

# Master's Degree

## Road Construction, Maintenance, and Operation

Accreditation/Membership



American Society for  
Engineering Education

A large, semi-transparent diagonal image of a construction site is visible in the background. It shows a yellow excavator with a large bucket digging into a pile of dirt and gravel. In the background, there are concrete structures and a concrete mixer truck. The image is framed by a white border on the left and a grey border on the right.

**tech** global  
university



## Master's Degree

### Road Construction, Maintenance, and Operation

- » Modality: online
- » Duration: 12 months.
- » Certificate: TECH Global University
- » Accreditation: 60 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtitute.com/us/engineering/master/master-road-construction-maintenance-operation](http://www.techtitute.com/us/engineering/master/master-road-construction-maintenance-operation)



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01

# Introduction to the Program

Roads are the backbone of land transport, ensuring the efficient mobility of people and goods in an increasingly interconnected world. Their development has been key to the progress of civilization, and today, with the incorporation of new technologies and sustainable materials, the sector is advancing at an unprecedented pace. According to a report from the Ministry of Transport, Mobility, and Urban Agenda, over 90% of domestic traffic circulates by road, highlighting the growing demand for resilient and efficient infrastructures. Aware of this scenario, TECH has designed this university qualification with a multidisciplinary approach, enabling professionals to specialize with innovative management criteria to lead the transformation of the sector.



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An exhaustive and 100% online program, exclusive to TECH, with an international perspective backed by our affiliation with the American Society for Engineering Education”

## tech 06 | Introduction to the Program

Roads have always been fundamental pillars in the development of societies, facilitating the transport of people and goods and enabling the connection between territories. Today, their importance has been reinforced by the growing demand for resilient, efficient, and sustainable infrastructure. The COVID-19 pandemic once again highlighted their essential role, ensuring supply and mobility during times of crisis.

In response to this reality, TECH presents the Master's Degree in Road Construction, Maintenance, and Operation, a program designed to train engineers and experts in road infrastructure in the use of innovative methodologies and digital tools applied to the sector. The academic itinerary incorporates the latest trends in the use of smart materials, process automation, and BIM modeling for road infrastructure.

Furthermore, the program not only focuses on current infrastructure but also explores the future of roads, analyzing new concepts and technological solutions that will shape the evolution of the sector. All of this is delivered through a 100% online methodology, flexible and compatible with professional activities. With TECH, students will have access to a high-level academic experience, advanced learning resources, and the support of the world's largest digital university.

Thanks to TECH's membership in the **American Society for Engineering Education (ASEE)**, its students gain free access to annual conferences and regional workshops that enrich their engineering education. Additionally, they enjoy online access to specialized publications such as Prism and the Journal of Engineering Education, enhancing their academic development and expanding their professional network on an international scale.

This **Master's Degree in Road Construction, Maintenance, and Operation** contains the most complete and up-to-date university program on the market. Its most notable features are:

- The development of practical cases presented by experts in Road Construction, Maintenance, and Operation.
- 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

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*With TECH, you will specialize in an efficiency model for Road Construction and Operation, optimizing every kilometer developed.*

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*You will master digital tools applied to road management, enabling you to optimize road planning and maintenance.*

*You will gain a deep understanding of the regulations and standards in road infrastructure, enabling you to apply technical and legal criteria to each project.*

*TECH's distinctive Relearning system will allow you to update your knowledge in Road Engineering at your own pace, without relying on external constraints.*

The teaching staff includes professionals from the field of Road Construction, Maintenance, and Operation, who bring their work experience to this program, alongside recognized specialists from leading companies 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 learning experience designed to prepare for real-life situations.

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



02

# Why Study at TECH?

TECH is the world's largest online university. With an impressive catalog of more than 14,000 university programs, available in 11 languages, it is positioned as a leader in employability, with a 99% job placement rate. In addition, it has a huge faculty of more than 6,000 professors of the highest international prestige.

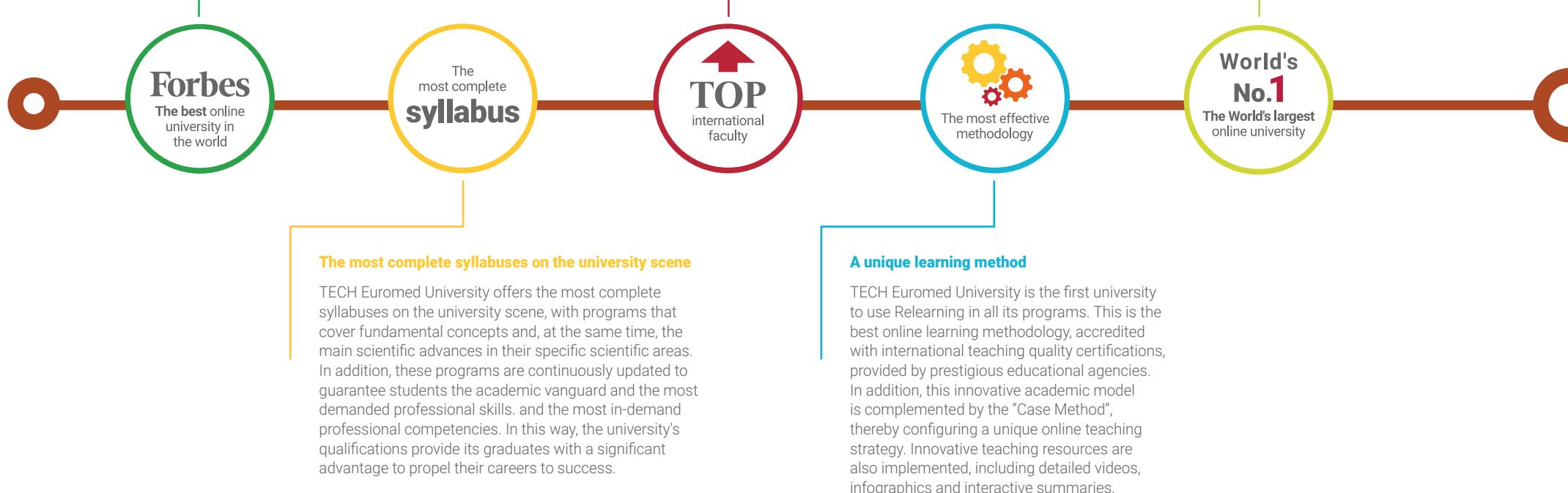


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*Study at the largest online university in  
the world and ensure your professional  
success. The future begins at TECH”*

**The world's best online university, according to FORBES**

The prestigious Forbes magazine, specialized in business and finance, has highlighted TECH Euromed University as "the best online university in the world". This is what they have recently stated in an article in their digital edition in which they echo the success story of this institution, "thanks to the academic offer it provides, the selection of its teaching staff, and an innovative learning method oriented to form the professionals of the future".



#### **The official online university of the NBA**

TECH Euromed University is the official online university of the NBA. Thanks to our agreement with the biggest league in basketball, we offer our students exclusive university programs, as well as a wide variety of educational resources focused on the business of the league and other areas of the sports industry. Each program is made up of a uniquely designed syllabus and features exceptional guest hosts: professionals with a distinguished sports background who will offer their expertise on the most relevant topics.

#### **Leaders in employability**

TECH Euromed University has become the leading university in employability. Ninety-nine percent of its students obtain jobs in the academic field they have studied within one year of completing any of the university's programs. A similar number achieve immediate career enhancement. All this thanks to a study methodology that bases its effectiveness on the acquisition of practical skills, which are absolutely necessary for professional development.



#### **Google Premier Partner**

The American technology giant has awarded TECH Euromed University the Google Premier Partner badge. This award, which is only available to 3% of the world's companies, highlights the efficient, flexible and tailored experience that this university provides to students. The recognition not only accredits the maximum rigor, performance and investment in TECH Euromed University's digital infrastructures, but also places this university as one of the world's leading technology companies.



The Official  
Online University  
of the NBA



#### **The top-rated university by its students**

Students have positioned TECH Euromed University as the world's top-rated university on the main review websites, with a highest rating of 4.9 out of 5, obtained from more than 1,000 reviews. These results consolidate TECH Euromed University as the benchmark university institution at an international level, reflecting the excellence and positive impact of its educational model.



99%  
maximum  
employability  
guaranteed

03

# Syllabus

This program offers a comprehensive journey through Road Construction, Maintenance, and Operation, covering everything from route design to the implementation of innovative technologies. In fact, the professional will develop skills in business management, pavement and structure optimization, as well as acquiring advanced knowledge in tunnels, electromechanical and traffic installations. The program will also explore the potential of BIM modeling in road planning and the trends that will shape the future of roads. Through real-world cases and advanced resources, you will be prepared to lead projects with efficiency, sustainability, and a strategic vision of the road sector.



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*Specialize in every phase of a road's lifecycle, from design to maintenance, ensuring safe and efficient infrastructure"*

**Module 1. Contracting and Business Management**

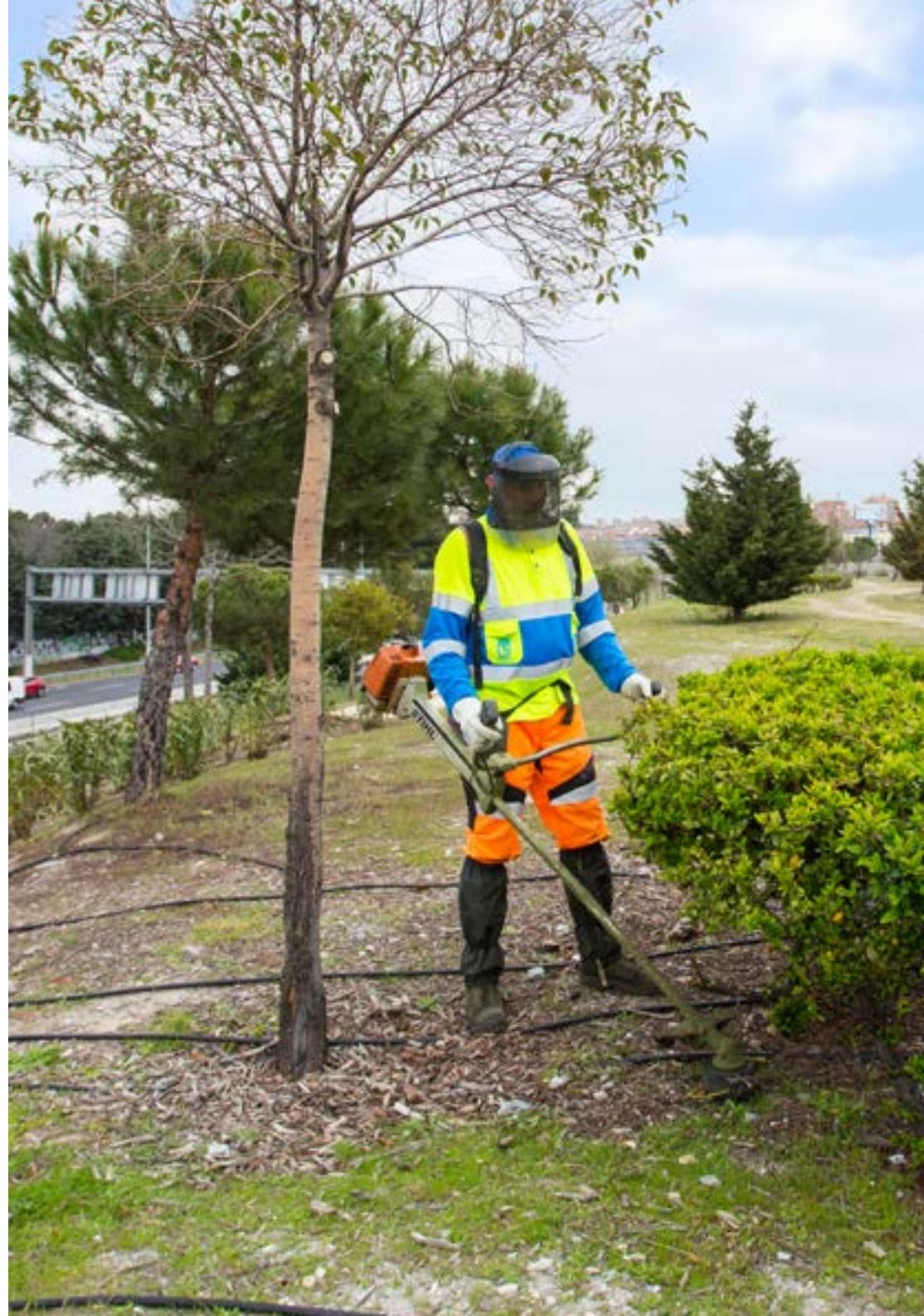
- 1.1. Phases in the Life of the Road
  - 1.1.1. Planning
  - 1.1.2. Project
  - 1.1.3. Construction
  - 1.1.4. Conservation
  - 1.1.5. Operation
  - 1.1.6. Financing
- 1.2. Types of Contract
  - 1.2.1. Works
  - 1.2.2. Services
  - 1.2.3. Concessions
- 1.3. The Contract
  - 1.3.1. Tendering
  - 1.3.2. Awarding
  - 1.3.3. Contractual Structure
  - 1.3.4. Execution Deadlines
  - 1.3.5. Contract Variants
  - 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 by ISO Standards
  - 1.4.3. Bridge Management System
  - 1.4.4. Pavement Management System
  - 1.4.5. CMMS (Computerized Maintenance Management System)
  - 1.4.6. Management Indicators
- 1.5. Relevant Aspects in Construction
  - 1.5.1. Health and Safety
  - 1.5.2. Subcontracting
  - 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. Commercial 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 Digitalization
- 1.8. Economic 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. Key Markets
  - 1.9.2. Contract 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. Alignment, Grading, and Pavement Execution**

- 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. Alignment
  - 2.2.1. Plan Alignment
  - 2.2.2. Elevation Alignment
  - 2.2.3. Cross Section
  - 2.2.4. Drainage

- 2.3. Earthworks, Excavations, and Blasting
    - 2.3.1. Earthworks
    - 2.3.2. Excavations
    - 2.3.3. Ripping and Blasting
    - 2.3.4. Special Operations
  - 2.4. Pavement Dimensioning
    - 2.4.1. Grading
    - 2.4.2. Pavement Sections
    - 2.4.3. Analytical Calculation
  - 2.5. Constituent Elements of Bituminous Pavements
    - 2.5.1. Aggregates
    - 2.5.2. Asphalts and Binders
    - 2.5.3. *Filler*
    - 2.5.4. Additives
  - 2.6. Hot Bituminous Mixes
    - 2.6.1. Conventional Bituminous Mixes
    - 2.6.2. Discontinuous Bituminous Mixtures
    - 2.6.3. SMA Bituminous Mixes
  - 2.7. Management of an Asphalt Plant
    - 2.7.1. Organization of the Plant
    - 2.7.2. Mix Proportions: Working Formulas
    - 2.7.3. Quality Control: CE Marking
    - 2.7.4. Plant Maintenance
  - 2.8. Cold Bituminous Mixes
    - 2.8.1. Bituminous Slurries
    - 2.8.2. Gravel Spreading
    - 2.8.3. Cold Mix Agglomeration
    - 2.8.4. Complementary Techniques: Crack Sealing, etc.
  - 2.9. Rigid Pavements
    - 2.9.1. Design
    - 2.9.2. Implementation
    - 2.9.3. Maintenance of Rigid Pavements
  - 2.10. Implementation
    - 2.10.1. Transport and Spreading
    - 2.10.2. Compaction
    - 2.10.3. Best Practices
- Module 3. Tunnels and Pavement Operations**
- 3.1. In-situ Recycling and Stabilization of Pavements with Cement and/or Lime
    - 3.1.1. In-situ Stabilization with Lime
    - 3.1.2. In-situ Stabilization with Cement
    - 3.1.3. In-situ Recycling of Pavements with Cement
  - 3.2. Recycling of Bituminous Mixes
    - 3.2.1. Recycling Machinery
    - 3.2.2. Cold In-situ Recycling with Bituminous Emulsion
    - 3.2.3. Recycling at Plant (RAP)
  - 3.3. Pavement Condition Surveys
    - 3.3.1. Deterioration Assessment
    - 3.3.2. Surface Regularity
    - 3.3.3. Pavement Adhesion
    - 3.3.4. Deflections
  - 3.4. Pavement Maintenance Operations
    - 3.4.1. Deterioration Repair
    - 3.4.2. Surface Rejuvenation and Resurfacing
    - 3.4.3. CRT Correction
    - 3.4.4. IRI Correction
    - 3.4.5. Pavement Rehabilitation
  - 3.5. Special Operations
    - 3.5.1. Asphalt Operation in Urban Areas
    - 3.5.2. Operations on High-Capacity Roads
    - 3.5.3. Use of Geogrids and/or Geocomposites
  - 3.6. Tunnels. Regulations
    - 3.6.1. International Regulations

- 3.7. Types of Tunnels
  - 3.7.1. Open-Cut Tunnels
  - 3.7.2. Mining Tunnels
  - 3.7.3. With Tunnel Boring Machine
- 3.8. General Tunnel Characteristics
  - 3.8.1. Excavation and Support
  - 3.8.2. Waterproofing and Lining
  - 3.8.3. Tunnel Drainage
  - 3.8.4. International Specificities
- 3.9. Tunnel Inventory and Inspection
  - 3.9.1. Inventory
  - 3.9.2. Laser Scanning Equipment
  - 3.9.3. Thermography
  - 3.9.4. Ground Penetrating Radar
  - 3.9.5. Passive Seismics
  - 3.9.6. Refraction Seismics
  - 3.9.7. Test Pits
  - 3.9.8. Core Sampling
  - 3.9.9. Lining Core Sampling
  - 3.9.10. Condition Assessment
- 3.10. Tunnel Maintenance
  - 3.10.1. Routine Maintenance
  - 3.10.2. Extraordinary Maintenance
  - 3.10.3. Renovation Operations
  - 3.10.4. Rehabilitation
  - 3.10.5. Reinforcement



## Module 4. Structures and Masonry Works

- 4.1. Evolution of Structures
  - 4.1.1. Roman Engineering
  - 4.1.2. Evolution of Materials
  - 4.1.3. Structural Calculation Evolution
- 4.2. Crossings
  - 4.2.1. Pontoon
  - 4.2.2. Bridge
  - 4.2.3. Special Structures for Wildlife Preservation
- 4.3. Other Structures
  - 4.3.1. Walls and Retaining Elements
  - 4.3.2. Walkways
  - 4.3.3. Arches and Signposts
- 4.4. Small Masonry Works and Drainage
  - 4.4.1. Pipes
  - 4.4.2. Culverts
  - 4.4.3. Sewer Systems
  - 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 Indexes
  - 4.5.4. Action Planning
- 4.6. Structure Inspections
  - 4.6.1. Routine Inspections
  - 4.6.2. Main General Inspections
  - 4.6.3. Main Detailed Inspections
  - 4.6.4. Special Inspections
- 4.7. Structure Maintenance
  - 4.7.1. Routine Maintenance
  - 4.7.2. Renovation Operations
  - 4.7.3. Rehabilitation
  - 4.7.4. Reinforcement

## 4.8. Special Maintenance Operations

- 4.8.1. Expansion Joints
- 4.8.2. Supports
- 4.8.3. Concrete Facades
- 4.8.4. Containment System Adjustment

## 4.9. Special Structures

- 4.9.1. By Design
- 4.9.2. By Span
- 4.9.3. By Materials

## 4.10. The Value of Structures

- 4.10.1. Asset Management
- 4.10.2. Collapse. Downtime Costs
- 4.10.3. Heritage Value

## Module 5. Electromechanical Installations

- 5.1. Installations on Roads
  - 5.1.1. Fundamental Concepts
  - 5.1.2. Open-Cut Tunnels
  - 5.1.3. In Tunnels
  - 5.1.4. Predictive Maintenance
- 5.2. Outdoor 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. Electric Power Supply
  - 5.4.1. Installation
  - 5.4.2. Preventative Maintenance
  - 5.4.3. Corrective Maintenance

- 5.5. Generators 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. Fire Protection Systems
  - 5.8.1. Installation
  - 5.8.2. Preventative Maintenance
  - 5.8.3. Corrective Maintenance
- 5.9. Particulate and Gas Filtration Stations
  - 5.9.1. Installation
  - 5.9.2. Preventative Maintenance
  - 5.9.3. Corrective Maintenance
- 5.10. Other Installations
  - 5.10.1. Evacuation Route
  - 5.10.2. Motors
  - 5.10.3. Transformation Centers
  - 5.10.4. Ventilation Control

## Module 6. Traffic Installations

- 6.1. The Technical Room
  - 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 Posts and Radio Communications
  - 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. Weather Condition Detection
  - 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 Installations
  - 6.10.1. Public Address System
  - 6.10.2. Thermal Cameras
  - 6.10.3. Fire Detection

## Module 7. Other Road Elements

- 7.1. Vertical Signage
  - 7.1.1. Types of Vertical Signage
  - 7.1.2. Inspections
  - 7.1.3. Operations
- 7.2. Horizontal Signage
  - 7.2.1. Types of Road Markings
  - 7.2.2. Surveys
  - 7.2.3. Operations
- 7.3. Guardrails, Islands, and Curbs
  - 7.3.1. Types of Guardrails
  - 7.3.2. Inspections
  - 7.3.3. Operations
- 7.4. Containment Systems
  - 7.4.1. Types of Containment Systems
  - 7.4.2. Inspections
  - 7.4.3. Operations
- 7.5. Fencing
  - 7.5.1. Components
  - 7.5.2. Inventory and Inspection
  - 7.5.3. Maintenance
- 7.6. Drainage
  - 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-Rail
  - 7.8.2. Road- Airport
  - 7.8.3. Road-Bicycle Lane
- 7.9. Workplace Risk Prevention
  - 7.9.1. Sector Specifics
  - 7.9.2. Best Practices
  - 7.9.3. The Importance of Training
  - 7.9.4. Technology in Occupational Safety
- 7.10. Life Cycle
  - 7.10.1. Construction and Implementation
  - 7.10.2. Maintenance and Operation
  - 7.10.3. End of Service Life

## Module 8. Operation

- 8.1. Use and Defense
  - 8.1.1. Road Defense
  - 8.1.2. Road Use
- 8.2. Traffic Studies
  - 8.2.1. Traffic Forecasting for the Project
  - 8.2.2. Traffic Model Based on Information
  - 8.2.3. Traffic Data Analysis
- 8.3. Road Safety
  - 8.3.1. Competencies
  - 8.3.2. Road Safety Agents
  - 8.3.3. The Importance of Training and Information
  - 8.3.4. Road Safety Audits
  - 8.3.5. International Experiences

- 8.4. ISO Management Systems
  - 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. The Control Center
  - 8.5.1. Traffic Management
  - 8.5.2. Facility Management
  - 8.5.3. Incident Response
- 8.6. Operation Manual
  - 8.6.1. Operating Actors: Administrative Authority, Tunnel Manager, Safety Officer, Operator
  - 8.6.2. Review and Approval
  - 8.6.3. Operation Manual Structure
- 8.7. Minimum Operation Conditions
  - 8.7.1. Atmospheric Conditions
  - 8.7.2. CCTV
  - 8.7.3. Ventilation
  - 8.7.4. Fire Protection System
  - 8.7.5. Lighting
  - 8.7.6. Hydrants
  - 8.7.7. High Voltage
  - 8.7.8. Other Installations
- 8.8. Tunnel Operator
  - 8.8.1. Control Center Operator
  - 8.8.2. Maintenance Operator
  - 8.8.3. Incident Response Operator
- 9.2. BIM at a Conceptual Level
  - 9.2.1. Applicable Regulations
  - 9.2.2. BIM Methodology Description
  - 9.2.3. BIM Advantages
- 9.3. BIM Methodology Implementation in an Operational Infrastructure
  - 9.3.1. Asset Coding
  - 9.3.2. Documentation Coding
  - 9.3.3. Attribute Dictionary
  - 9.3.4. IFC Files
- 9.4. BIM Model in Maintenance and Operation
  - 9.4.1. Platform Integration
  - 9.4.2. Importance of Document Management
  - 9.4.3. Infrastructure Condition Knowledge
- 9.5. BIM Experiences in Other Infrastructures
  - 9.5.1. BIM in Railways
  - 9.5.2. BIM in Building Construction
  - 9.5.3. BIM in Industry
- 9.6. BIM Software
  - 9.6.1. Planning
  - 9.6.2. Open BIM
  - 9.6.3. 3D Modeling
- 9.7. BIM Management
  - 9.7.1. ISO 19650
  - 9.7.2. BIM Manager
  - 9.7.3. BIM Roles
- 9.8. Digital Twin
  - 9.8.1. Description
  - 9.8.2. Functioning
  - 9.8.3. Advantages
- 9.9. Other Skills to be Developed by Road Professionals
  - 9.9.1. Databases
  - 9.9.2. Python Programming
  - 9.9.3. Big Data

## Module 9. BIM in Roads

- 9.1. Information Origins
  - 9.1.1. Project Documentation
  - 9.1.2. Network Inventory
  - 9.1.3. CMMS
  - 9.1.4. ITS
- 9.9. Other Skills to be Developed by Road Professionals
  - 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 Road of the Future

- 10.1. Social Equity
  - 10.1.1. Remote Work Possibilities
- 10.2. Environment
  - 10.2.1. Circular Economy
  - 10.2.2. Road's Energy Autonomy
  - 10.2.3. Energy Use of the Subsoil
  - 10.2.4. New Projects Under Development
- 10.3. Continuous Present
  - 10.3.1. CSR
  - 10.3.2. Administrator Liability
  - 10.3.3. The Road During the Pandemic
- 10.4. From Passive Information to Active Information
  - 10.4.1. The Hyperconnected User
  - 10.4.2. Cross-Information with Other Transport Modes
  - 10.4.3. Social Media
- 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. 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 It Affects the Road
  - 10.8.3. Services Required
- 10.9. Smart Roads
  - 10.9.1. Solar Roads
  - 10.9.2. Decarbonizing Roads
  - 10.9.3. Road and Solar Energy
  - 10.9.4. Future Asphalt
- 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 for Occupational Safety

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*You will apply BIM methodology in the planning and execution of road infrastructure, driving the sector's digitalization”*

04

# Teaching Objectives

This high-level university program aims to specialize professionals in Road Construction, Maintenance, and Operation, providing them with comprehensive knowledge of each phase in the lifecycle of these infrastructures. Throughout the academic experience, graduates will acquire advanced skills in planning and executing road projects, optimizing resources, and applying innovative technologies such as BIM. Additionally, they will develop competencies in contract management, road safety, and sustainability, enabling them to lead digital transformation processes in the sector.



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*You will explore emerging trends in road design and management with a strategic vision”*



## General Objectives

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- Analyze the fundamental principles of business and contract management in road projects
- Design and execute efficient road alignments, considering geotechnical and safety factors
- Apply advanced techniques in the construction and maintenance of pavements and tunnels
- Implement innovative solutions in structures and masonry works to enhance the durability of roads
- Integrate electromechanical installations in road infrastructure to improve operability and safety
- Optimize signage and traffic installations with strategies for efficient mobility
- Incorporate complementary elements into roads to improve their functionality and accessibility
- Manage road operation with a technical and strategic approach to maximize performance





## Specific Objectives

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### Module 1. Contracting and Business Management

- ◆ Analyze the fundamental aspects of contract management in road projects, ensuring regulatory compliance and resource optimization
- ◆ Develop planning and control strategies for the execution of road infrastructure, applying principles of efficiency and sustainability

### Module 2. Alignment, Grading, and Pavement Execution

- ◆ Design and evaluate road alignments considering technical, environmental, and road safety criteria
- ◆ Apply advanced techniques in grading and paving to improve the durability and resistance of roads

### Module 3. Tunnels and Pavement Operations

- ◆ Identify methodologies for Tunnel Construction and Maintenance, considering structural and ventilation factors
- ◆ Evaluate pavement rehabilitation procedures to optimize performance and extend service life

### Module 4. Structures and Masonry Works

- ◆ Apply design and construction principles for bridges, viaducts, and other essential road structures
- ◆ Develop innovative solutions to improve the stability and safety of masonry works on roads

**Module 5. Electromechanical Installations**

- Integrate electromechanical technologies in road infrastructure to enhance operability and energy efficiency
- Evaluate lighting, ventilation, and electrical supply systems in tunnels and roads to optimize their functionality

**Module 6. Traffic Installations**

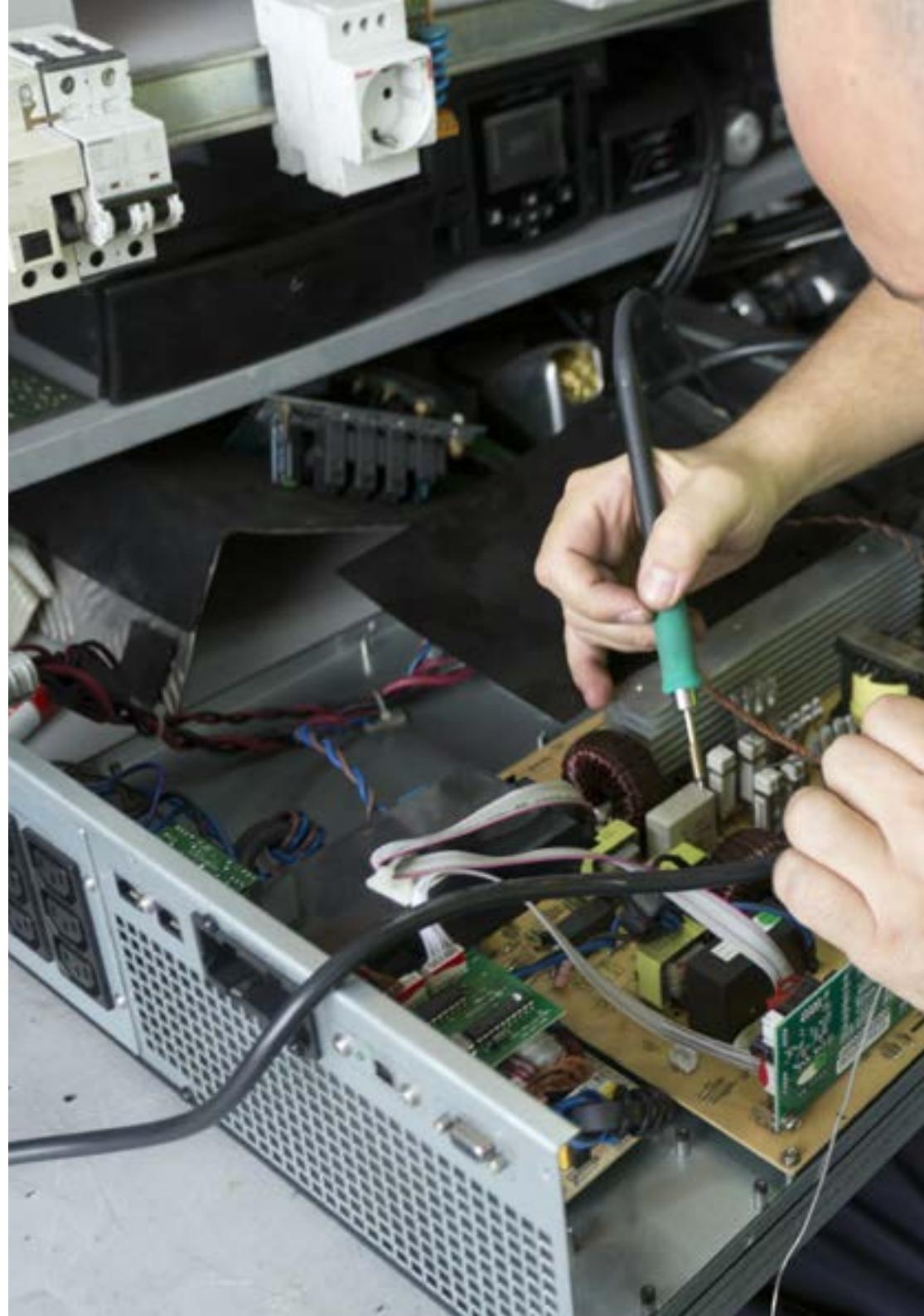
- Design traffic signage and control systems to improve safety and traffic flow
- Implement smart solutions in traffic management, incorporating connected mobility technologies

**Module 7. Other Road Elements**

- Analyze the importance of complementary road elements, such as rest areas and safety devices
- Design strategies for incorporating innovative road equipment to enhance user experience

**Module 8. Operation**

- Evaluate management and maintenance models for roads to ensure operability and safety
- Apply methodologies for resource optimization in the conservation of road infrastructure





#### Module 9. BIM in Roads

- ♦ Implement BIM methodology in the design, execution, and maintenance of road projects
- ♦ Develop digital models of road infrastructure to improve decision-making and project efficiency

#### Module 10. The Road of the Future

- ♦ Explore emerging trends in mobility and sustainability applied to road infrastructure development
- ♦ Design innovative solutions for the digitalization and automation of roads, considering the latest technological advances

“

*Apply innovative solutions in the construction of structures and masonry works to enhance the resilience of roads”*

05

# Career Opportunities

Upon completing this Master's Degree, graduates will be prepared to lead projects in construction companies, public organizations, and road concessionaires. They will be capable of planning and supervising roadworks, applying advanced technologies in paving, structures, and signage. Additionally, they will be trained to manage contracts and optimize road maintenance, ensuring the sustainability and efficiency of roads. Their experience will enable them to integrate into multidisciplinary engineering and consulting teams, developing innovative solutions for future mobility and infrastructure.



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*You will supervise roadworks with the support of advanced technologies in paving and structures, excelling in your work environment and ensuring efficient and sustainable projects”*

#### Graduate Profile

The graduate will be an expert in Road Engineering, with expertise in the design, construction, and maintenance of road infrastructures. They will have advanced skills in alignment, grading, and the application of emerging technologies like BIM. Furthermore, they will be prepared to optimize road safety through the use of signage systems and traffic management. Their analytical skills and decision-making abilities will enable them to lead infrastructure projects, ensuring efficient and sustainable solutions. With a practical and strategic approach, they will be equipped to address the challenges of sector modernization, driving connectivity and territorial development.

*You will lead the development and maintenance of road infrastructure, developing strategic capabilities to face the challenges of road sector modernization*

- **Supervision and maintenance of road infrastructure:** Assess the state of roads and implement conservation and rehabilitation strategies.
- **Application of BIM technologies in Road Engineering:** Effectively use Building Information Modeling to improve the accuracy and efficiency in managing road projects.
- **Management of electromechanical and traffic installations:** Integrate signage, lighting, and traffic control systems into smart roads.
- **Design and evaluation of masonry works:** Design and optimize structures such as bridges, viaducts, and drainage systems in road environments.





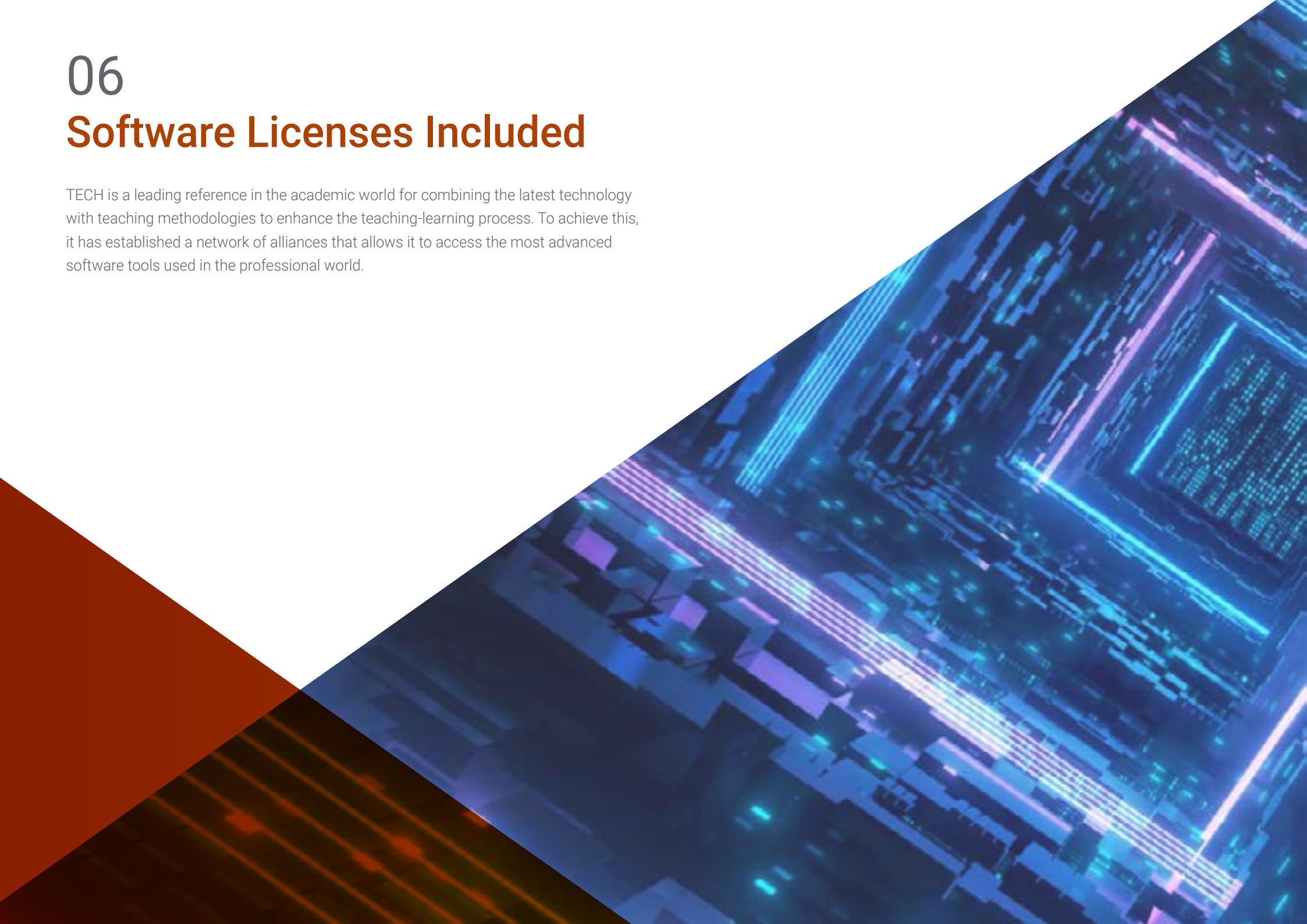
After completing this university program, you will be able to apply your knowledge and skills in the following positions:

- 1. Road Project Manager:** Responsible for the planning, execution, and supervision of road construction and maintenance works, ensuring their efficiency and durability.
- 2. Specialist in Road Infrastructure Design and Alignment:** In charge of the geometric and structural optimization of roads, applying regulations and road safety criteria.
- 3. Road Maintenance and Conservation Engineer:** Manager of strategies for the rehabilitation, strengthening, and maintenance of pavements and road structures.
- 4. Coordinator of Electromechanical Installations in Road Infrastructure:** Supervisor of lighting, signage, and energy systems in roads, ensuring their proper functioning.
- 5. Consultant in Road Operation and Management:** Focused on the planning and operation of road networks, optimizing their sustainability and safety.
- 6. Tunnel and Underground Works Engineer:** Responsible for the design, construction, and maintenance of tunnels to ensure their stability and safety.
- 7. BIM Specialist for Road Infrastructure:** Manager of road projects using Building Information Modeling (BIM).
- 8. Road Safety and Sustainable Mobility Manager:** Responsible for designing strategies to improve traffic flow and reduce risks in road infrastructure.
- 9. Materials and Pavement Engineer for Roads:** In charge of developing and researching new materials for more durable and sustainable pavements.
- 10. Smart Infrastructure and Future Roads Manager:** Leader in the implementation of technology for the digitalization and automation of road networks.

06

## Software Licenses Included

TECH is a leading reference in the academic world for combining the latest technology with teaching methodologies to enhance the teaching-learning process. To achieve this, it has established a network of alliances that allows it to access the most advanced software tools used in the professional world.



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*Upon enrolling, you will receive, completely free of charge, academic credentials for the following professional software applications”*

TECH has established a network of professional alliances with the leading providers of software applied to various professional fields. These alliances allow TECH to access hundreds of software applications and licenses, making them available to its students.

The software licenses for academic use will allow students to utilize the most advanced applications in their professional field, enabling them to become familiar with and master these tools without incurring any costs. TECH will be responsible for managing the licensing process so that students may use them without limitations throughout the entire duration of the Master's Degree in Biomedical Engineering, completely free of charge.

TECH will provide free access to the following software applications:

**Ansys**



### **Ansys**

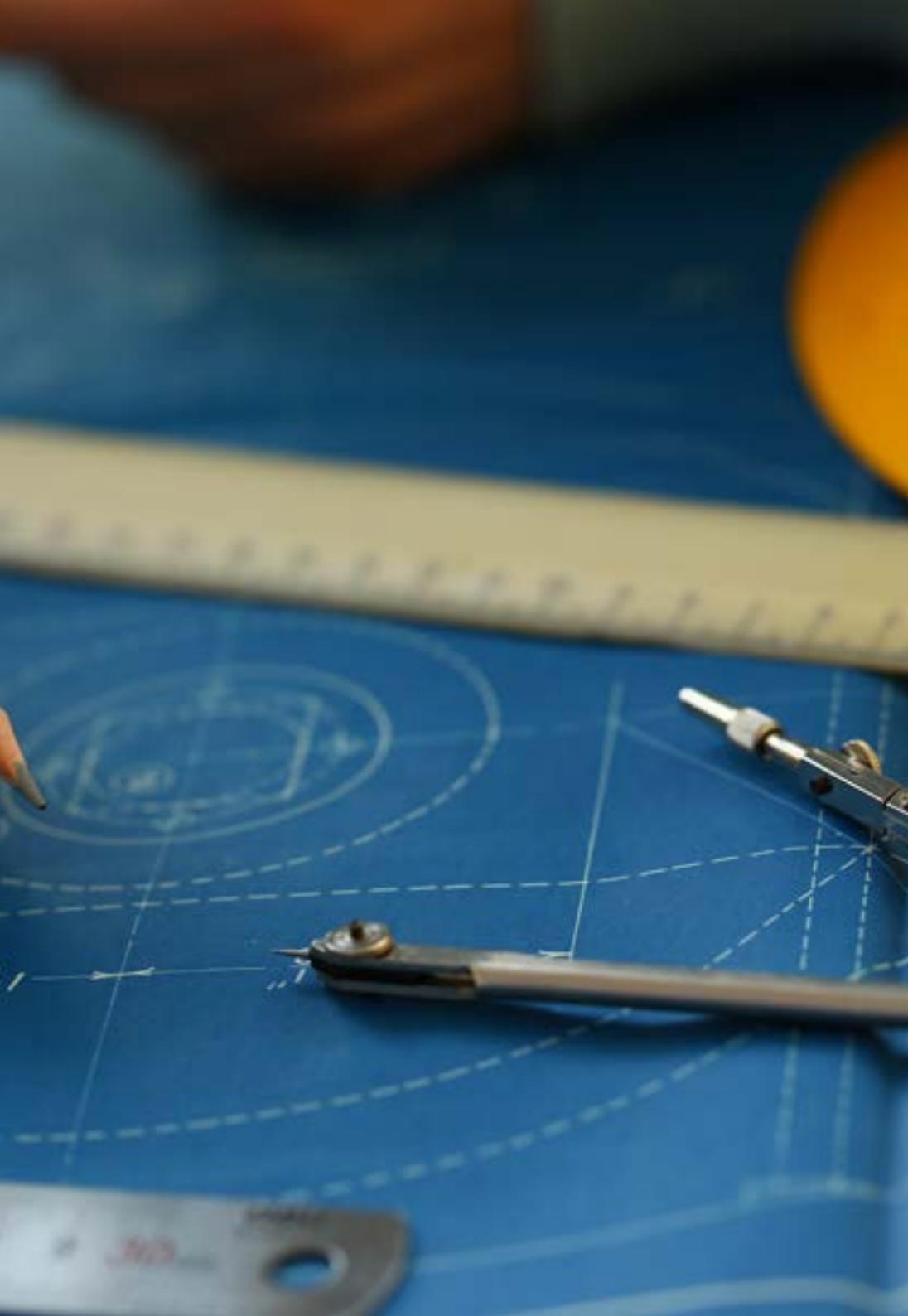
**Ansys** is engineering simulation software that models physical phenomena such as fluids, structures, and electromagnetism. With a commercial value of **26,400 euros**, it is offered **free of charge** during the university program at TECH, providing access to cutting-edge technology for industrial design.

This platform excels in its ability to integrate multiphysics analysis into a single environment. It combines scientific precision with automation through APIs, streamlining the iteration of complex prototypes in industries such as aerospace or energy.

#### **Key Features:**

- ♦ **Integrated multiphysics simulation:** analyze structures, fluids, electromagnetism, and thermals in a single environment
- ♦ **Workbench:** a unified platform to manage simulations, automate processes, and customize workflows with Python
- ♦ **Discovery:** prototype in real-time with simulations accelerated by GPU
- ♦ **Automation:** create macros and scripts with APIs in Python, C++, and JavaScript
- ♦ **High Performance:** solvers optimized for CPU/GPU and cloud scalability on demand

In conclusion, **Ansys** is the ultimate tool to transform ideas into technical solutions, offering power, flexibility, and an unparalleled simulation ecosystem.



### Google Career Launchpad

**Google Career Launchpad** is a solution for developing digital skills in technology and data analysis. With an estimated value of **5,000 dollars**, it is included **for free** in TECH's university program, providing access to interactive labs and certifications recognized in the industry.

This platform combines technical training with practical cases, using technologies such as BigQuery and Google AI. It offers simulated environments to work with real data, along with a network of experts for personalized guidance.

#### Key Features:

- ♦ **Specialized Courses:** Updated content in cloud computing, machine learning, and data analysis
- ♦ **Live Labs:** Hands-on practice with real Google Cloud tools, no additional configuration required
- ♦ **Integrated Certifications:** Preparation for official exams with international validity
- ♦ **Professional Mentoring:** Sessions with Google experts and technology partners
- ♦ **Collaborative Projects:** Challenges based on real-world problems from leading companies

In conclusion, **Google Career Launchpad** connects users with the latest market technologies, facilitating their entry into fields such as artificial intelligence and data science with industry-backed credentials.

07

# Study Methodology

TECH is the first university in the world to combine case study methodology with Relearning, a 100% online learning system based on guided repetition.

This innovative pedagogical strategy has been conceived to offer professionals the opportunity to update knowledge and develop skills in an intensive and rigorous way. A learning model that places the student at the center of the academic process and gives them the leading role, adapting to their needs and leaving aside the more conventional methodologies.



“

TECH prepares you to face new challenges  
in uncertain environments and achieve  
success in your career”

## The student: the priority of all TECH programs

In TECH's study methodology, the student is the absolute protagonist. The pedagogical tools of each program have been selected taking into account the demands of time, availability and academic rigor that, today, not only students demand but also the most competitive positions in the market.

With TECH's asynchronous educational model, it is the student who chooses the time they spend studying, how they decide to establish their routines and all this from the comfort of the electronic device of their choice. The student will not have to attend live classes, which many times they cannot attend. The learning activities will be done when it is convenient for them. You will always be able to decide when and from where to study.

“

*At TECH you will NOT have in person classes  
(which you might not be able to attend)"*



## The most comprehensive academic programs worldwide

TECH is distinguished by offering the most complete academic pathways within the higher education landscape. This level of comprehensiveness is achieved through the development of curricula that not only encompass essential knowledge but also integrate the latest innovations in each area of study.

By being constantly updated, these programs allow students to keep up with market changes and acquire the skills most valued by employers. In this way, those who complete their studies at TECH receive a comprehensive preparation that provides them with a notable competitive advantage to advance in their careers.

And what's more, they will be able to do so from any device, PC, tablet or smartphone.

“

*TECH's model is asynchronous, so it allows you to study with your PC, tablet or smartphone wherever you want, whenever you want and for as long as you want”*

## Case Studies or Case Method

The case method has been the learning system most used by the best business schools in the world. Developed in 1912 so that law students would not only learn the law based on theoretical content, its function was also to present them with real complex situations. In this way, they could make informed decisions and value judgments about how to solve them. In 1924 it was established as a standard teaching method at Harvard.

With this teaching model, it is the student who builds their professional competence through strategies such as Learning by Doing or Design Thinking, which are used by other renowned institutions such as Yale or Stanford.

This action-oriented method will be applied throughout the entire academic itinerary that the student undertakes with TECH. Students will be confronted with multiple real-life situations and will have to integrate knowledge, research, argue and defend their ideas and decisions. All this with the premise of answering the question of how they would act when facing specific events of complexity in their daily work.



## Relearning Method

At TECH, case studies are enhanced with the best 100% online teaching method: Relearning.

This method breaks with traditional teaching techniques to put the student at the center of the equation, providing the best content in different formats. In this way, they are able to review and reiterate the key concepts of each subject and learn to apply them in a real environment.

Along the same lines, and according to multiple scientific researches, repetition is the best way to learn. For this reason, TECH offers between 8 and 16 repetitions of each key concept within the same lesson, presented in a different way, with the objective of ensuring that the knowledge is completely consolidated during the study process.

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



## A 100% online Virtual Campus with the best teaching resources

To apply its methodology effectively, TECH focuses on providing graduates with teaching materials in different formats: texts, interactive videos, illustrations and knowledge maps, among others. All of them are designed by qualified teachers who focus their work on combining real cases with the resolution of complex situations through simulation, the study of contexts applied to each professional career and learning based on reiteration, through audios, presentations, animations, images, etc.

The latest scientific evidence in the field of Neurosciences points to the importance of taking into account the place and context where the content is accessed before starting a new learning process. Being able to adjust these variables in a personalized way helps people to remember and store knowledge in the hippocampus for long-term retention. This is a model called Neurocognitive Context-Dependent E-Learning that is consciously applied in this university program.

Furthermore, in order to maximize tutor-student contact, a wide range of communication possibilities are provided, both in real time and deferred (internal messaging, discussion forums, telephone answering service, e-mail contact with the technical secretary, chat and videoconferencing).

Likewise, this very complete Virtual Campus will allow TECH students to organize their study schedules according to their personal availability or work obligations. In this way, they will have global control of the academic content and teaching tools, in accordance with their accelerated professional updating.

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*The online mode of study of this program will allow you to organize your time and your learning pace, adapting it to your schedule”*

### The effectiveness of the method is justified by four fundamental achievements:

1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that assess real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.



### The university methodology best rated by its students

The results of this innovative academic model can be seen in the overall satisfaction levels of TECH graduates.

The students' assessment of the teaching quality, the quality of the materials, the structure of the program and its objectives is excellent. Not surprisingly, the institution has become the top-rated university by its students according to the global score index, obtaining a 4.9 out of 5.

*Access the study contents from any device with an Internet connection (computer, tablet, smartphone) thanks to the fact that TECH is up to date with the technological and pedagogical vanguard.*

*You will be able to learn with the advantages of access to simulated learning environments and the learning by observation approach, that is, the "Learning from an Expert" approach.*

Therefore, the best educational materials, thoroughly prepared, will be available in this program:



#### **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.

This content is then adapted in an audiovisual format that will create our way of working online, with the latest techniques that allow us to offer you high quality in all of the material that we provide you with.



#### **Practicing Skills and Abilities**

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



#### **Interactive Summaries**

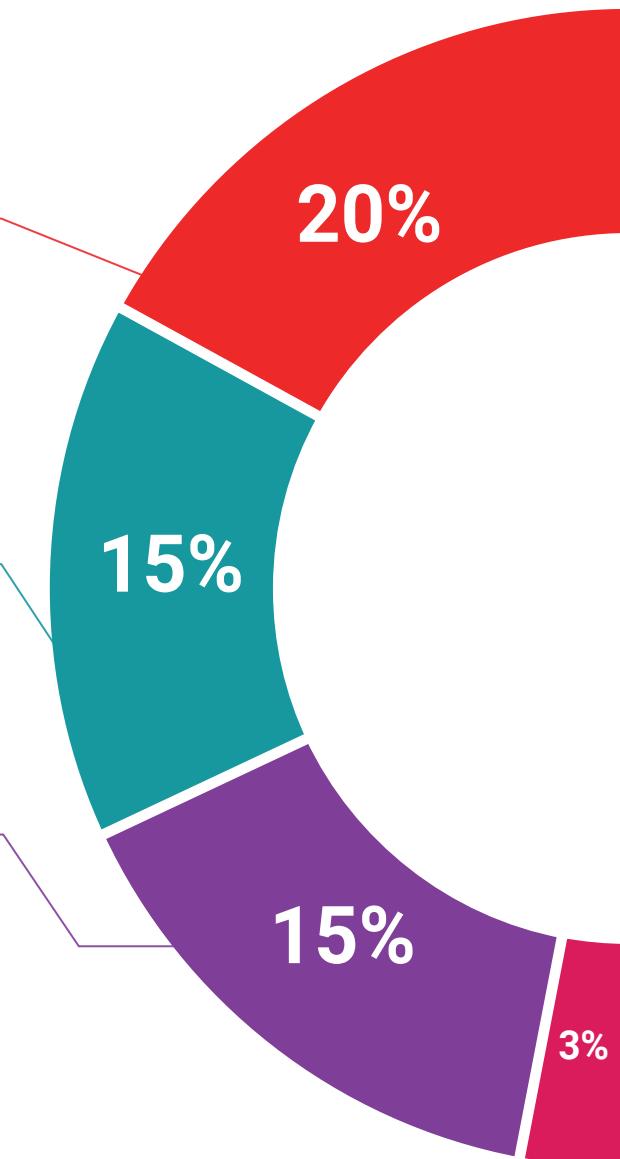
We present the contents in an attractive and dynamic way in multimedia pills that include audio, videos, images, diagrams and concept maps in order to reinforce knowledge.

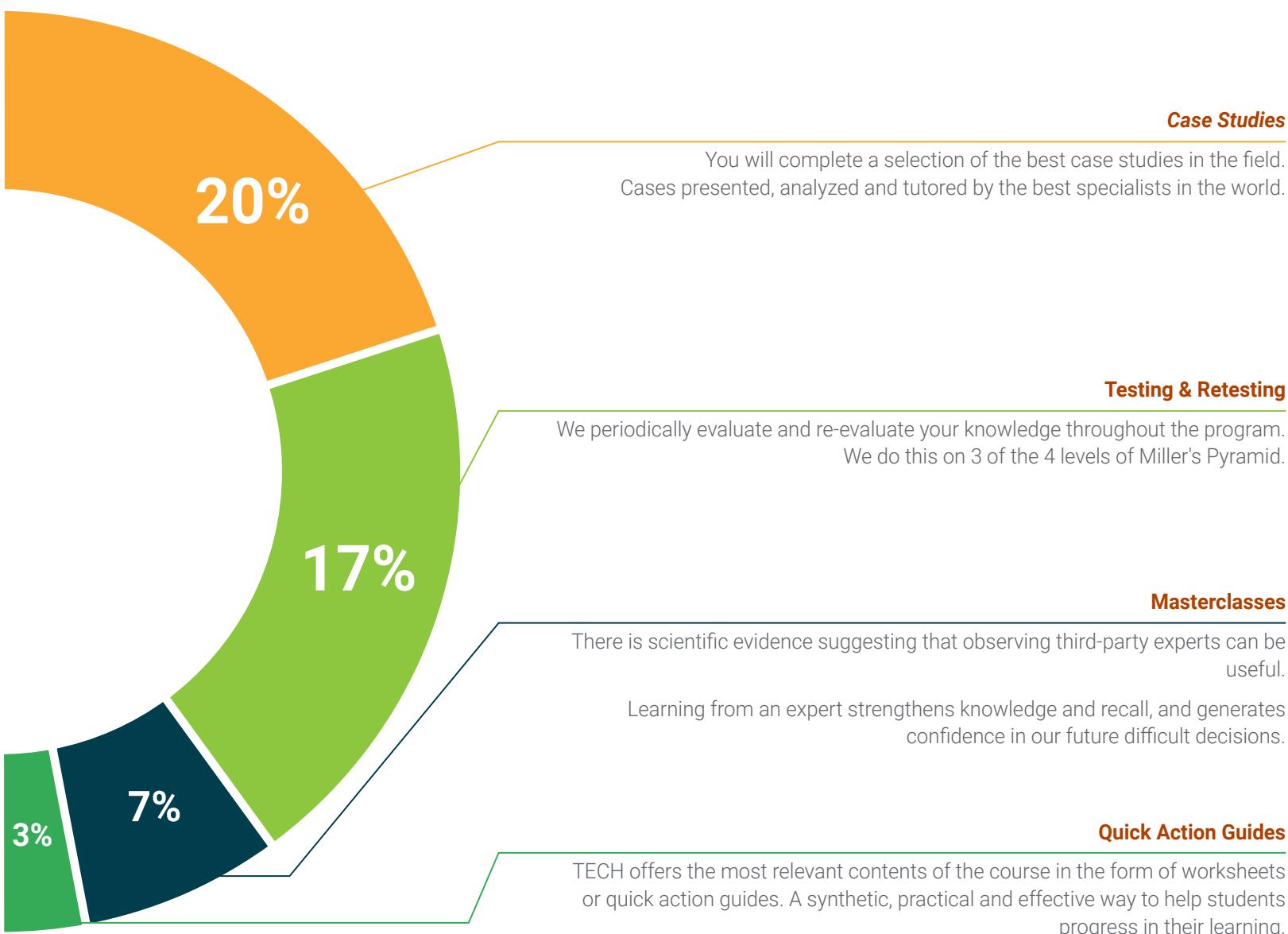
This unique educational system for the presentation of multimedia content was awarded by Microsoft as "Successful Case in Europe."



#### **Additional Reading**

Recent articles, consensus documents, international guidelines... In our virtual library you will have access to everything you need to complete your course.





08

# Teaching Staff

The teaching team for this university program consists of engineers, architects, and experts in road infrastructure with a solid background in the planning, construction, and maintenance of roads. In fact, their experience in road projects enables them to provide an updated and applied perspective to the sector. Through a practical approach based on real-world case studies, the professionals will share innovative strategies to optimize roadwork management, improve project sustainability, and apply advanced digital tools. This synergy between technical knowledge and practical application will ensure teaching aligned with the demands of the sector.



66

*Train with a teaching staff committed to offering a practical and comprehensive perspective on Road Engineering"*

## Management



### Mr. Barbero Miguel, Héctor

- Civil Engineer
- Head of the Safety, Operation and Maintenance Area at Emesa M30
- 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.
- Certificate in Digital Transformation from MIT

## Faculty

### Mr. Fernández Díaz, Álvaro

- Area delegate at Trabajos Bituminosos SLU
- Civil Engineer from the ETSI Civil Engineering School of the Polytechnic University of Madrid
- Course on Occupational Risk Prevention for Construction Company Managers given by the Construction Labor Foundation
- Course on Motivation, Teamwork and Leadership given by Fluxa Formation

### Mr. García García, Antonio

- Network Automation Engineer
- Staff Engineer Network Intelligence & Automation at CommScope and ARRIS
- Member of the EMEA Network Intelligence & Automation Solution Group within the Professional Services Business Unit and Technical Engineer in Computer Systems from the Pontifical University of Salamanca

**Ms. Hernández Rodríguez, Lara**

- ◆ Road, Canal and Port Engineering
- ◆ Production Manager in New Accesses of the South Expansion. Phase 1A. Port of Barcelona
- ◆ Production Manager in the work on the abutments of the Barranco de Pallaresos viaduct on the AVE line. Madrid and French Border
- ◆ Specialist in International Tenders for Railway Works in the International Contracting Department of OHL Construcción. Barcelona Barcelona
- ◆ Degree in Civil Engineering from the Polytechnic University of Madrid
- ◆ Expert in Port and Coastal Engineering from the University of Las Palmas de Gran Canaria.

**Mr. Navascués Rojo, Maximiliano**

- ◆ Civil Engineer
- ◆ Project Manager at Budget
- ◆ Head of the Works Group at the multinational Dragados
- ◆ Civil Engineer from the Polytechnic of Madrid
- ◆ Master's Degree in Tunnels and Underground Works from the Spanish Association of Tunnels and Underground Works
- ◆ Master's Degree in E-business and E-Commerce from the Comillas Pontificia University (ICAI-ICADE)
- ◆ Executive MBA
- ◆ Certified Project Management Professional (PMP) by the Project Management Institute (PMI)

**Ms. Suárez Moreno, Sonia**

- ◆ Engineer in Public Works, Roads, Canals and Ports

- ◆ Director of Production at Empresa Mantenimiento y Explotación M30 SA (API Conservación, Dragados-IRIDIUM and Ferrovial Servicios)
- ◆ Member of the Association of Civil Engineers of Madrid
- ◆ Head of COEX M-40 at Grupisa
- ◆ Public Works Engineer, Polytechnic University of Madrid
- ◆ Civil Engineer from the European University of Madrid
- ◆ Executive Program for Women in Senior Management in the Woman Leadership & Management Program at Esade
- ◆ Senior Technician in Occupational Risk Prevention, Occupational Safety and Ergonomics and Applied Psychosociology
- ◆ EJE&CON's "Talent without Gender" award for the company's talent development and communication policies.
- ◆ Member of Conservation Committee of the Technical Association of Roads (ATC) and Spanish Association of Executives and Directors

**Mr. Ferrán Íñigo, Eduardo**

- ◆ Specialist in Business Administration
- ◆ Opening and management of franchised business centers in Madrid
- ◆ Creation from scratch of a company that installs electric vehicle recharging points
- ◆ Degree in Business Administration from the University of Salamanca
- ◆ Master's Degree in Business Administration from ICADE

09

# Certificate

The Master's Degree in Road Construction, Maintenance, and Operation guarantees students, in addition to the most rigorous and up-to-date education, access to a diploma for the Master's Degree issued by TECH Global University.



66

*Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"*

This private qualification will allow you to obtain a diploma for the **Master's Degree in Road Construction, Maintenance, and Operation** endorsed by **TECH Global University**, the world's largest online university.

**TECH Global University**, is an official European University publicly recognized by the Government of Andorra ([official bulletin](#)). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

This private qualification from **TECH Global University** is a European continuing education and professional development program that guarantees the acquisition of competencies in its area of expertise, providing significant curricular value to the student who successfully completes the program.

TECH is a member of the **American Society for Engineering Education (ASEE)**, a society composed of leading international figures in engineering. This distinction strengthens its leadership in academic and technological development in engineering.

Accreditation/Membership



Title: **Master's Degree in Road Construction, Maintenance, and Operation**

Modality: **online**

Duration: **12 months**.

Accreditation: **60 ECTS**



Mr./Ms. \_\_\_\_\_, with identification document \_\_\_\_\_  
has successfully passed and obtained the title of:

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

This is a private qualification of 1,800 hours of duration equivalent to 60 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February 2024



General Structure of the Syllabus

Subject type	ECTS
Compulsory (CO)	60
Optional (OP)	0
External Work Placement (WIP)	0
Master's Degree Thesis (MDT)	0
<b>Total</b>	<b>60</b>

General Structure of the Syllabus

Year	Subject	ECTS	Type
1 <sup>st</sup>	Contracting and Business Management	6	CO
1 <sup>st</sup>	Alignment, Grading, and Pavement Execution	6	CO
1 <sup>st</sup>	Tunnels and Pavement Operations	6	CO
1 <sup>st</sup>	Structures and Masonry Works	6	CO
1 <sup>st</sup>	Electromechanical Installations	6	CO
1 <sup>st</sup>	Traffic Installations	6	CO
1 <sup>st</sup>	Other Road Elements	6	CO
1 <sup>st</sup>	Operation	6	CO
1 <sup>st</sup>	BIM in Roads	6	CO
1 <sup>st</sup>	The Road of the Future	6	CO





**Master's Degree**  
Road Construction,  
Maintenance, and Operation

- » Modality: online
- » Duration: 12 months.
- » Certificate: TECH Global University
- » Accreditation: 60 ECTS
- » Schedule: at your own pace
- » Exams: online

# Master's Degree

## Road Construction, Maintenance, and Operation

Accreditation/Membership



American Society  
for  
Engineering Education

**tech** global  
university

