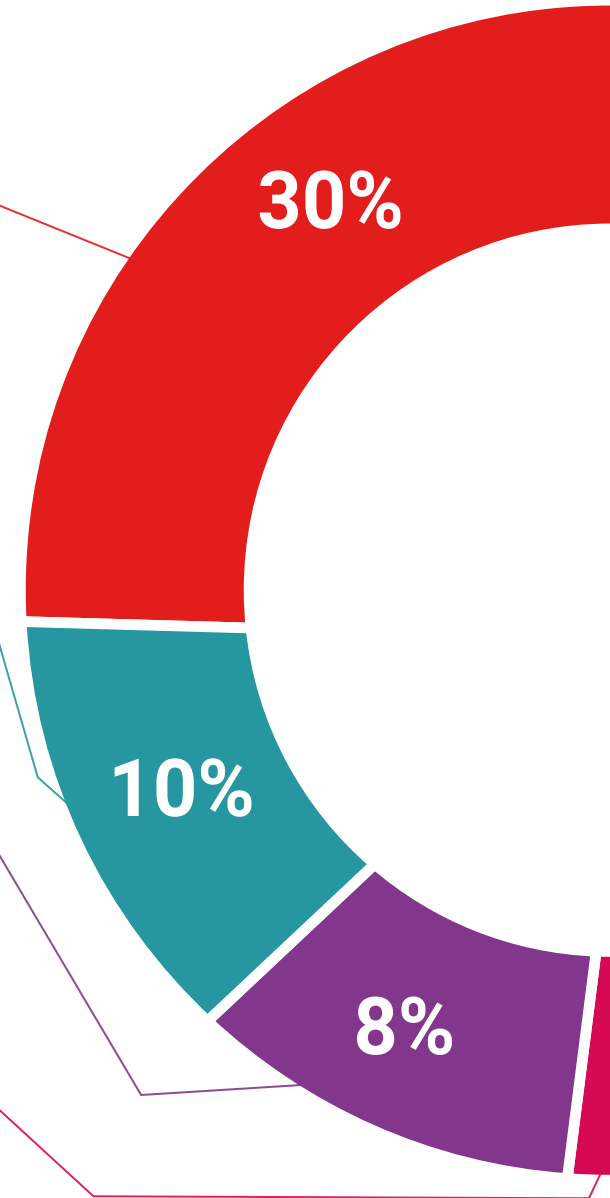
#### Practising Skills and Abilities

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



#### 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**

They will complete a selection of the best case studies in the field used at Harvard. Cases that are presented, analyzed, and supervised by the best senior management 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 multimedia content presentation training Exclusive system 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 your goals.



07

# Certificate

The Professional Master's Degree in Road Construction, Maintenance and Operation 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"*

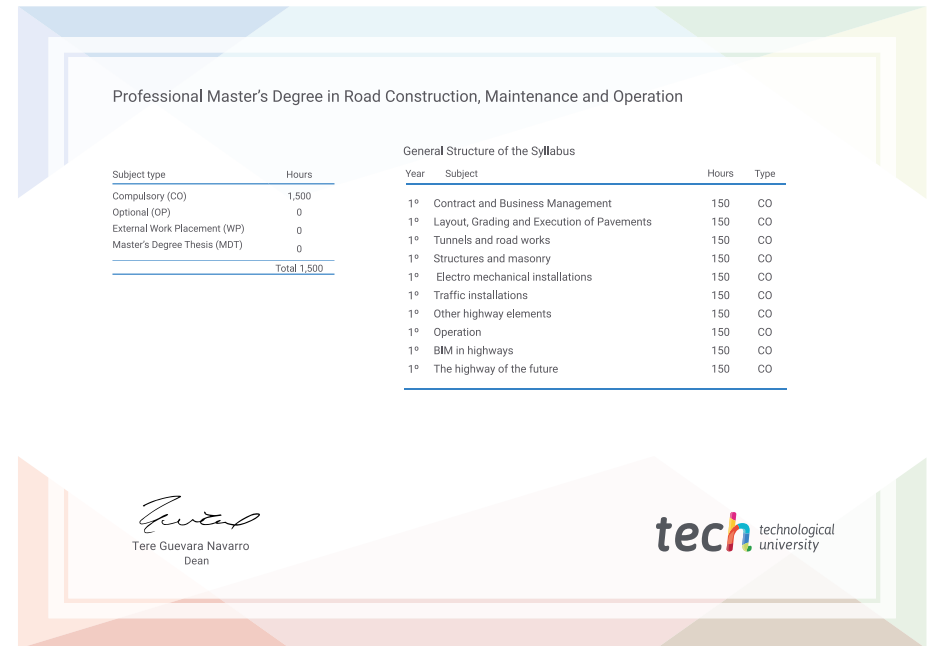


This **Professional Master's Degree in Road Construction, Maintenance and Operation** contains the most complete and up-da-ted program on the market.

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 certificate 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 professional career evaluation committees.

Title: **Professional Master's Degree in Road Construction, Maintenance and Exploitation**  
 Official N° of hours: **1,500 h.**



\*Apostille Convention. In the event that the student wishes to have their paper certificate 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

personalized service innovation

knowledge present quality

online training

development language

virtual classroom

**tech** technological  
university

## Professional Master's Degree

Road Construction,  
Maintenance  
and Operation

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

# Professional Master's Degree

## Road Construction, Maintenance and Operation

