Structuralia
Engineering eLearning

UNIVERSIDAD
NEBRIJA

# Master´s Degree in Railway Infrastructure Design, Construction and Maintenance. Specialty in High-speed Railway Infrastructures + 60 ECTS Credits





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**leader in online training**

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# ABOUT STRUCTURALIA

**Structuralia is an online educational institution offering highly specialized postgraduate programs** in engineering, infrastructure, construction, energy, building, digital transformation, and new technologies. Since our founding in 2001, we have been committed to providing quality training for the professional development of **engineers, architects, and STEM professionals.**

We provide a platform where you can acquire new skills and enhance your knowledge without being limited by time or location. Our methodology ensures an engaging, interactive, and **supportive educational experience,** equipping our students to meet future challenges in their respective fields of work.

More than **20** years of experience

Over **200k** student have learnt with us

More than **90** nationalities among our students



Specialize to
**advance your career**

# STRUCTURALIA ALLIANCE AND NEBRIJA UNIVERSITY

**Structuralia and the University of Nebrija** successfully consolidate a strategic partnership. Thus, the collaboration between Structuralia and the University of Nebrija promotes a collaborative, innovative and accessible approach towards learning that is adapted to the individual needs of students.

The two institutions prioritize practical and flexible learning, adapted to the demands of today's working world, and which promotes the personal and professional development of each student. The purpose is to acquire new knowledge in a dynamic and didactic way, which facilitates its retention and contributes to developing the necessary skills to be ready to take part in a society in constant and rapid transformation.

**Structuralia and the University of Nebrija** have set as their main objective the democratization of education to bring it to even the most remote areas and taking advantage of the latest technological innovations. In addition, they have a team of highly specialized teachers and learning platforms that incorporate cutting-edge educational technology to provide academic support throughout the entire educational process.



# STRUCTURALIA RANKINGS

**Structuralia** has achieved the recognition of different national and international rankings, thanks to its commitment to **democratize education** and bet on educational innovation to **achieve excellence.**

For the elaboration of these rankings, **indicators** such as online and offline reputation, the quality of the institution, social responsibility, educational innovation or the profile of professionals are used.




















## QS, seal of academic excellence

Structuralia: 5 stars in online education

## BY EDUCA EDTECH

**Structuralia** is a brand endorsed by **EDUCA EDTECH Group,** which is composed of a group of experienced and recognized **educational institutions of online training.** All the entities that make it up share the mission of **democratizing access to education** and are committed to knowledge transfer, technological development and research.

EDUCA EDTECH Group

### ONLINE EDUCATION

EUROINNOVA INTERNATIONAL ONLINE EDUCATION

inesem business school

INEAF BUSINESS SCHOOL

red educa.net

inesalud

EDU SPORT

EDUCA business school

ESIBE ESCUELA IBEROAMERICANA DE POSTGRADO

Educa.Pro

ceupe European Business School

UDAVINCI

CAPMAN testing solutions

Structuralia Engineering eLearning

UNIMIAMI International University of Miami

Educa PHAROS

# LXP METHODOLOGY

The **EDUCA LXP** methodology enhances the learning experience by incorporating AI into e-learning processes. It utilizes highly customized predictive models based on the analysis of student interactions with their virtual environments.

EDUCA LXP is the outcome of **Research Results Transfer** from multiple interdisciplinary R&D+i projects, involving international universities dedicated to knowledge transfer, technological development and research.



**1. Flexibility**

100% online and flexible learning, allowing students to study where, when and how they want.



**2. Accessibility**

We believe in making education accessible to all, working to ensure that everyone has the opportunity to continue their learning journey.



**3. Personalization**

We offer customized learning paths tailored to each student's unique needs and preferences.



**4. Accompaniment / Academic mentoring**

Guidance and support. Our team of expert teachers provides academic guidance, advocating for educational quality and adapting to the needs of the ever-changing labor market.



**5. Innovation**

We are at the forefront of technological development, constantly evolving with AI-driven Learning Experience Platforms.



**6. Educational excellence**

Our didactic approach focuses on competence based learning, promoting practical and meaningful learning experiences to ensure professional development.



Programs

# Our own university and official programs

# WHY CHOOSIG STRUCTURALIA

## 1. Our Experience

- ✓ More than **20 years of experience**.
- ✓ More than **200.000 students** have already learnt in our virtual classrooms.
- ✓ More than **90 nationalities** among our student body.

## 2. Our Team

Currently, Structuralia has a team of **more than 550 professionals working in the STEM (Science, Technology, Engineering and Mathematics)**. Our staff is solidly framed in a structure that facilitates the highest quality in the attention to students.

## 3. Our Methodology



### 100% ONLINE

Study at your convenience, wherever you are. Access our virtual campus from any device.



### LEARNING

We strive for a deep integration of new knowledge into your cognitive framework.



### TEAM TEACHERS

Structuralia has a team of professionals to elevate your study experience with topquality education.



### NOT BE ALONE

Receive continuous guidance from our tutoring team throughout your student journey.

## 4. AENOR Quality

- ✓ We are Collaboration Agency Nº99000000169 authorized by the Ministry of Employment and Social Security.
- ✓ Annual external audits are carried out to ensure the highest quality by AENOR.
- ✓ Our teaching processes are certified by AENOR under ISO 9001.

# Master´s Degree in Railway Infrastructure Design, Construction and Maintenance. Specialty in High-speed Railway Infrastructures + 60 ECTS Credits

**LENGHT**
1500 horas

**MODE**
**ONLINE**

**ASSISTANCE**
**PERSONALIZED**

**CREDIT**
60 ECTS

## Certificacion

Master´s Degree in Railway Infrastructure Design, Construction and Maintenance. Specialty in High-speed Railway Infrastructures with 60 ECTS Credits awarded by the Antonio de Nebrija University. Teaching not leading to an officially accredited qualification




## Description

This program is a compendium of the railway system as a whole. As a matter of fact, it provides knowledge about the entire life cycle of the railway system, from its initial project phases, through its construction process to its subsequent maintenance. It also clearly reflects the technological evolution in the railway field, the existing regulations, and the modern means of railway maintenance. Due to its comprehensive nature, this program goes into the different railway subsystems such as infrastructure, superstructure, power, signalling and telecommunications from both construction and maintenance perspectives, where each technique has its own material resources, construction procedures and specific maintenance. Furthermore, the master's degree offers the opportunity to focus and specialize in two particularly attractive fields with a high degree of growth, such as high-speed and urban railway systems.

## Goals

The general objective of this program is to build the student's capacities in different technical and management-related disciplines that are necessary for the design, construction and maintenance of railway systems and structures. The specific targets associated with this program are: - Learn the aspects related to the management of railway line construction, as well as those related to the modernization of existing lines in terms of legal constraints, financing of infrastructures, environmental management, supplier relationship, etc. - Learn the main specific parameters necessary to design and draft railway infrastructure projects, whether for conventional, high-speed, metro or tram lines. - Address technical aspects related to civil works involved in the construction of railway infrastructures such as viaducts, tunnels, earthworks, leveling, etc. - Learn the current specifications necessary for the design and construction of railway systems in relation to track superstructures, electrification, substations, signalling, communications, etc. - Have extensive knowledge of

crosscutting aspects of railway maintenance management, such as quality, environment, safety, railway maintenance models developed by different European countries. - Study the different infrastructure and superstructure track maintenance techniques, weld inspection and maintenance, expansion device regulations, etc. - Learn maintenance techniques applied to electrification installations such as the catenary, substations, grounding installations, etc. - Analyze and apply knowledge of railway signalling system maintenance: CTCs, interlocks, blockades, automated level crossings, etc. - Learn maintenance techniques applied to railway network telecommunications and information systems. - In relation to each of the specialties (High-Speed or Urban Railways), their objectives is for the student to learn the specific particularities in the Design, Construction and Maintenance of railway infrastructures in these two fields"

## What does it prepare you for?

This program is intended for technicians from different specialties who are interested in building their capacities in the design, construction, and maintenance of railway lines, civil engineers (Roads, canals and ports), civil work technical engineers, industrial engineers, technical industrial engineers, telecommunications engineers, etc. More specifically, this program is intended for: - Professionals with current or past experience in any of the different areas within the railway sector, who wish to acquire base knowledge and skills in order to join railway companies - Professionals with current or past experience in any of the different areas within the railway sector, who wish to acquire multi-disciplinary knowledge and skills above their current level or specialty.

## Who is the target audience?

This program is aligned with the current trends in the railway sector, thus providing a 360º view of the sector and the complete life cycle of each railway subsystem. From the initial tasks to the techniques and means available to tackle railway construction projects, and the most innovative maintenance methodologies, this program intends to lead the student to a global and continuous understanding of the railway sector as a whole from different perspectives related to structural subsystems: infrastructure, superstructure, power, telecommunications and signalling.

## Job opportunities

Once the student completes this master’s degree, he/she will be able to apply for different positions within the railway field. There is a wide variety of professional opportunities related to railway design and construction, and infrastructure maintenance. In addition, other opportunities include project designer/author, railway specialist, railway technician, production manager, construction manager, technical assistance manager or construction manager, track technologist, railway consultant, maintenance base technician, maintenance manager, railway system auditor, etc. Bear in mind that these opportunities will also be based on previous qualifications and years of experience in the sector which, along with the different skills and knowledge of railway infrastructure, superstructure, power, telecommunications and signalling design, construction and maintenance acquired throughout this

program, will be multiplied.

# List of subjects

MODULE 1: DESIGN AND CONSTRUCTION OF INFRASTRUCTURE SUBSYSTEMS

UNIT 1. RAILWAY PROJECTS AND INTEGRAL MANAGEMENT. INTERMODALITY

1. Railway projects
2. Quality management in railway projects
3. Environmental management in railway projects
4. Health and safety management in railway projects
5. Intermodality

UNIT 2. PLATFORM AND EARTHWORKS

1. Geological and geotechnical phases
2. Constitution of the platform
3. Platform protective layers. Settlement layers
4. Cuts and embankments
5. Engineering structures

UNIT 3. TUNNELS

1. The project of a tunnel
2. Excavation of a tunnel
3. Traditional excavation methods
4. Drilling and blasting
5. Mechanized excavation methods: headers and tbms

UNIT 4. BRIDGES AND VIADUCTS

1. Viaduct project
2. Regulations and loads
3. Typologies
4. Viaduct construction
5. Viaduct reception

MODULE 2: DESIGN AND CONSTRUCTION OF SUPERSTRUCTURE SUBSYSTEMS

UNIT 1. GROUND LAYOUT AND TRACK ELEVATION

1. Layout components
2. Cant
3. Transition curves
4. Layout of transition curves
5. Other transition curves

UNIT 2. TRACK MATERIALS

1. Ballast. Introduction
2. Sleepers
3. Fastening System
4. Rail and welding
5. Switches and crossings and railway installations

UNIT 3. TRACK ASSEMBLY

1. Initial track assembly operations
2. Track assembly operations (I)
3. Track assembly operations (II)
4. Track devices assembly operations
5. Track assembly methods

UNIT 4. RAILWAY OPERATION FACILITIES. TERMINALS

1. Infrastructure and coordination works with rail operations
2. Commissioning of new infrastructures
3. Passenger terminals
4. Freight terminals
5. Civil protection

MODULE 3: DESIGN AND CONSTRUCTION OF POWER SUBSYSTEMS

UNIT 1. RAILWAY ELECTRIC TRACTION

1. Railway electric traction
2. Railway electrification systems
3. Electric traction supply systems
4. Components of the railway power supply system by overhead contact line
5. Reference regulations and energy TSI

UNIT 2. OVERHEAD CONTACT LINE

1. Geometric characteristics of the overhead contact line
2. Mechanical characteristics of the overhead contact line
3. Electrical characteristics of the overhead contact line
4. Dynamic characteristics of the overhead contact line
5. Constraints in the design of overhead contact line

UNIT 3. SUBSTATIONS

1. Concepts and types of substations
2. Design of a substation
3. Elements of a traction substation
4. Protective equipment in direct current outputs
5. Energy remote monitoring

UNIT 4. ENERGY SUBSYSTEM IN HIGH-SPEED, METRO AND TRAM

1. Design parameters of high-speed lines
2. Design parameters of metro lines
3. Design parameters of tram lines
4. Energy efficiency of the railway
5. Tram-train and tram

MODULE 4: DESIGN AND CONSTRUCTION OF SIGNALLING AND TELECOMMUNICATIONS SUBSYSTEMS

UNIT 1. SIGNALING SYSTEMS AND COMPONENTS

1. General considerations
2. Block assembly diagram
3. Train position detection systems
4. Signaling systems associated with turnouts and light signaling systems
5. Level crossing protection

UNIT 2. MAIN ATP SYSTEMS

1. General considerations
2. ASFA
3. The LZB system
4. ERTMS
5. The CBTC signaling system on metropolitan railways

UNIT 3. TELECOMMUNICATIONS SUBSYSTEM. TRANSMISSION MEDIA AND TELECOMMUNICATION NETWORKS

1. Means of transmission by metallic cables
2. Means of transmission by fiber optics and radio links
3. Transport network
4. PDH access network
5. Voice switched network and data network

UNIT 4. TELECOMMUNICATIONS SUBSYSTEM. NETWORK MANAGEMENT AND SUPERVISION SYSTEMS, TELECOMMUNICATIONS SERVICES AND TECHNICAL ROOMS

1. Management network and supervision systems
2. Voice and data services
3. Mobile services (I). Train-ground system
4. Mobile services (II). GSM-R system
5. Telecommunications rooms in buildings

MODULE 5: RAILWAY INFRASTRUCTURE MAINTENANCE

UNIT 1. MAINTENANCE MODELS AND PLANS, OPERATION AND EXPLOITATION

1. Fundamental principles of maintenance
2. Types of maintenance
3. Coordination of maintenance and exploitation and incident management
4. Works on the track. Personnel involved, work regimen and risks

5. Traffic safety management systems

UNIT 2. MAINTENANCE OF EARTHWORKS

1. Stability of slopes and evaluation elements
2. Slope protection elements: metal nets, geotextiles, gabions and shotcrete
3. Retaining walls and earth pressure. Rankine theory
4. Earth pressure: coulomb theory and stability of retaining walls
5. Stability of embankments. Treatments

UNIT 3. TUNNELS

1. Infrastructure and superstructure
2. Drain maintenance
3. Tunnels maintenance
4. Unique buildings and drones
5. Diagnosis and rehabilitation systems

UNIT 4. BRIDGES AND VIADUCTS

1. Repair and inspection procedures
2. Metal bridges
3. Reinforcements in piers and abutments. Treatments against oxidation
4. Concrete structures
5. Categorization of damage. Main inspections on bridges

MODULE 6: RAILWAY SUPERSTRUCTURE MAINTENANCE

UNIT 1. MAINTENANCE MODELS AND PLANS OPERATION AND EXPLOITATION

1. Historical evolution of maintenance
2. Track maintenance programming
3. Operations constituting the conservation of the track
4. Typology of partially mechanized track maintenance work
5. Type of fully mechanized track maintenance work

UNIT 2. TRACK COMPONENTS

1. Introduction to the maintenance of track components
2. The ballast, the sleepers, the fastening systems and the rail
3. Maintenance of track components (switches and crossings)
4. Slab track
5. Latest trends in superstructure maintenance

UNIT 3. WELDING CONTROL AND SUPERVISION

1. Flash-butt electric welding for rails
2. Aluminothermic rail welding
3. Inspections of aluminothermic weldings
4. Ultrasonic detection of rails and welding effects

5. Type of fully mechanized track maintenance work

UNIT 4. TRACK QUALITY EVALUATION

1. Concept of track quality and quality quantification
2. Geometric and dynamic track auscultation
3. Analysis of geometric auscultation results: safety and comfort
4. Analysis of geometric auscultation results: rolling surface condition - wave wear
5. Analysis of the geometric auscultation results: rolling surface condition - vertical, lateral and total wear; average track gauge definition

MODULE 7: RAILWAY ELECTRIFICATION MAINTENANCE

UNIT 1. MAINTENANCE OF THE OVERHEAD CONTACT LINE

1. Maintenance of the overhead contact line
2. Types of overhead contact line maintenance
3. Overhead contact line maintenance planning
4. Objectives, maintenance indicators and advanced maintenance of the overhead contact line
5. Geometrical and dynamic catenary monitoring

UNIT 2. CONTROL OF OVERHEAD CONTACT LINE SUPPORT ELEMENTS

1. Support blocks and posts
2. Support corbel assembly
3. Compensation system
4. Overhead switches
5. Overlapping

UNIT 3. TRACTION SUBSTATION MAINTENANCE

1. Introduction to traction substation maintenance
2. Checks
3. Measurement systems and equipment
4. Voltages
5. Alternating current substations

UNIT 4. TROUBLESHOOTING

1. Catenary protection systems
2. Grounding
3. Installation of a grounding system
4. Most frequent malfunctions
5. Assembly and laying of cables

MODULE 8: MAINTENANCE OF RAILWAY SIGNALLING AND TELECOMMUNICATIONS SYSTEMS

UNIT 1. MAINTENANCE OF INTERLOCKINGS, BLOCKS AND CTCS

1. Introduction to railway signalling. TSI on CCS

2. Lockout devices. Origins of Electrical Interlocks
3. Electronic interlockings
4. Installations to be controlled by the interlockings
5. Signalling Block Systems

UNIT 2. MAINTENANCE OF TRACK CIRCUITS AND LEVEL CROSSINGS

1. Introduction to train detection systems. SIL
2. Track circuits separated by insulating rail joints
3. Train detection by axle counters
4. Half-barrier protection systems
5. Maintenance and troubleshooting in level crossings

UNIT 3. MAINTENANCE OF SYSTEMS (ATP - ERTMS)

1. Introduction to ATP systems. EBICAB900 system
2. The LZB system. Maintenance
3. ERTMS system. Maintenance
4. General description of the safety remote control
5. Remote control subsystems

UNIT 4. MAINTENANCE OF COMMUNICATIONS SYSTEMS

1. Communications and fiber optical cable maintenance
2. Transportation Networks. Maintenance of Transmission Networks and DWDM networks
3. Maintenance of radio communications networks. Tren-Tierra and GSM-r
4. Maintenance of networks and data and voice services
5. Information and control systems

MODULE 9: HIGH-SPEED RAILWAYS

MODULE 10: MFP. MASTER'S DEGREE IN RAILWAY INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE. SPECIALTY IN HIGH-SPEED RAILWAY INFRASTRUCTURES

# Did you find this information interesting?

If you still have questions, our academic advising team will be happy to answer them.

Ask us about our training method, our teachers, scholarships or even just get to know us.

## Request information without commitment.

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info@structuralia.com

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