RAIL ACADEMY

by egis

TRAININGS

URBAN & RAILWAY TRANSPORT

FOREWORD

EGIS' TRAINING OFFERING DEDICATED TO URBAN AND RAILWAY TRANSPORT.

Sharing our knowledge

Men and women are the assets that constitute the wealth of an engineering company.

We constantly work on improving the knowledge and skills of our experts to ensure that return on experience delivers valuable benefits to our employees and clients.

With Rail Academy by Egis, we offer you access to more than 50 years of experience in urban and railway transport.

Our courses offer a fantastic opportunity for learning and exchange, not only with our experts but also with your peers who share your concerns.

Tailored sessions

An interactive experience, with sessions tailored to your specific requirements.

All the programmes presented can be adapted to become tailored training courses to meet a specific requirement and help you in designing effective solutions to cater to your own goals.

We invite you to discover, in the following pages, our offering and training courses.

CONTENTS

RAIL ACADEMY by egis

+ than **35** courses on offer

+ than **20** years of experience in technical training

+ **45** expert training consultants

Sharing of + than **50** years of experience at Egis in urban and railway projects

CONCEPT

OUR RANGE

- An **extensive catalogue of training courses** covering our skills in systems, infrastructure and cross-disciplinary expertise on the following transport modes: conventional railway, high-speed, metro, tramway
- **Dedicated Egis experts** who **share their know-how** and **experience**
- The opportunity to **build your network** and **exchange with your peers**
- **Tailor-made programmes** for single-client training courses

OUR TRAINING APPROACH

- Interactive courses combining **theory, practical return on experience, case studies** and **workshops**
- Training courses based on **feedback**, delivered by experts and **practising project managers**
- **Classroom, online or blended**: opt for the teaching methods that meet your requirements
- The possibility of combining certain courses with **site visits**

3 TYPES OF FORMAT

Multi-Company training course
Exchange with you peers on common concerns

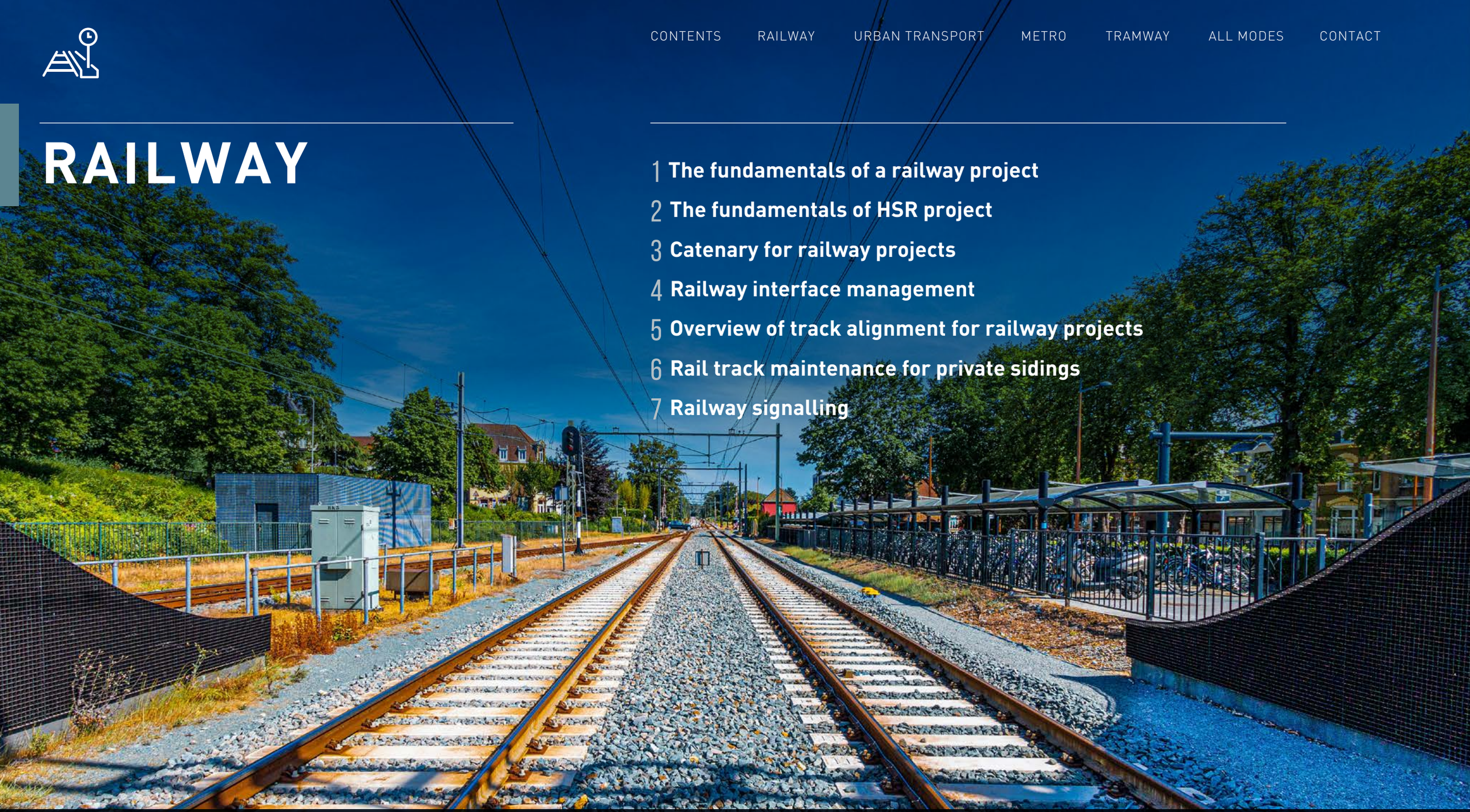
Single-client training course
Designed to your specific needs

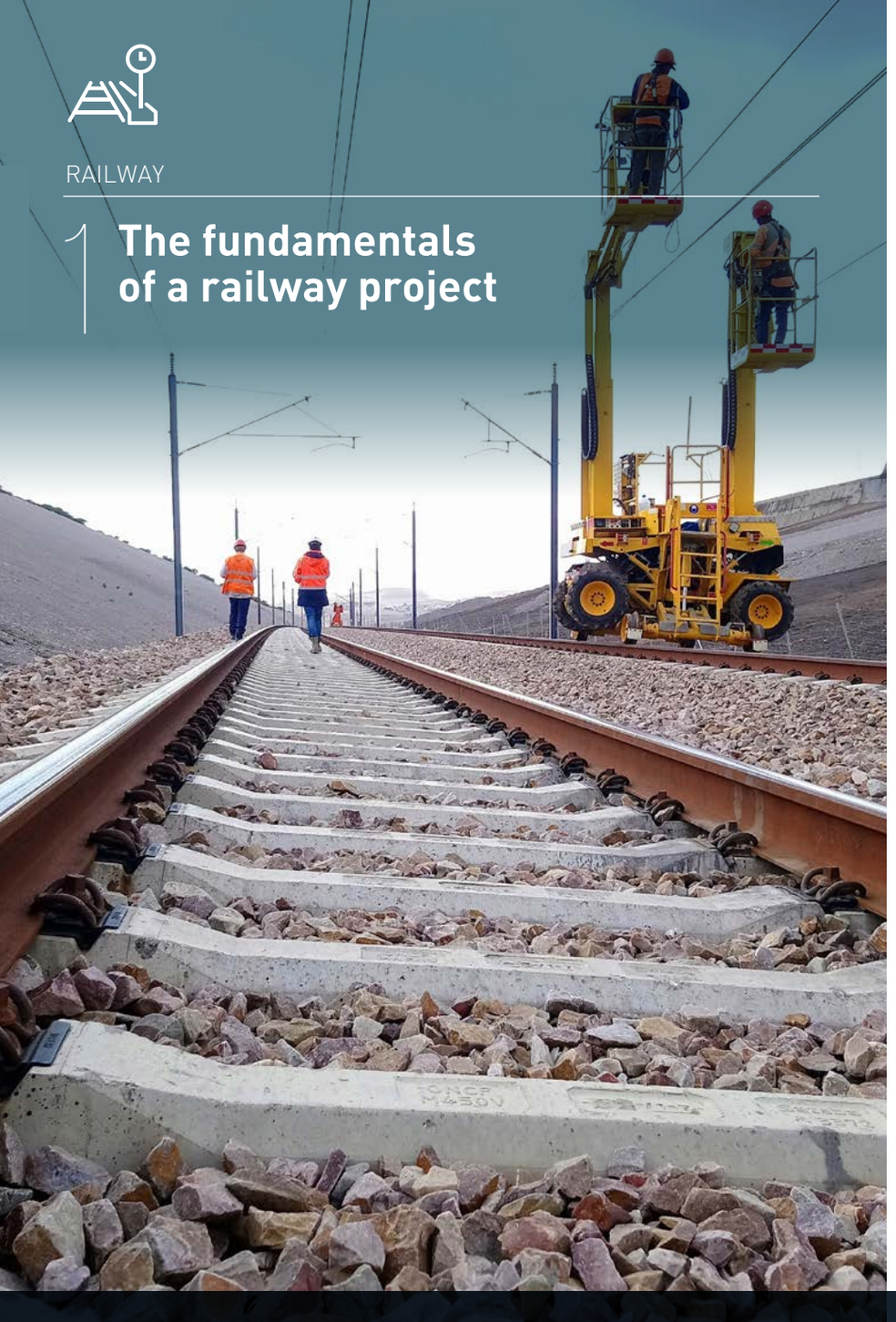
Webinars
Listen to and dialogue with our experts

OUR PAST AND PRESENT CLIENTS

And many others

RAILWAY





RAILWAY

1 The fundamentals of a railway project

DURATION

2 days

OBJECTIVES

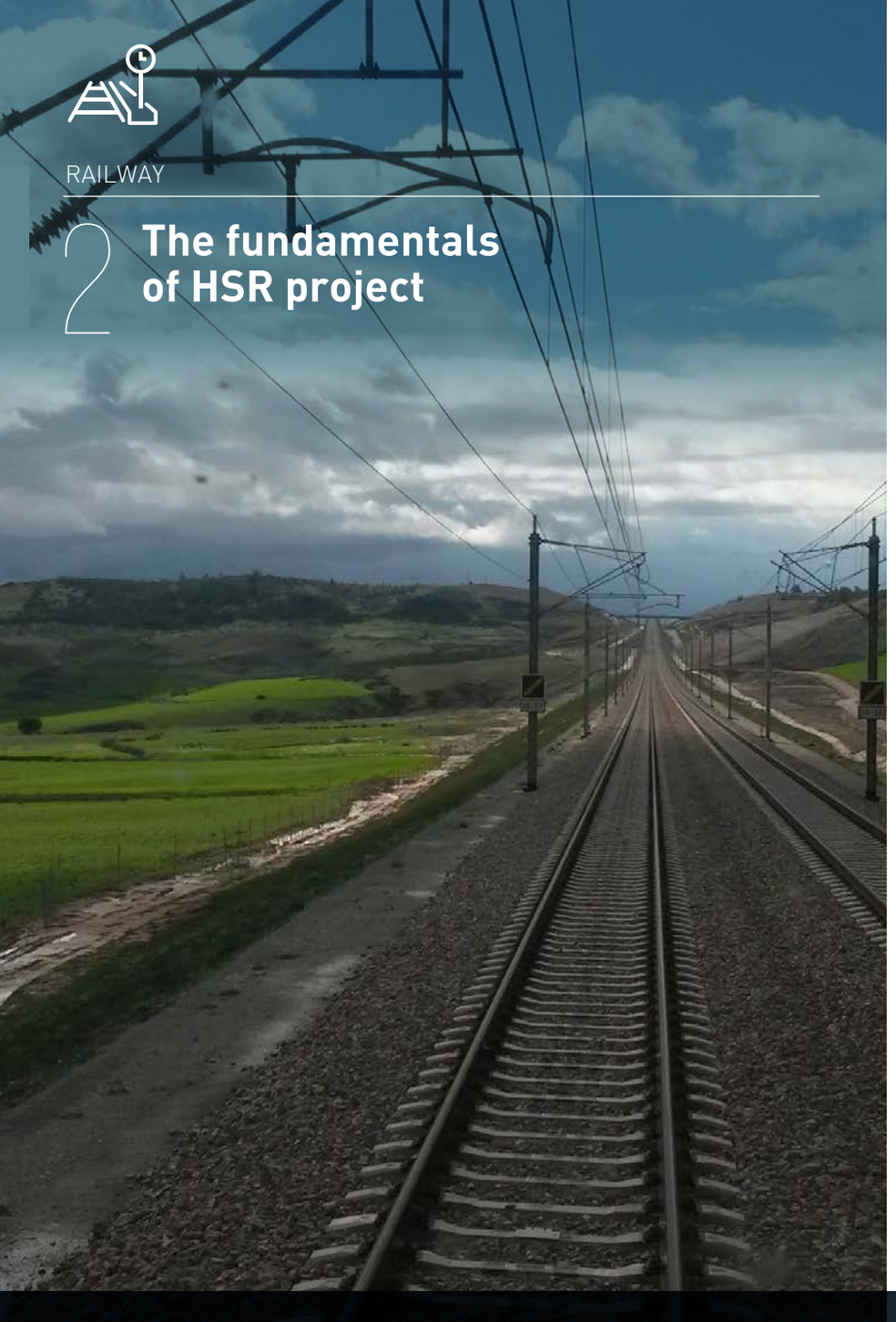
A rail project comprises several different technical fields: civil engineering (tunnels & bridges, earthworks, etc.), but also all the systems and equipment (tracks, overhead contact lines, power supply, telecommunications, stations associated with the project, maintenance centres, signalling systems, etc.). Safety is critical, and it structures the entire project.

On completion of this course, participants will:

- Possess the key skills required to contribute actively to a rail project: an understanding of the context, and general technical and organisational knowledge
- Understand the interfaces between the different systems involved in a rail project
- Have general knowledge of rail systems as a whole
- Understand all the systems constituting a rail project, as well as the related safety aspects

PROGRAMME

- **Presentation of the players** involved in a rail project
- **General principles** of rail safety
- **Rolling stock**
- Track/bridge/tunnel **infrastructure**
- **Signalling – telecommunications**
- **Level crossings**
- **Fixed** electric traction **installations**
- **Protection** against rail risks
- **Specification systems** applicable to the rail sector – documentation
- **Rail regulations** (frames of reference, standards, etc.)



RAILWAY

2 The fundamentals of HSR project

DURATION

2 days

OBJECTIVES

A HSR (high-speed rail) project comprises several different technical fields: civil engineering (tunnels & bridges, earthworks, etc.) but also all the systems and equipment (tracks, overhead contact lines, power supply, telecommunications, stations associated with the project, maintenance centres, signalling system, etc.). Safety is critical, and it structures the entire project.

Besides technical aspects, procurement and programme management are also key topics.

On completion of this course, participants will:

- Understand the general planning of a HSR project and programme management
- Possess the key skills required to contribute actively to a HSR project: an understanding of the context, and general technical and organizational knowledge
- Understand the interfaces between the different systems involved in a rail project
- Have general knowledge of rail systems as a whole
- Have a good overview of a benchmark of existing technologies and design standards in Europe and worldwide
- Understand all the systems constituting a rail project, as well as the related safety aspects

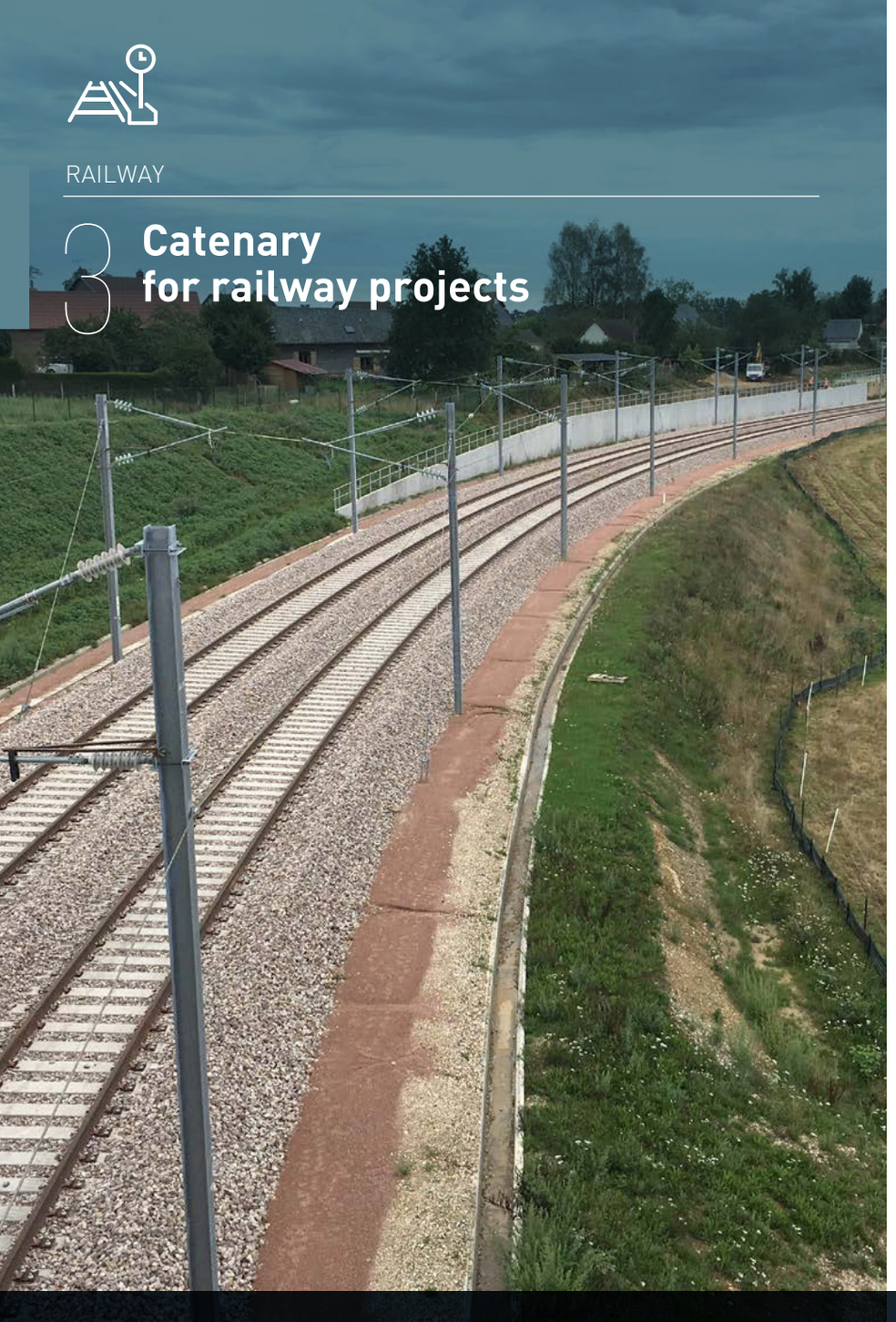
PROGRAMME

Implementing a HSR project:

- **Functional definition**
- **Legal and financial** arrangements
- **Organization between contracting authorities and project managers**
- **Specification systems** applicable to the rail sector-documentation
- **HSR regulations** (frames of reference, standards, etc.)
- **Environmental issues**
- **Corridor definitions requirements:** methods and process
- **Operation and maintenance**

Zoom on key technical issues:

- **General principles of rail safety**
- **Power Supply**
- **Catenaries**
- **Infrastructure**
- **Signalling**
- **Rolling stock**
- **BIM Workshop**
- **Interface Management**



RAILWAY

3 Catenary for railway projects

DURATION

1/2 day

OBJECTIVES

- Develop initial knowledge about fundamental catenary principles, interfaces with other systems, sizing etc.
- Discover the main OCS (overhead catenary systems) principles and rules, sectioning and electrical diagram
- Understand the climatic, local and geological constraints, the catenary layout plan (pegging plan – mast implantation) and mounting diagram
- Understand the interfaces with civil work (Upper and Lower bridges, Viaduct, Tunnel, other railway equipment (tracks, signalling, level crossings)

PROGRAMME

- **Principles:** catenary principles, determining design factors, overhead catenary system composition, staggering, aerial configuration arrangement
- **Catenary types**
- **Design:** catenary interfaces, design process, system design, basic design, detailed design
- **Installation:** construction design, organization chart, work planning, installation with or without track, code of practice, creeping effect
- **Testing and commissioning**: static tests, dynamic tests

RAILWAY

4 Railway interface management

DURATION

1/2 day

OBJECTIVES

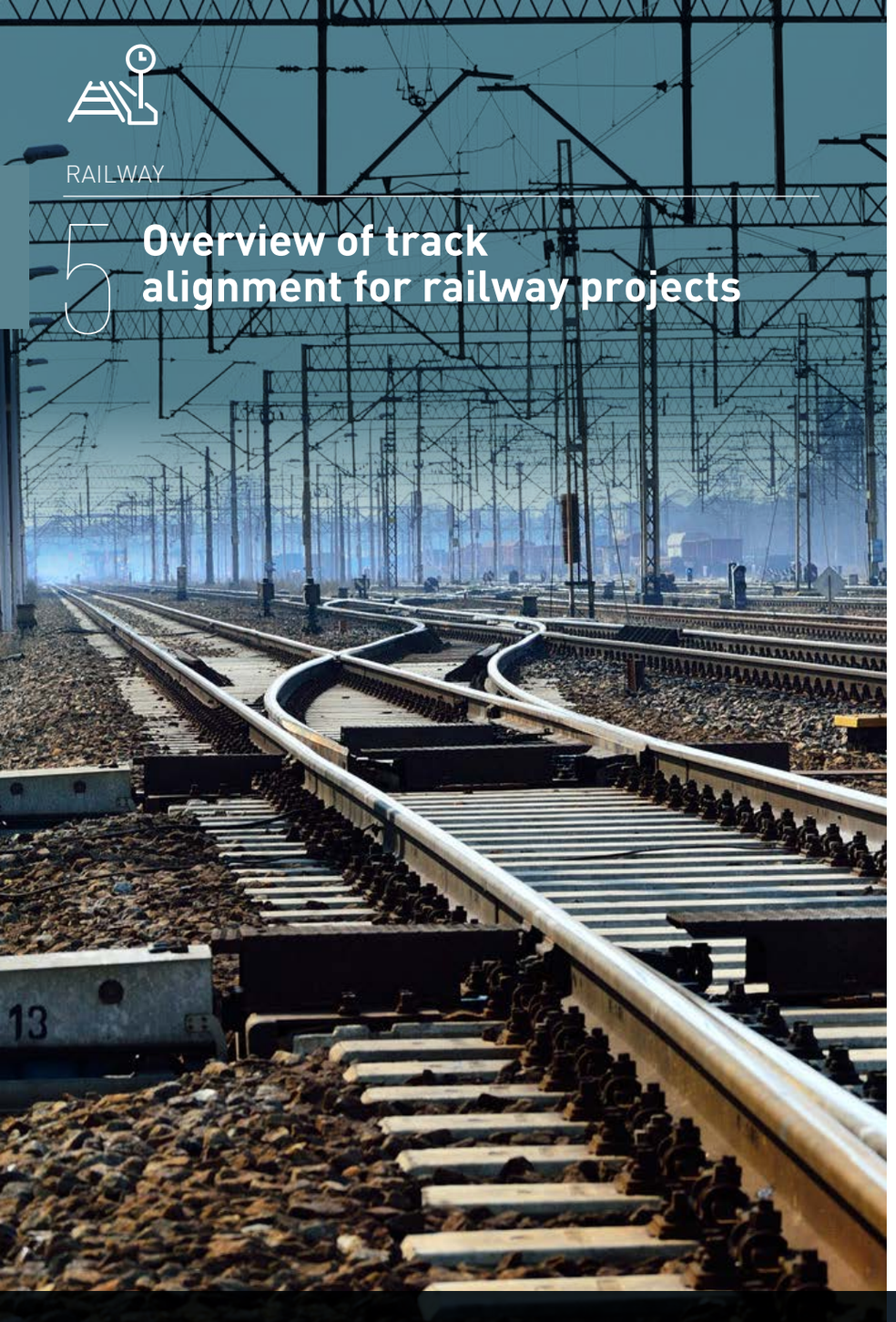
In Railway systems, Interface Management is the study of the interactions between the different subsystems involved: electrical Interfaces (e.g Traction Power Supply x Rolling Stock), mechanical Interfaces (e.g Wheel x Rail), software Interfaces. Identifying and exhaustively specifying these interfaces is a key part in the integration process of a Railway Project.

This training course aims to:

- Understand and describe the tools used by Interface engineers through the Interface Drainage x Trackwork
- Understand differences between interface management / coordination / clash analysis

PROGRAMME

- **Introduction:** theoretical definition of systems, sub-systems and interfaces
- **Interface management process:** project example, interface identifications, interface specifications, interface specifications follow-up process
- **Interface management team organisation:** example of team organization, interface management flow chart design phase, progress follow-up using interface sheet register



RAILWAY

5 Overview of track alignment for railway projects

DURATION

1 day

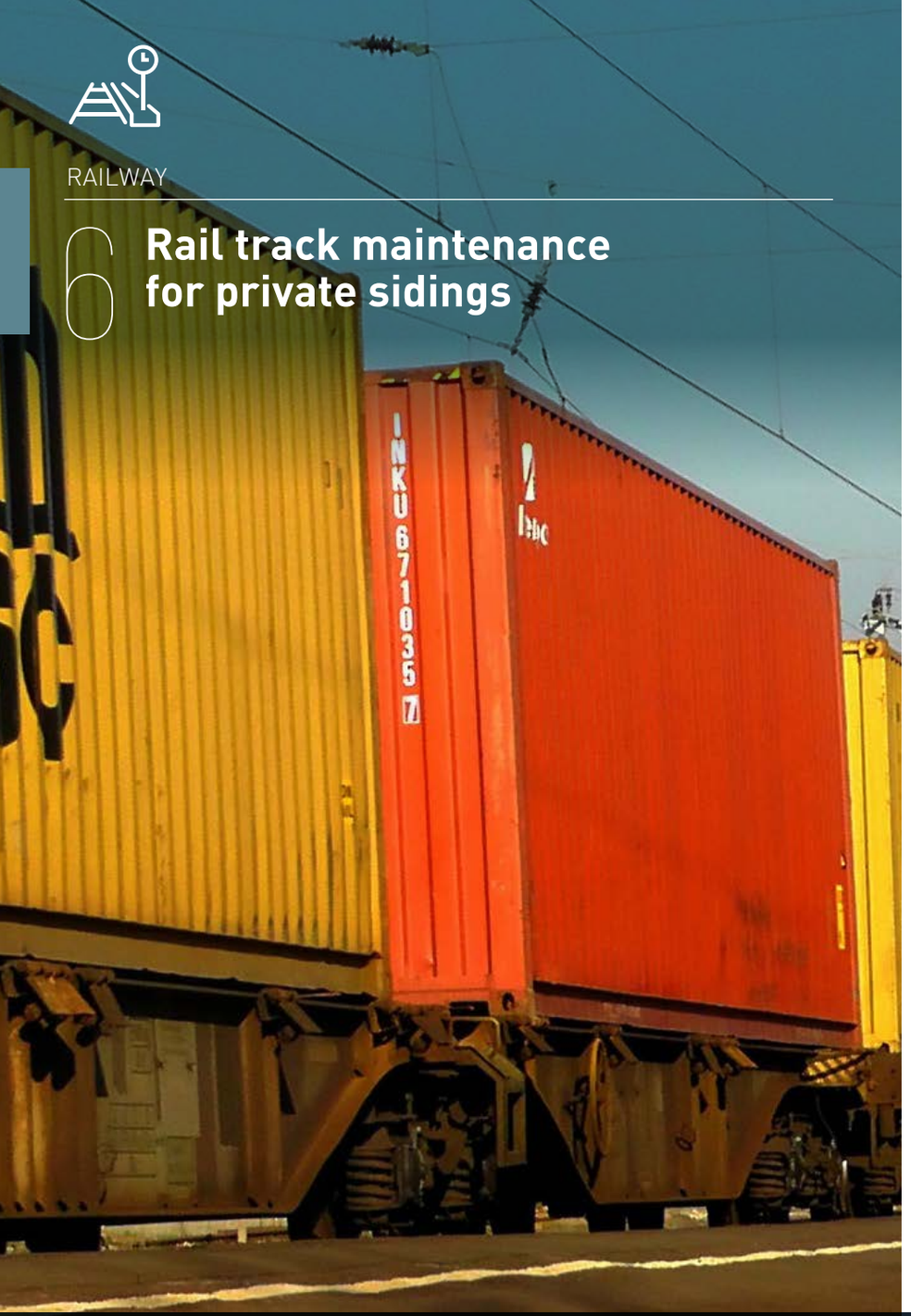
OBJECTIVES

This training allows you to:

- Develop initial knowledge in the railway domain
- Discover the maintenance aspects of a railway project, from conventional rail network to high-speed lines
- Understand the various interactions between the track and railway systems (signalling, catenary, engineering works, cleaning, drainage, platforms, rolling stock, operations, train speeds, tonnage, environment)
- Demonstrate the complexity of train traffic
- Understand how the various elements of a railway interact

PROGRAMME

- **Track components:** rail infrastructure and superstructure, sleepers, fastening systems, ballast
- **Locking rules:** interlocking definition, route definition, different types of locking
- **Track alignment and design:** load transmission to the track, horizontal and vertical alignment, the guidance of the rolling stock by rails, function of the bi conicity, yawing motion, axle load, constraints and tangential effort, pseudo sliding, coefficient of adherence, adherence factors, guidance capacity (wheel flange), rail track-bed
- **Track laying techniques:** jointed tracks, continuous welded rails CWR, destressing: general principles, expansion joint
- **Turnouts/switches:** terminology of turnout components, types of common crossings, components
- **Track interfaces:** interaction between track and catenary, track bed, signalling system, structures, drainage system and soil
- **Engineering works:** auxiliary track laying, unloading CWR, gantry track laying, laying sleepers with excavator, positioning CWR, tightening the fastening clips, heavy tamper, stabilising, adjustment, regulator
- **Testing and geometric controls:** standardised and verified parameters (for geometry)



RAILWAY

6 Rail track maintenance for private sidings

DURATION

2 days

OBJECTIVES

This course will enable participants to acquire knowledge on:

- Rail track and switch terminology
- The notions of rail track maintenance
- Organising maintenance (completing check lists, using inspection equipment, drafting track equipment diagrams, inspection visits, etc.)

This course combines theory with a practical section on the ground (with inspection of items, checking of maintenance standards, use of track gauge and superelevation device, etc.).

PROGRAMME

- **Track geometry:** longitudinal profile, superelevation (cant), distortion, deflection, gauge, etc.
- **Track bed**
- **Permanent way structure:** concrete, ballast
- **Rail track components:** terminology
- **Level crossings**
- **Track categories:** standard bars, continuous welded rails
- **Track switches:** terminology
- **Rail track maintenance:** preventive, corrective
- **Inspection** visits
- **Maintenance** standards
- **Organisation** of maintenance
- **Site visit**

RAILWAY

Railway signalling

DURATION

1 day

OBJECTIVES

The objective of this training course is to provide railway specialists interfacing with railway signalling with an introduction to the key issues and the principles of this speciality.

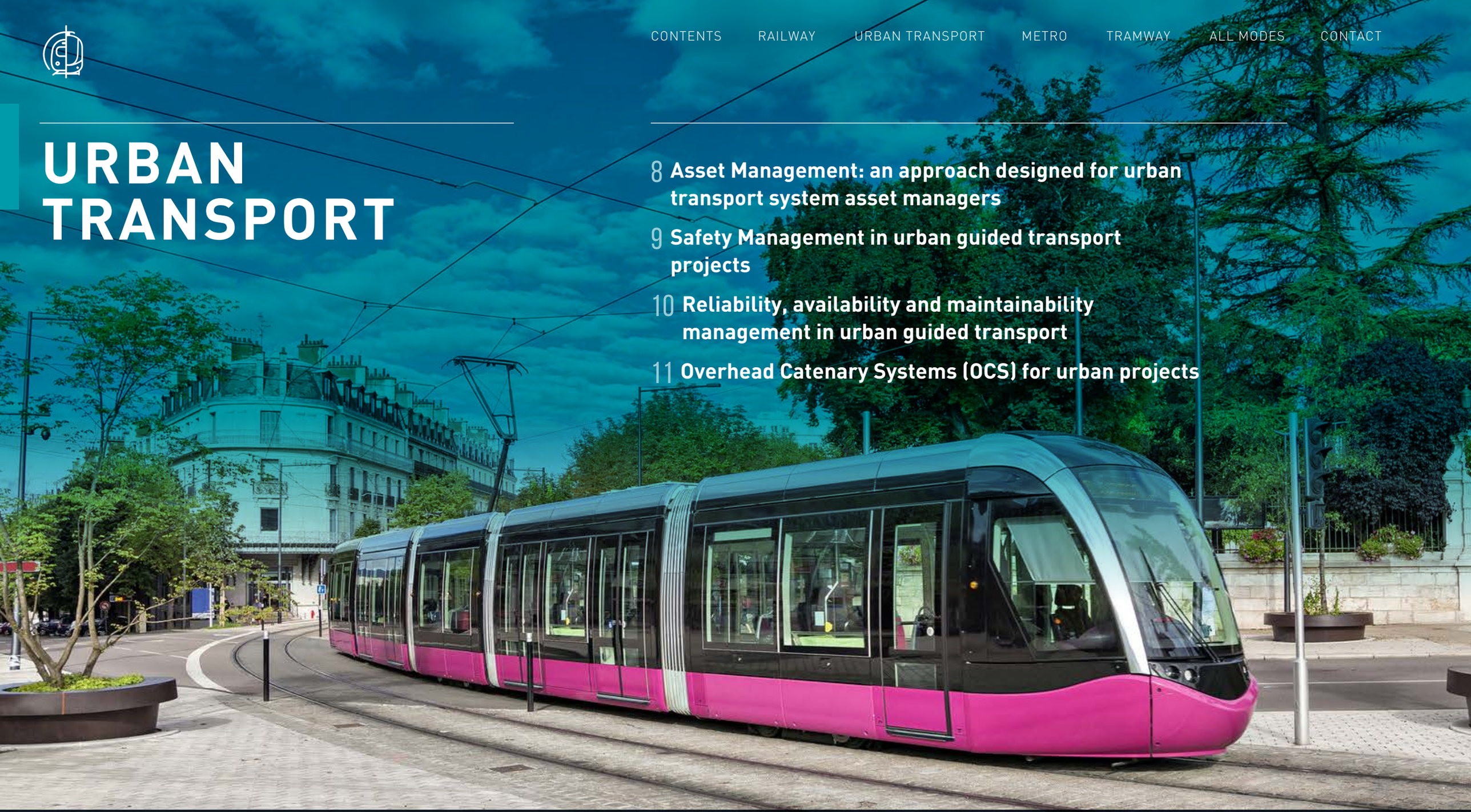
At the end of this course, the participants will have good notions of the following concepts:

- Railway risks and the actions needed to be warned about them
- Route notions and the various engagement principles
- Railway signalling equipment
- Automatic Train Control
- Operating studies

PROGRAMME

- **Railway risks**: head-on collision, side-on collision, rear collision, obstacle, derailment, runaway trains
- **Locking rules:** interlocking definition, route definition, different types of locking
- **Signalling hardware:** signals, train detection equipment, switch (locking and control device), and signalling system architecture
- **Automatic train control:** train protection and warning system, high Speed system TVM, ERTMS, L1, L2, L3
- **Safety and RAM** (Reliability Availability Maintainability): safety management, risk mitigation, RAM process
- **Railway control centre:** purpose objective challenges, traffic management, control centre space organization, examples of control centres

URBAN TRANSPORT



URBAN TRANSPORT

8 Asset Management: an approach designed for urban transport system asset managers

DURATION

1 day

OBJECTIVES

Implementing an efficient asset management strategy is fundamental to maintain urban transport infrastructure in the long term at the best cost. Beyond that, it must allow public transport authorities and concession holders to manage asset related risks, and contribute to guaranteeing transportation systems' performance. In recent years, the technical frameworks dedicated to asset management have gradually become more structured and resulted in a dedicated ISO standard being developed and published.

On completion of this course, participants will:

- Be familiar with the terminology and key concepts of Asset Management
- Have basic knowledge of the ISO 55001 standard, which defines an internationally recognized and certifiable framework for asset management processes
- Have acquired an overview of crucial issues arising throughout the life cycle of a transport system, and will understand the methods and tools used to optimize asset management in the context of a public transport network

During this course, theoretical content is completed by Egis' real case studies to illustrate the practical implementation of asset management on transport systems.

PROGRAMME

- **The definitions of Asset Management** and key concepts
- **Asset Management** and Information System
- **Digitalization of a rail track asset management:** case study
- **Understanding the ISO 55001** standard, trends, benefits for the Public Transport Authority, consequences for the various institutional players
- **Implementation of a risk-based** asset management decision support framework: case study
- **Delegation of a part of the asset management** to an operator: case study

URBAN TRANSPORT

9 Safety Management in urban guided transport projects

DURATION

1 day

OBJECTIVES

Guaranteeing safety at all times is an intrinsic objective for all transport systems. Being sure that safety is managed as efficiently as possible throughout the system life cycle is both an issue of daily concern for organising authorities and operators and a pre-requisite for commissioning or modifying a transport system.

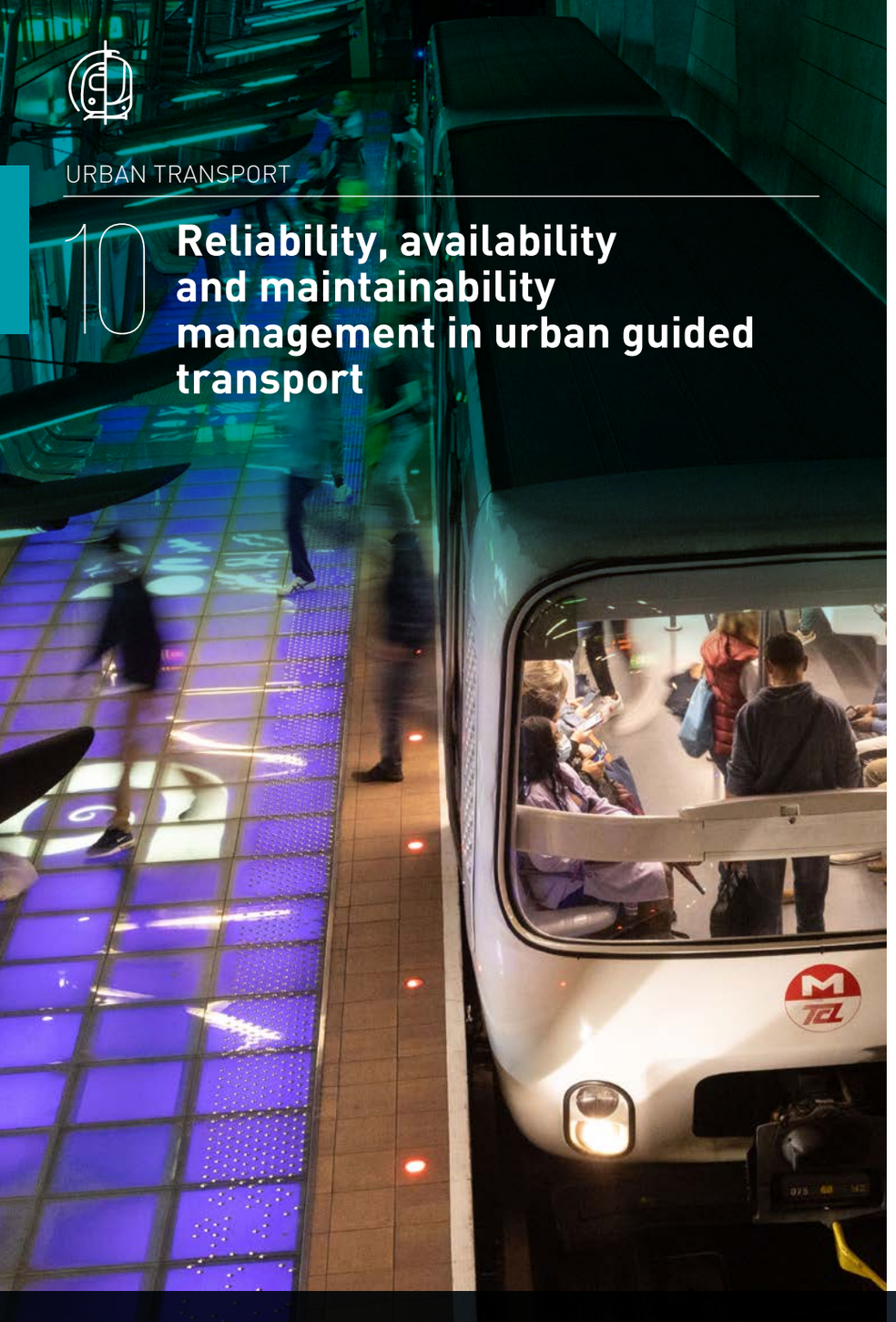
Safety management is based on principles and methods that are specific to the guided and rail transport sector and defined by dedicated regulations or standards. In France and many other countries, the EN 50126 rail standard relating to the specification and demonstration of reliability, availability, maintainability and safety (RAMS) is the frame of reference recognised and required by regulations.

On completion of this course, participants will:

- Be familiar with the main principles of managing and demonstrating safety on urban transport systems in France and internationally
- Understand the scope of the safety process as specified by the EN 50126 standard

PROGRAMME

- **Issues** inherent to the safety process
- **Useful notions** and **definitions**
- **Framework of regulations** and standards
- **Role and responsibilities of the players** involved in the safety process
- Safety **management process**
- Statutory **safety documents**



URBAN TRANSPORT

10

Reliability, availability and maintainability management in urban guided transport

DURATION

2 days

OBJECTIVES

An essential prerequisite for achieving a high level of service quality on a transport network is being capable of managing equipment failures and implementing efficient recovery and maintenance solutions. To do so, a Reliability, Availability and Maintainability (RAM) management approach must be implemented throughout the project, guaranteeing that these issues are taken into account right from the equipment and system design stage. The approach must then make it possible to validate the RAM performance levels throughout implementation of the project and once the system has been commissioned.

On completion of this course, participants will:

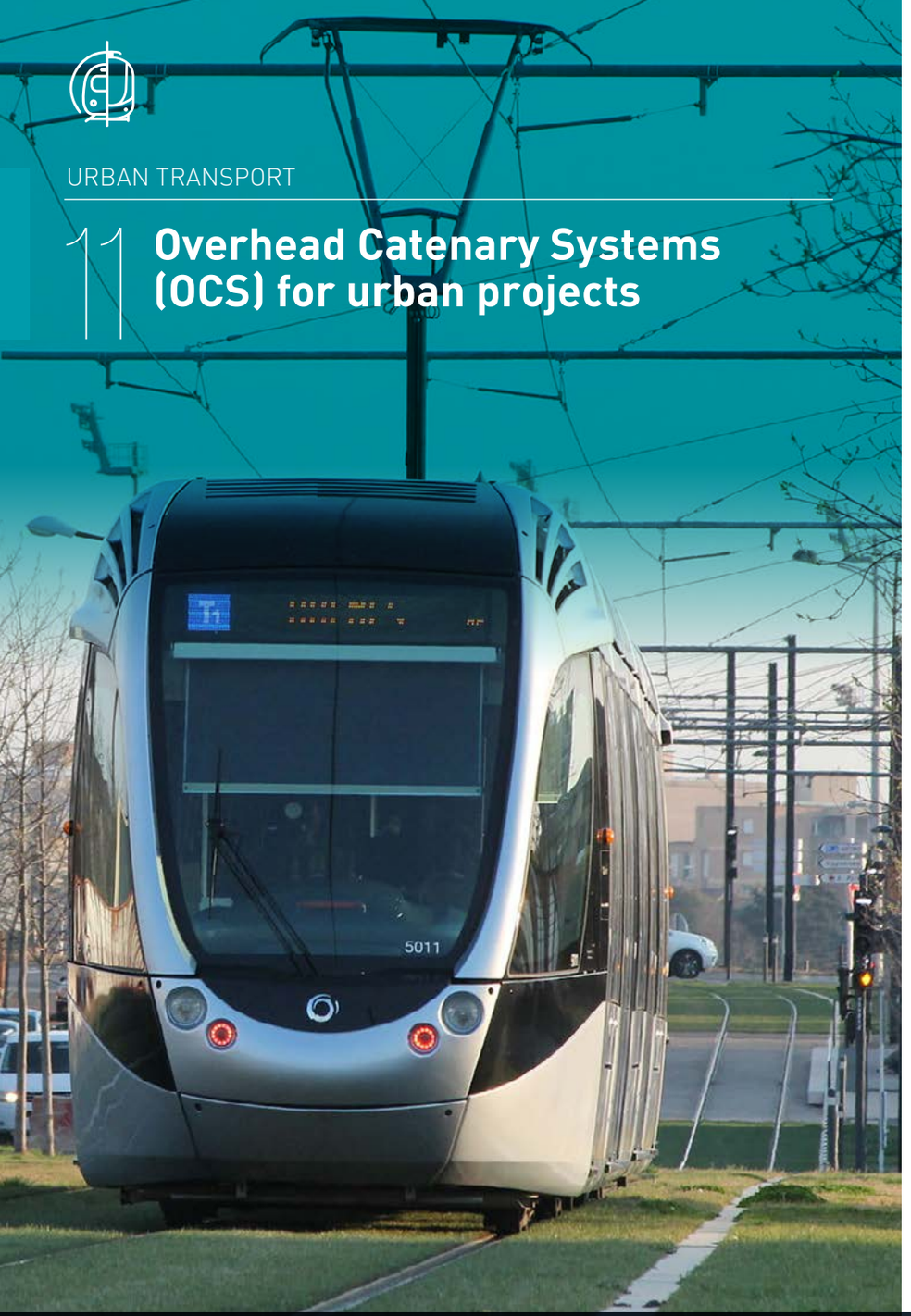
- Understand the issues inherent to Reliability, Availability and Maintainability activities
- Have acquired an overview of "RAM" activities as they relate to systems and contractors, from the general design phase through to the end of the defects liability period
- Have the skills required to take "RAM" aspects into account in tender documents and in contract management & supervision processes

PROGRAMME

- **Issues and objectives** of implementing a Reliability, Availability and Maintainability (RAM) approach on a transport system project
- **Useful notions** and **definitions**
- **RAM activities** during the general design phase
- **The benefits of RAM modelling:** example of a comparison of design options from an availability viewpoint using specialist software
- **Formalising RAM objectives**: integrating RAM aspects in specifications RAM activities during detailed design and construction phases, for the project owner / consultant and the industrial players
- **Measuring RAM** during the operating phase

URBAN TRANSPORT

11 Overhead Catenary Systems (OCS) for urban projects



DURATION

1 day

OBJECTIVES

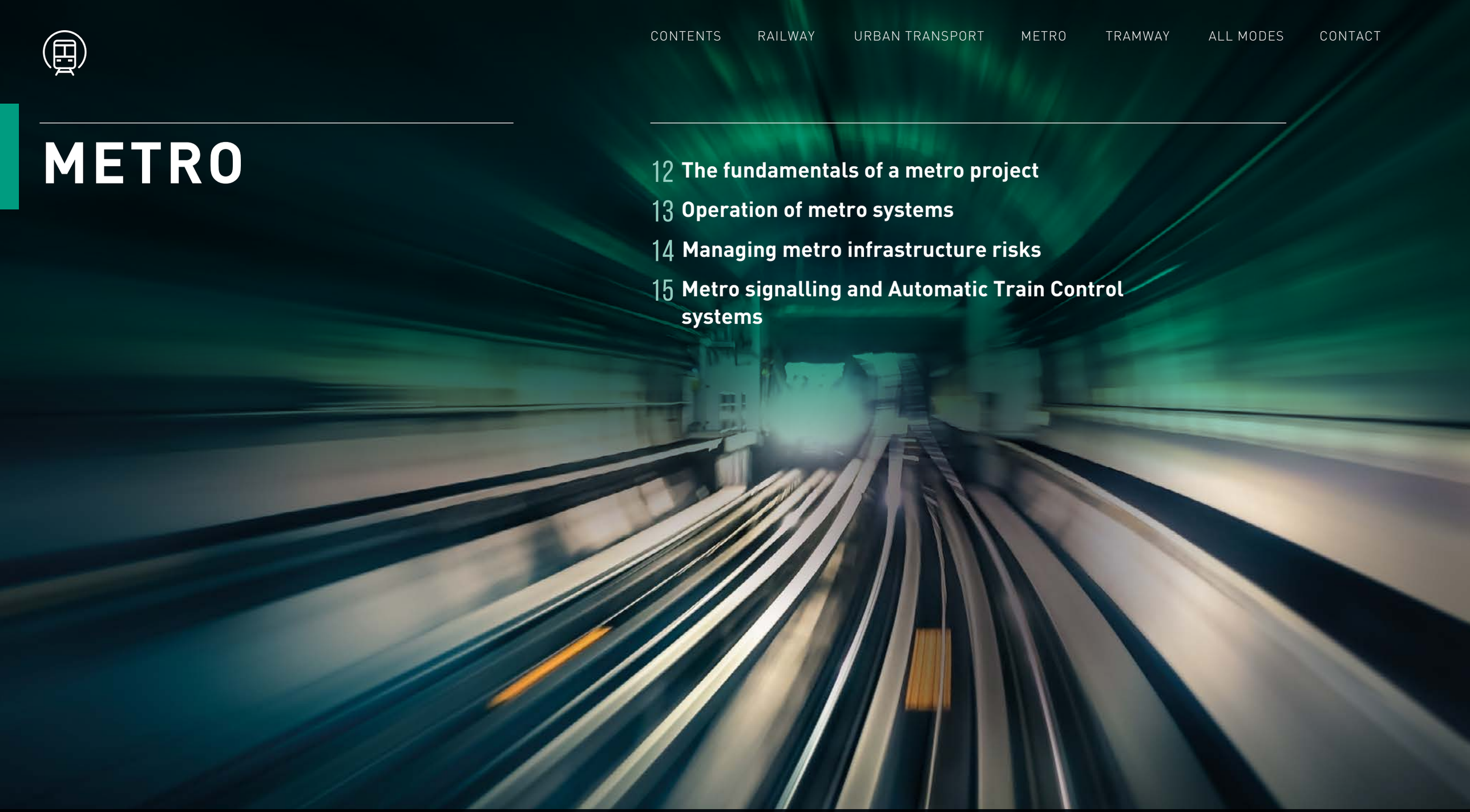
The main objectives of the course are to:

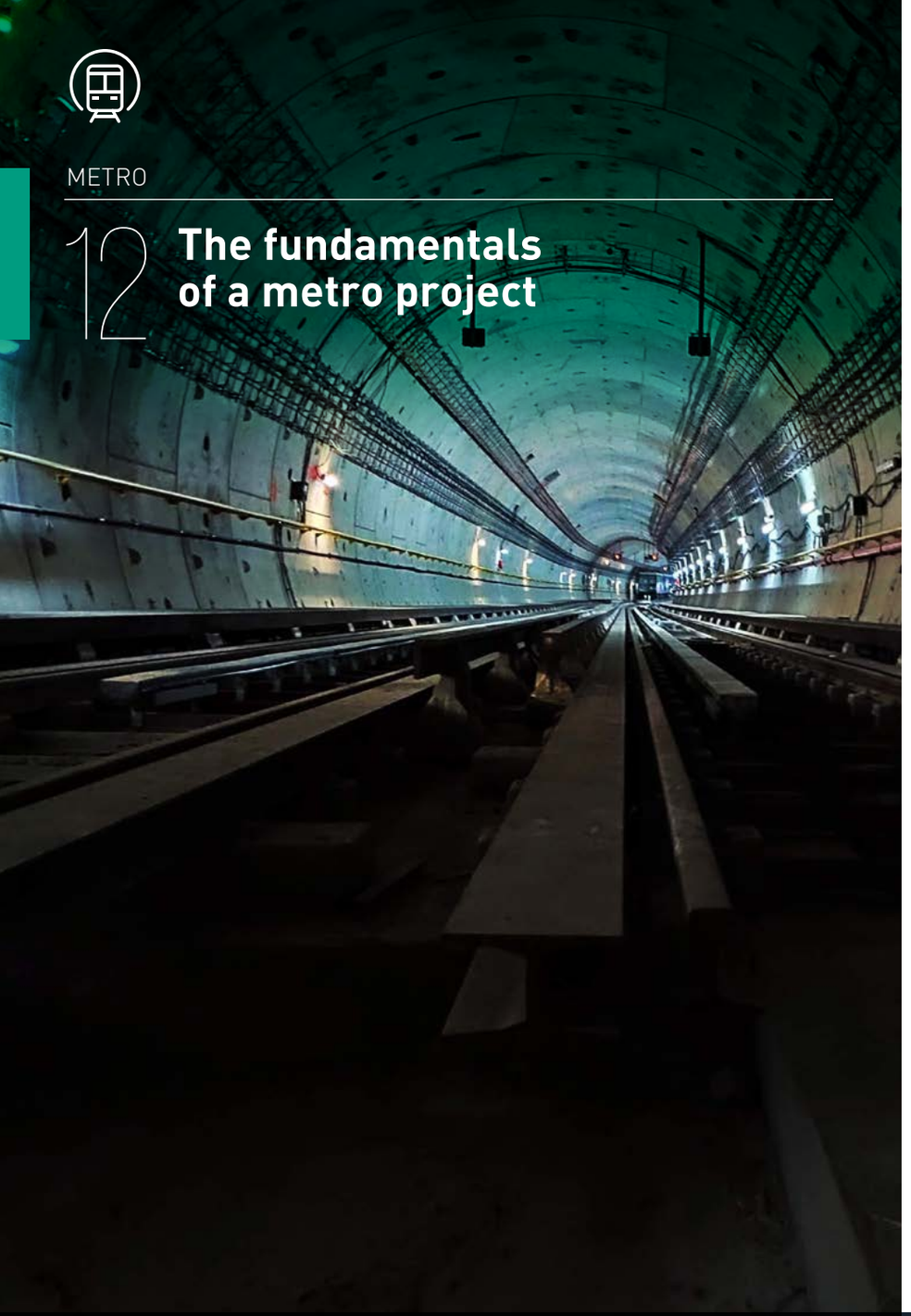
- Have a global overview of technical issues for Overhead Catenary Systems, to design a tramway or metro project
- Understand the technical process of OCS
- Be aware of technical constraints for electrification and interface with other technical fields

PROGRAMME

- **OCS types Overview**
- **OCS Interface**
- **Basic concepts**
- **OCL design risks & mitigation**
- **Works**
- **Key points / Conclusion**

METRO





METRO

12 The fundamentals of a metro project

DURATION

3 days

OBJECTIVES

A metro project is designed to meet transport needs in densely urbanised cities and requires major, highly technical infrastructure works.

On completion of this course, participants will:

- Be familiar with the specific features of metro projects
- Be able to accurately identify the main challenges of a metro project, in any country
- Understand the interactions between the different players, technical skills and specialities involved

PROGRAMME

- **The environment of a metro project:** general schedule of an operation
- The **System**
- **Civil engineering** aspects
- **Focus on geotechnical studies**
- **Systems:** rolling stock, guiding system, power and lighting networks, traction power distribution, signalling and PLCs, platform screen doors, signal and communication networks, CCR, ticketing and access control, depot and stabling facilities, electromechanical equipment
- **Preliminary studies**
- **BIM** & **Digital Twin**
- **Sustainable development** and eco-design
- **Station flow sheets**
- **Safety/security** aspects
- **Architects' assignments**
- **Costs**
- Technical **integration/coordination**

METRO

13 Operation of metro systems

DURATION

1 day

OBJECTIVES

Metro system operations are computer-assisted or managed entirely by a so-called ATO (automatic train operation) software system, from train driving itself to the addition of extra trains at peak times. Metro networks in today's ever-growing cities must be constantly modified and developed to ensure that their passenger capacity keeps pace with demand: operating issues are therefore plentiful and often complex.

On completion of this course, participants will:

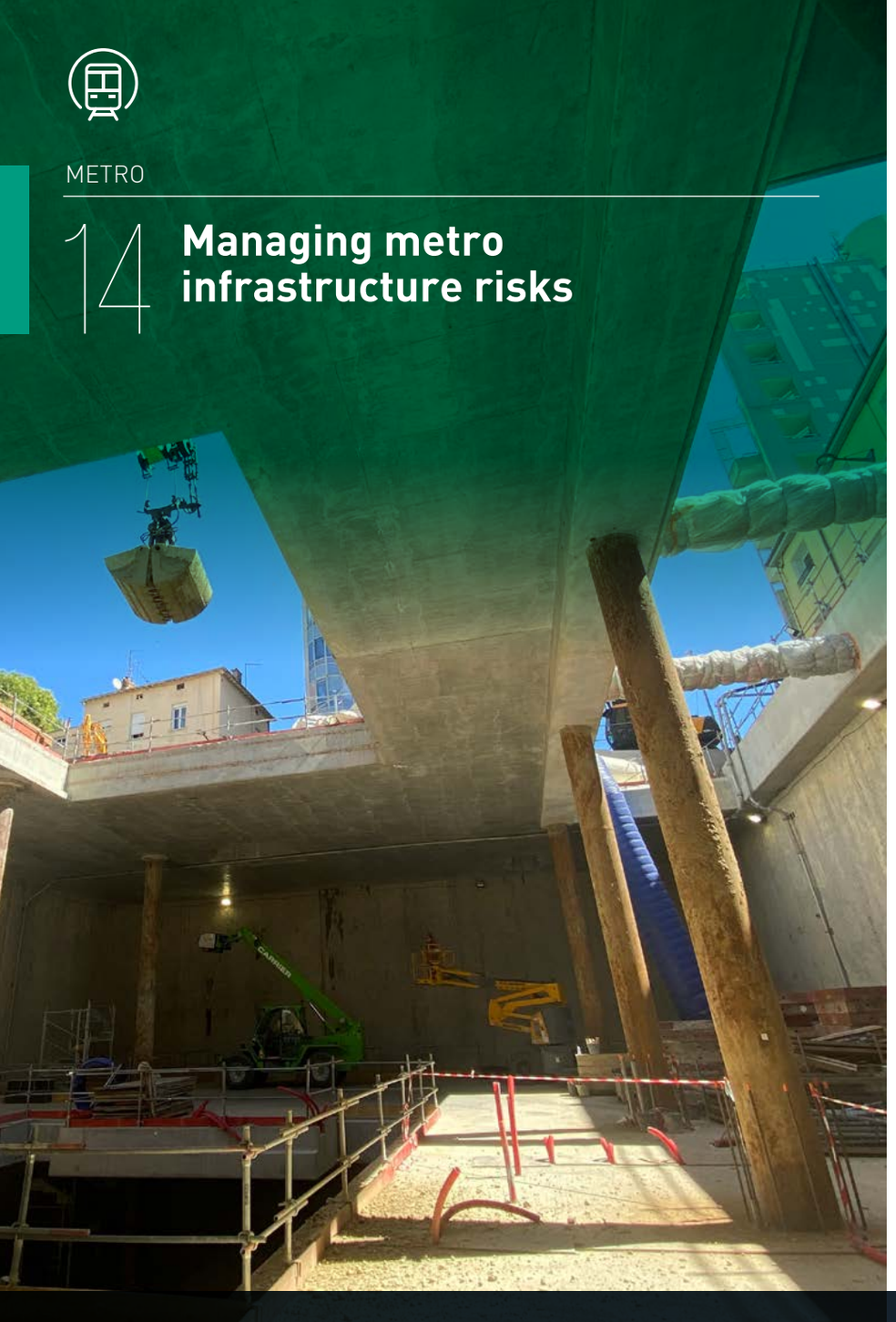
- Be familiar with the stages of system definition
- Be capable of taking operating issues into account
- Understand the interfaces with the different specialist fields

PROGRAMME

- **Definition of requirements** and **performance levels**
- **Operating issues**
- **Operating issues** in terms of maintenance
- **Design of the system**
- **Operation** and **maintenance**
- **Operation** and **maintenance problems**

METRO

14 Managing metro infrastructure risks



DURATION

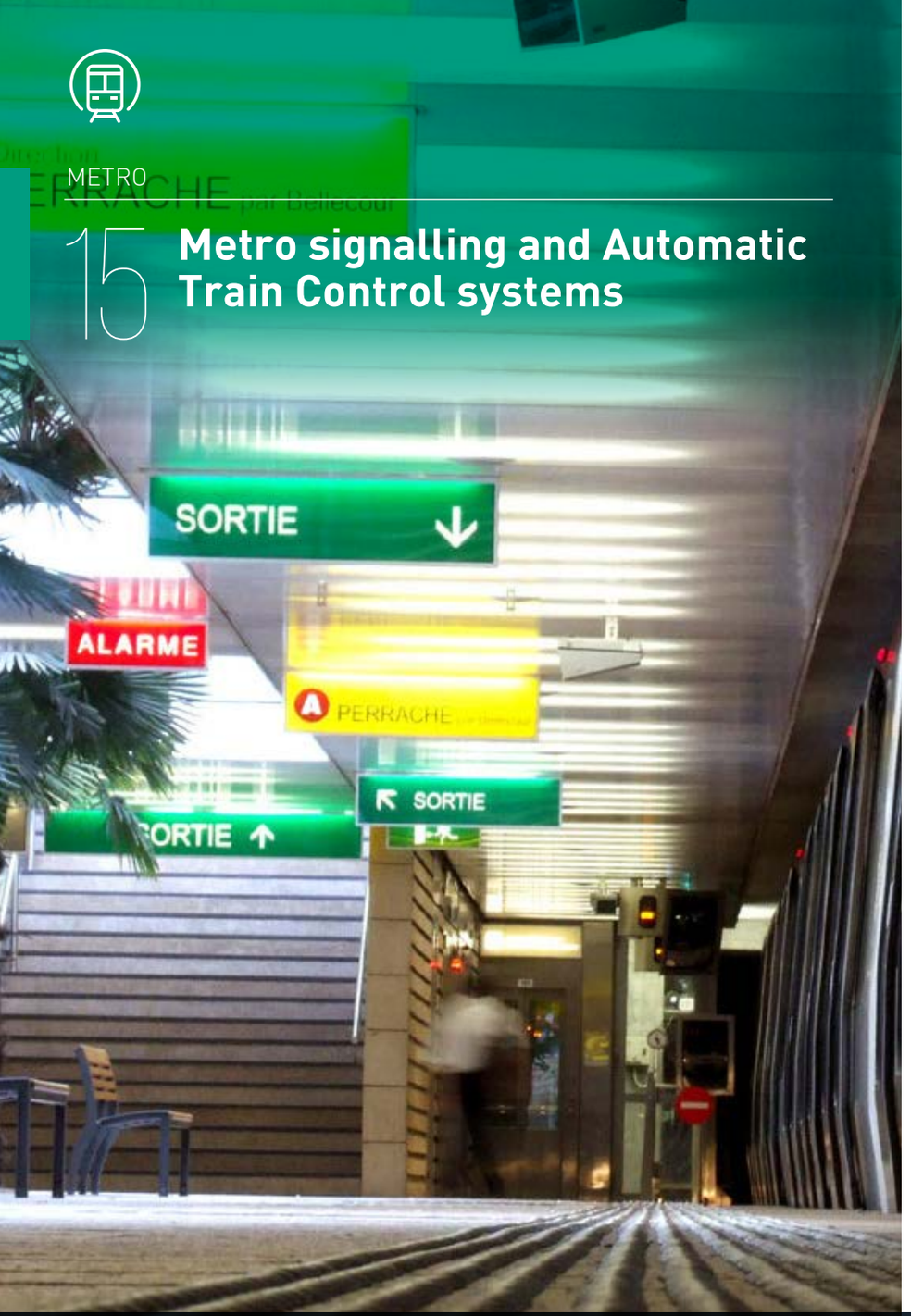
1 day

OBJECTIVES

The aim of the course is to present the items that are essential to understand how to manage the technical risks that may arise in underground construction sites and the tools to assess them and mitigate them.

PROGRAMME

- **Reminder of legal regulations**
- **Risk reduction option:** vulnerability, geotechnical survey, works supervision tools and method
- Example of Egis **project risk matrix**
- **Return on experience** (case study)



METRO

15 Metro signalling and Automatic Train Control systems

DURATION

1 day

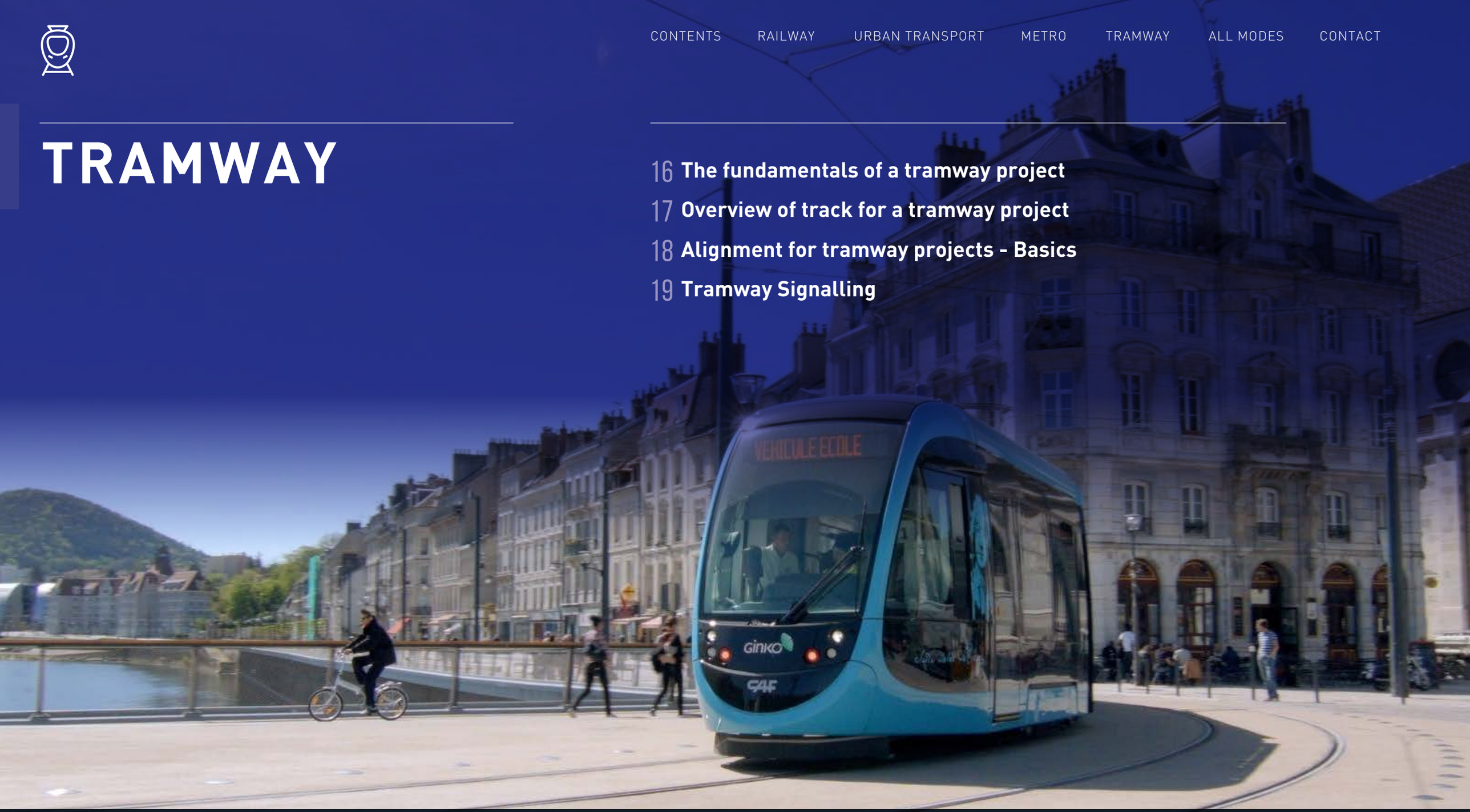
OBJECTIVES

This course aims to provide an introduction to signalling system used in metros. It includes a description of the functions and technologies used, their use principles, and the challenges for signalling projects.

PROGRAMME

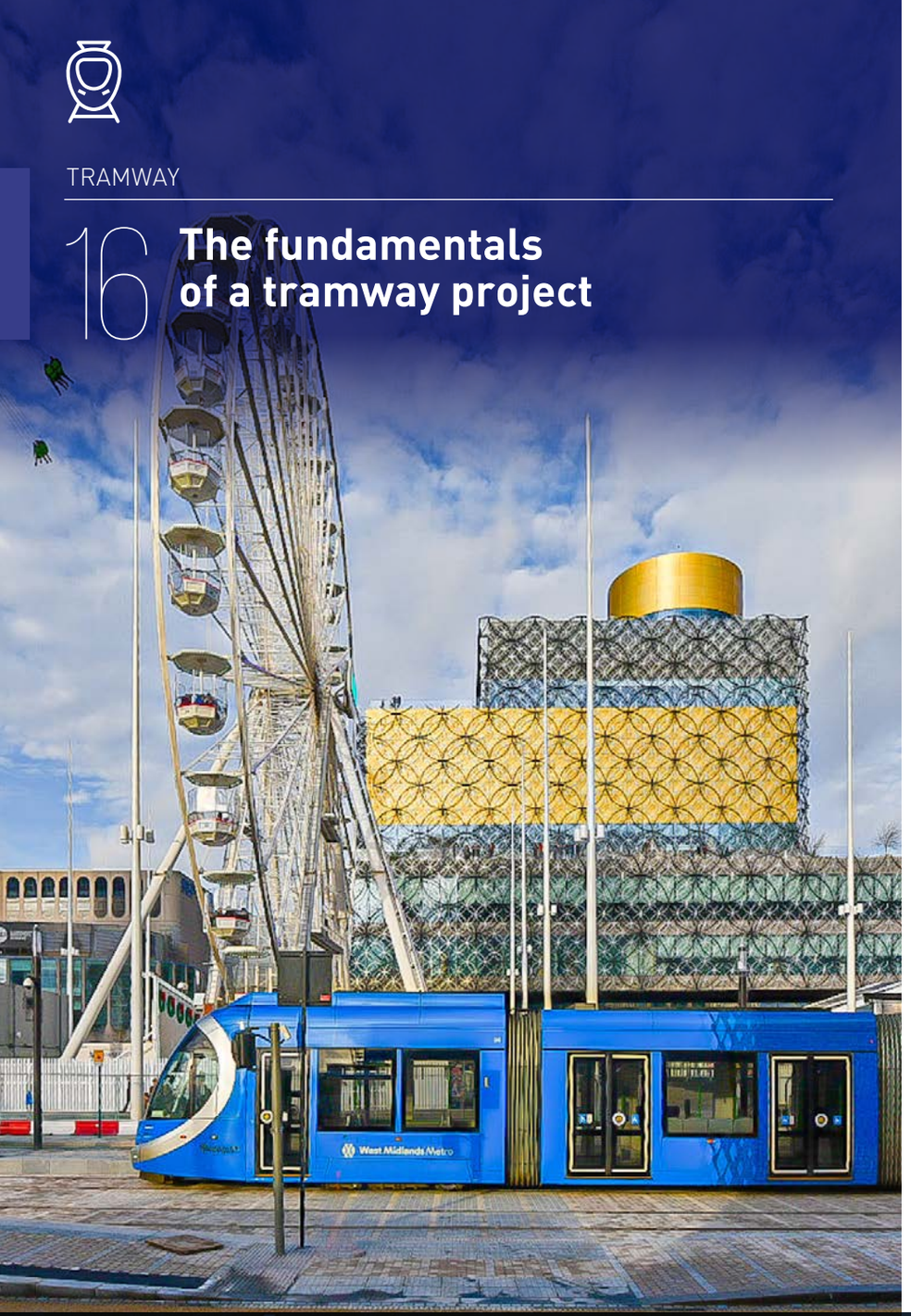
- **Introduction to signalling and Automatic Train Control technologies**
  - History of signalling technologies
  - Products and market players
  - Standards
- **Functions of signalling and Automatic Train Control systems (ATP, ATO, ATS)**
  - Grades of automation
  - Train protection and interlocking functions
  - Train operating functions
  - Traffic supervision and Automatic Route Setting functions
- **Architecture of signalling and Automatic Train Control systems**
  - Overview of Automatic Train Control system
  - Equipment examples
- **Operating principles of Automatic Train Control systems**
  - System initialisation constraints
  - Start-up and close-down of operation
  - Operation supervision
- **Challenges of signalling projects (new lines and refurbishment)**
  - Project risks and constraints
  - Best practices
  - Typical schedule
- **Case studies**

TRAMWAY



TRAMWAY

16 The fundamentals of a tramway project



DURATION

3 days

OBJECTIVES

From the initial idea through to actual commissioning, a tramway project is complex and involves many interfaces.

On completion of this course, participants will:

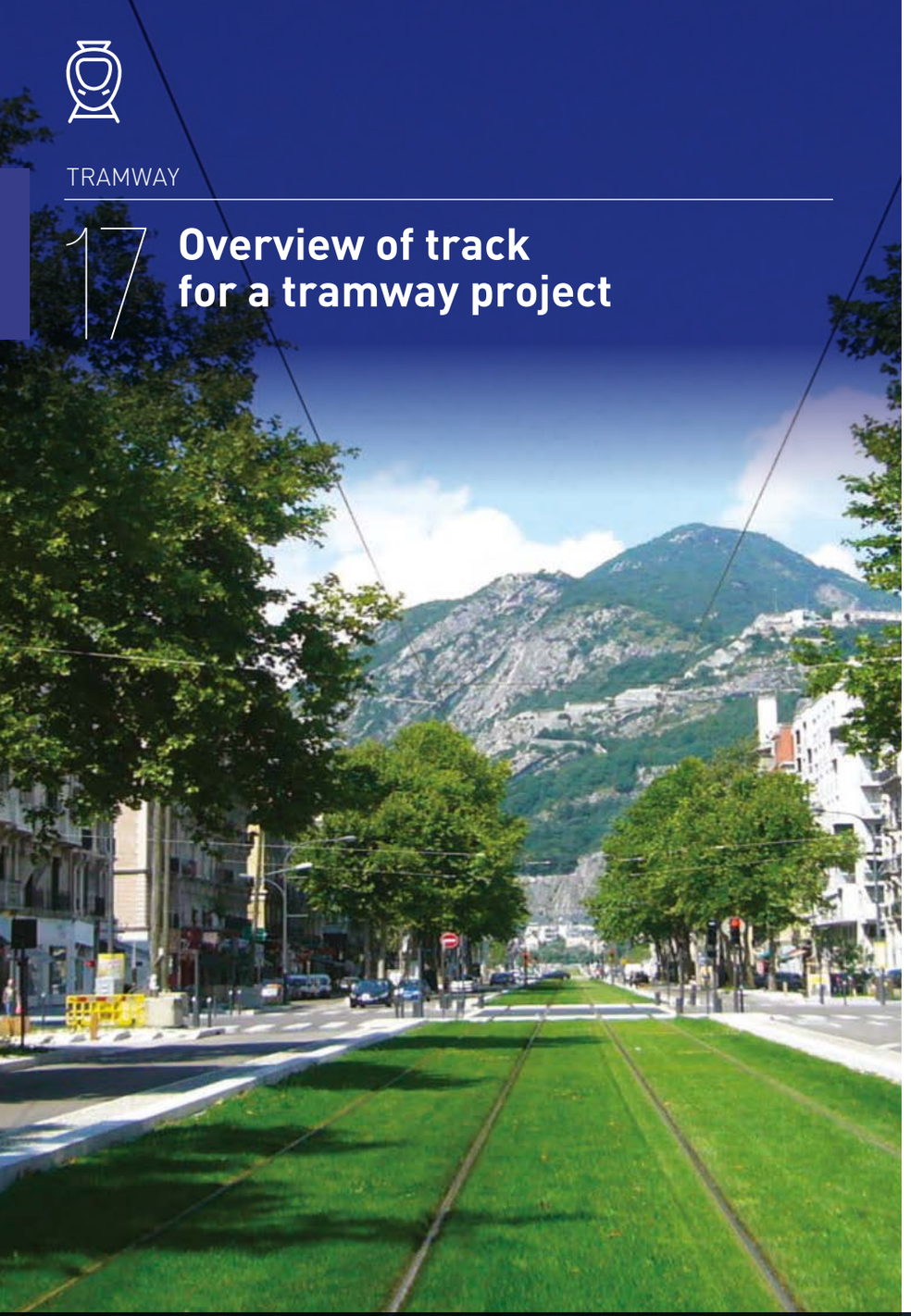
- Be familiar with the specific features of tramway projects
- Be able to accurately identify the main challenges of the different tramway project design and construction phases
- Understand the interactions between the different players, technical skills and specialities involved
- Understand that a tramway project involves an array of interfaces

PROGRAMME

- **Preliminary phases:** initial assessment and preliminary studies
- **Design phases:** from the preliminary design study to the working design studies
- **Internal organisation**, scheduling of studies, preliminary design
- The **detailed design** and tender documents phase
- The **systems in general**, signal and communication networks, and rail signalling systems
- **Power supply** and **overhead lines**
- **Stabling** and **maintenance centre**
- **Rolling stock**
- **Safety process**
- **Organisation, planning and coordination**, from the detailed design stage to assistance with acceptance procedures
- **Works phase** and worksite safety
- **End of the operation:** acceptance procedures/phase, sub-system and general tests, trial runs
- **Defect liability period**

TRAMWAY

17 Overview of track for a tramway project



DURATION

1 day

OBJECTIVES

Acquire and develop basic knowledge:
- on rail track
- elements of system design
- importance of implementation quality

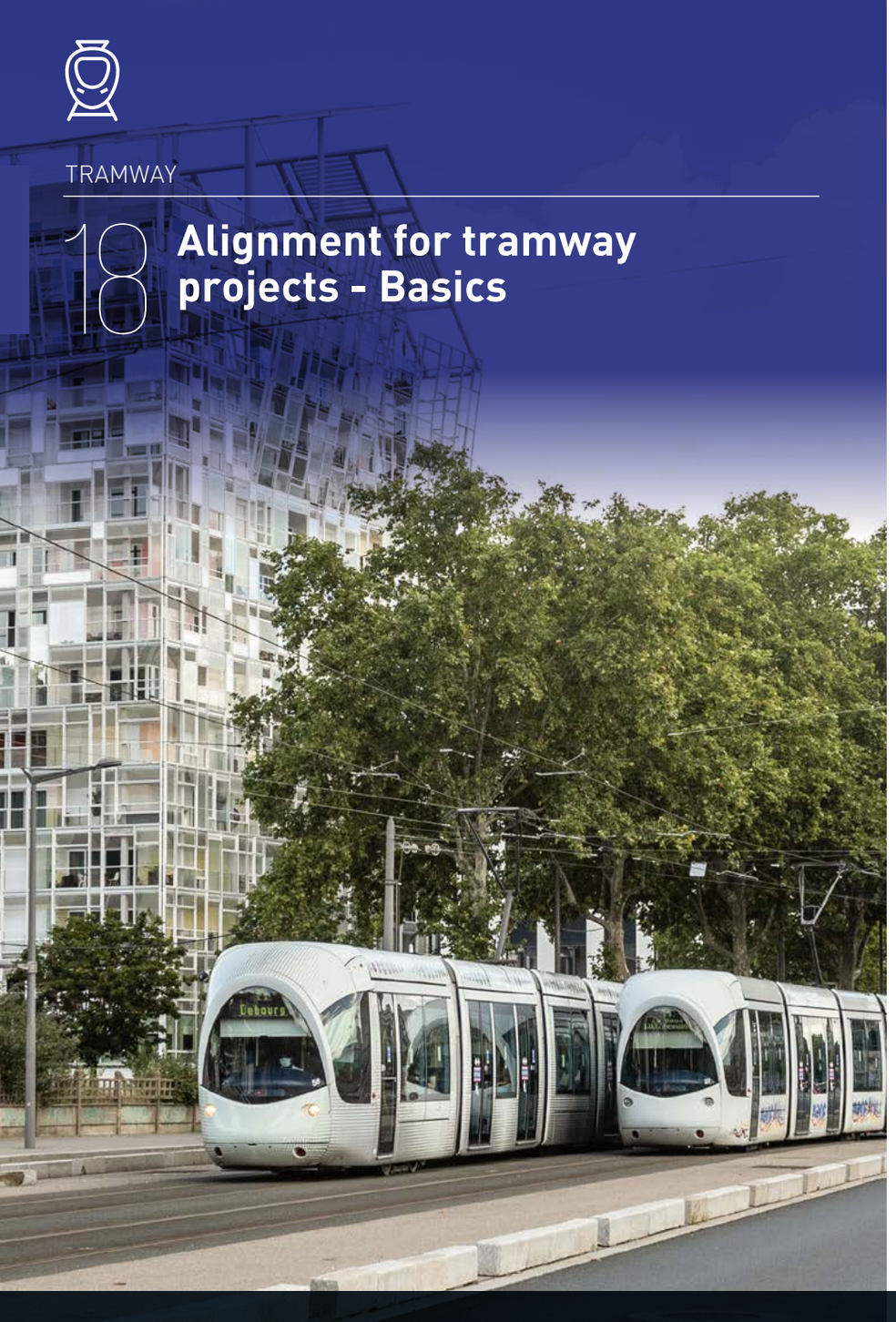
Raise awareness to:
- the influence of the transport system on rail track design
- the homogeneity of the transport project of which the track is an integral part
- managing constraints relating to integrating the rail track in its environment

PROGRAMME

- **Rail track basics**
- **Interfaces**
- **Rail track mechanical aspects**
- **Common designs**
- **Specific designs:** structure, prefabrication, etc.
- The **rail** and its **metallurgy**
- **Interactions** between track and structure
- **Function** and **design of track switches**
- **Rail welding**
- **Continuous welded rails**
- **Vibration phenomena**
- **Construction process:** issues and areas of vigilance
- **GHG footprint** and **sustainability**
- **Standards** and **guidelines**

TRAMWAY

18 Alignment for tramway projects - Basics



DURATION

1 day

OBJECTIVES

Understand the constraints of the alignment so as to anticipate its feasibility, understand the connection between alignment and urban integration (consequences of guided urban transport).

PROGRAMME

The basics of “technical” alignment:

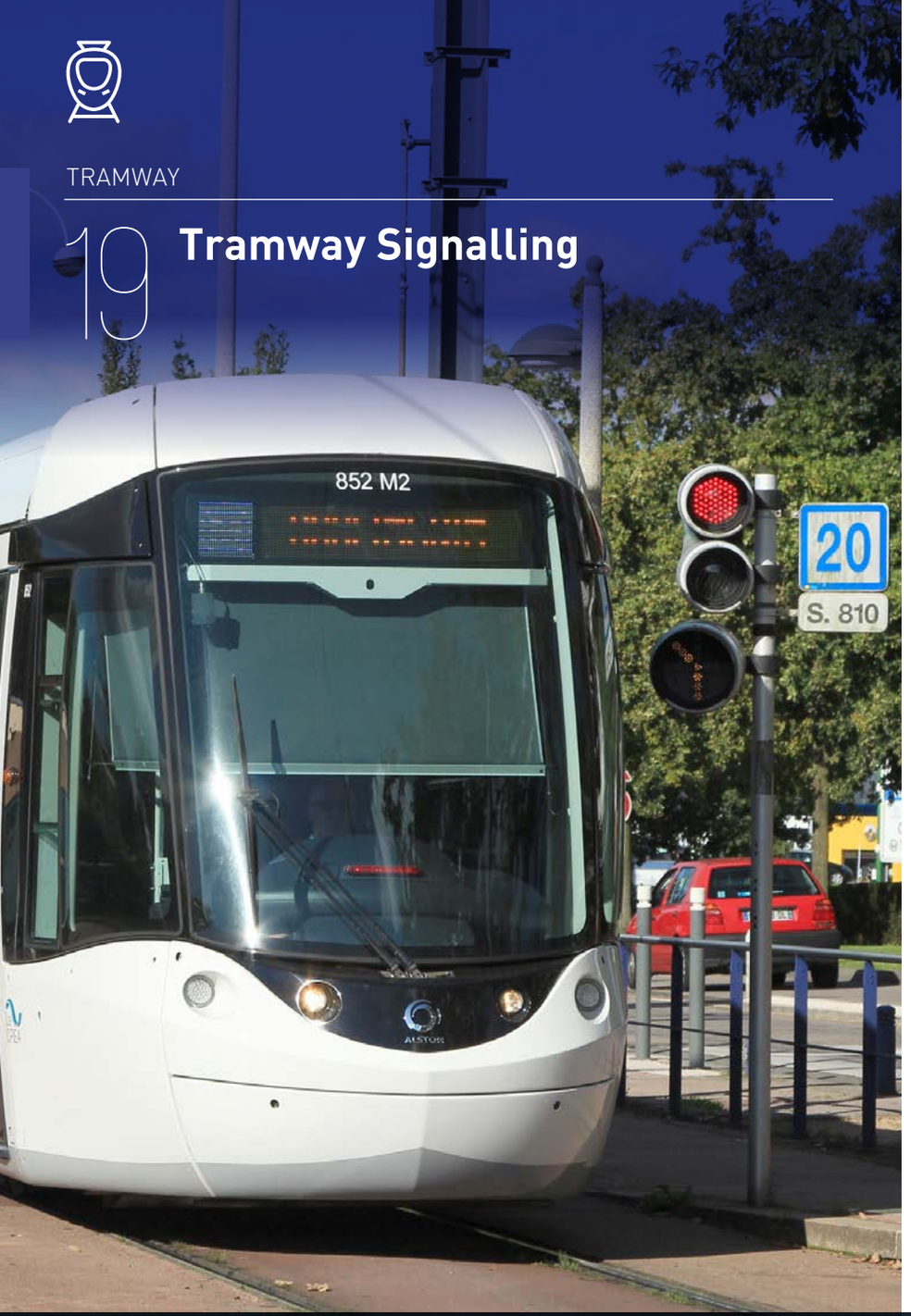
- **Constraints relating to rolling stock**
- **Constraints relating to comfort parameters**
- **Constraints relating to rail track** (and other systems or infrastructure): turnout areas, triangle design, railway signalling, stations, bridges and tunnels

The urban integration of the tramway:

- **Rules** resulting from the fact that the tramway is guided
- **Consideration of PRM** issues (contrasts, kerb view, etc.)
- I**nteraction with active transport modes**: pedestrians, bicycles

TRAMWAY

19 Tramway Signalling



DURATION

1 day

OBJECTIVES

The objective of this training is to provide participants interfacing with tramway signalling with an introduction to the key issues and the principles of this speciality.

On completion of this course, participants will have a general knowledge of tramway signalling and a "System" global view of the project.

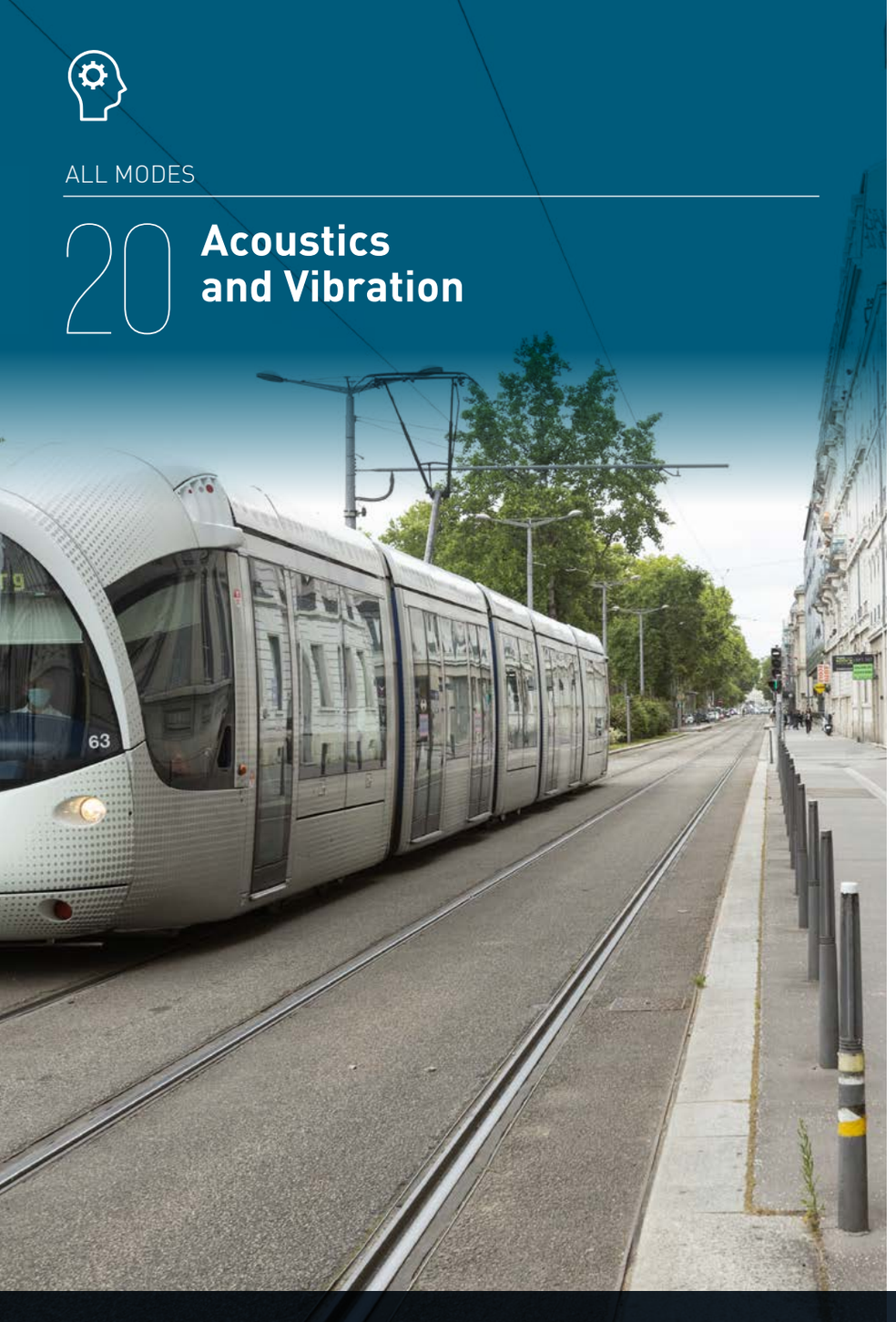
PROGRAMME

- **Introduction**
- Tramway Operation **Main Principles**
- **Roles** and **main functions** of tramway signalling
- **Signalling Architectures**
- Tramway Signalling **Specificities**
- **Interfaces** with other systems
- **Signalling** at crossroads
- Examples and **case-studies**
- **Switching areas**
- **Supervision**

ALL MODES

ALL MODES

20 Acoustics and Vibration



DURATION

1 day

OBJECTIVES

This course enables attendees to understand:

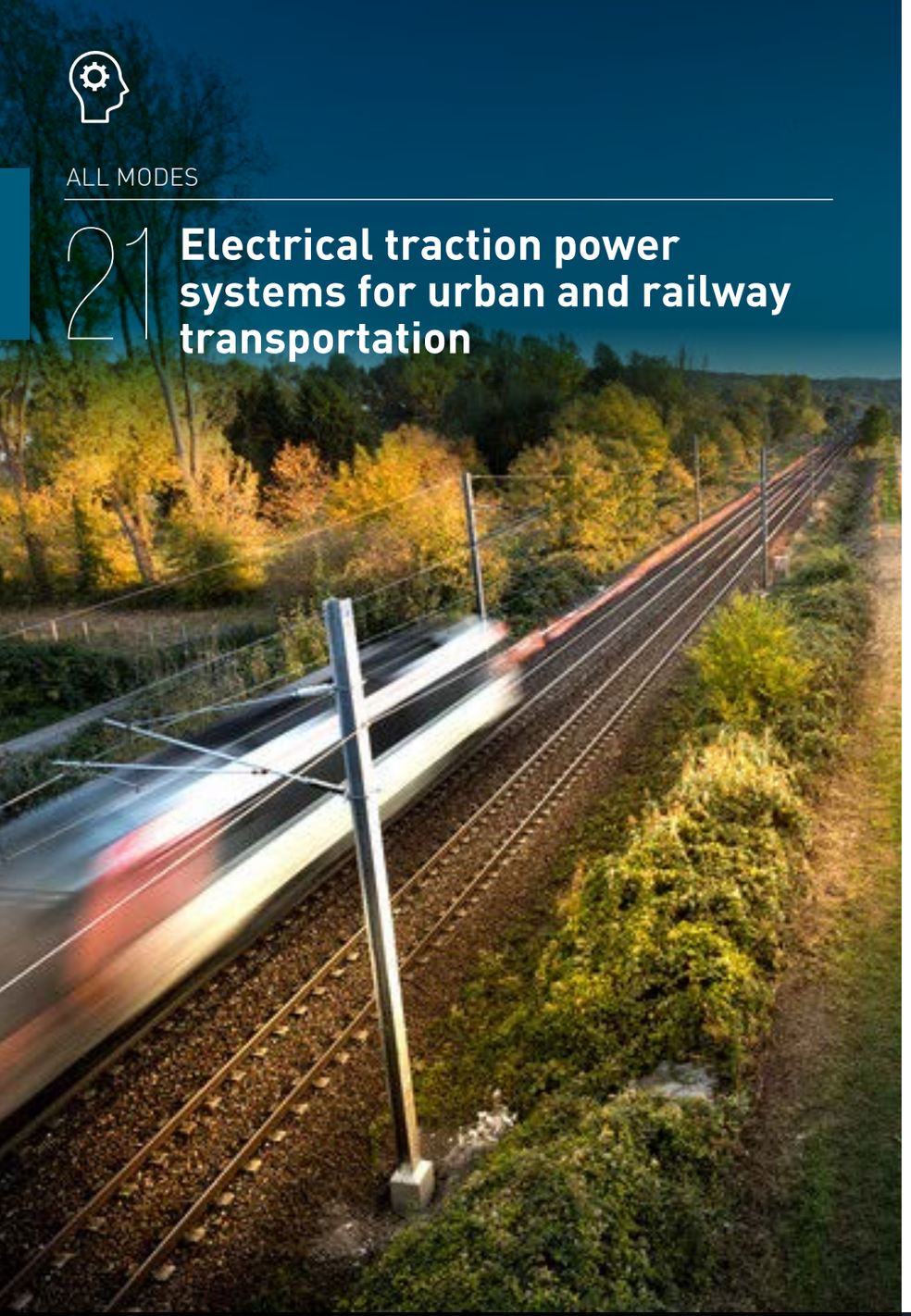
- The technical and regulatory issues of controlling vibration
- The procedure for conducting a noise and vibration study as part of an urban and railway projet

PROGRAMME

- **Introduction:** definitions and connection with project management
- **Quantification:** physical parameters
- **Legislation:** vibratory disturbance and target values
- **Vibration control:** parameters and method
- **Railtrack and damping:** design of damped rail track
- **Rail track and noise:** track in the generation of rolling noise
- **Vibration and Egis projects:** a few examples
- **Conclusions:** controlling vibrations in urban and railway projects

ALL MODES

21 Electrical traction power systems for urban and railway transportation



DURATION

1 day

OBJECTIVES

The main objective of this course is to present power supply infrastructure: high voltage, low voltage, traction and distribution online (overhead contact wire/catenary, 3rds rail, etc.).

The programme presented below is à la carte, with the possibility of focusing on one of the points presented depending on your requirements.

PROGRAMME

À la carte

- **A short history** and overview of electric traction
- **High-voltage architecture**
- **Traction generation architecture**
- **Traction distribution** architecture
- Autonomous electric **vehicle charging**
- **Traction, low voltage, high-voltage sizing**
- **Main interfaces**
- **Protection against hazards specific to electric traction**
- **Main legal** texts
- The **project procedure from the programme manager perspective**

ALL MODES

22 Ticketing System Automatic Fare Collection

DURATION

1 day

OBJECTIVES

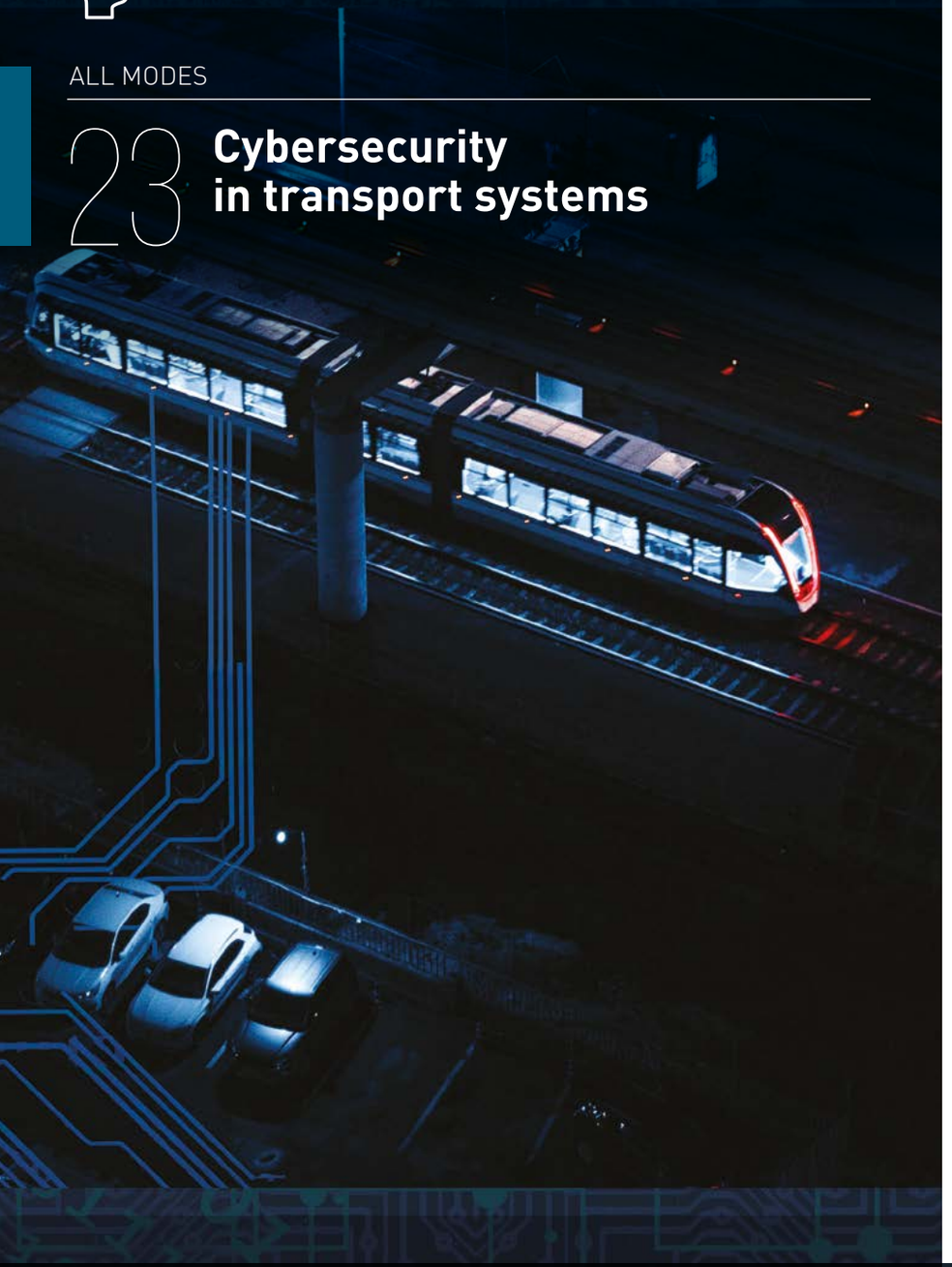
Identify the different existing technologies, new approaches and their specificities of use.
Define the contributions made by digital technology to a "traditional" ticketing system.
Choosing a system suited to your network, fare policy and goals.
Organise the sharing of solutions among the various public transport authorities.

PROGRAMME

- **Introduction:** financial revenue generated by Ticketing System
- **Fare media:** traditional tickets / digital media (including credit card)
- **Ticketing architecture:** "card-centric" / "architecture-centric"
- The notion of **Customer Experience**
- **Open Payment**
- **Sales Distribution channels** (on site, website)
- **Effective change management**
- **Clearing houses**
- **Interoperability between transport networks** (metro / tram / buses of a same area, national interoperability)
- **Customer management, After sales service**
- **Maintenance of Ticketing System**
- **About Ticketing system** equipment (sales, validation)
- **Equipment manufacturers**

ALL MODES

23 Cybersecurity in transport systems



DURATION

1 day

OBJECTIVES

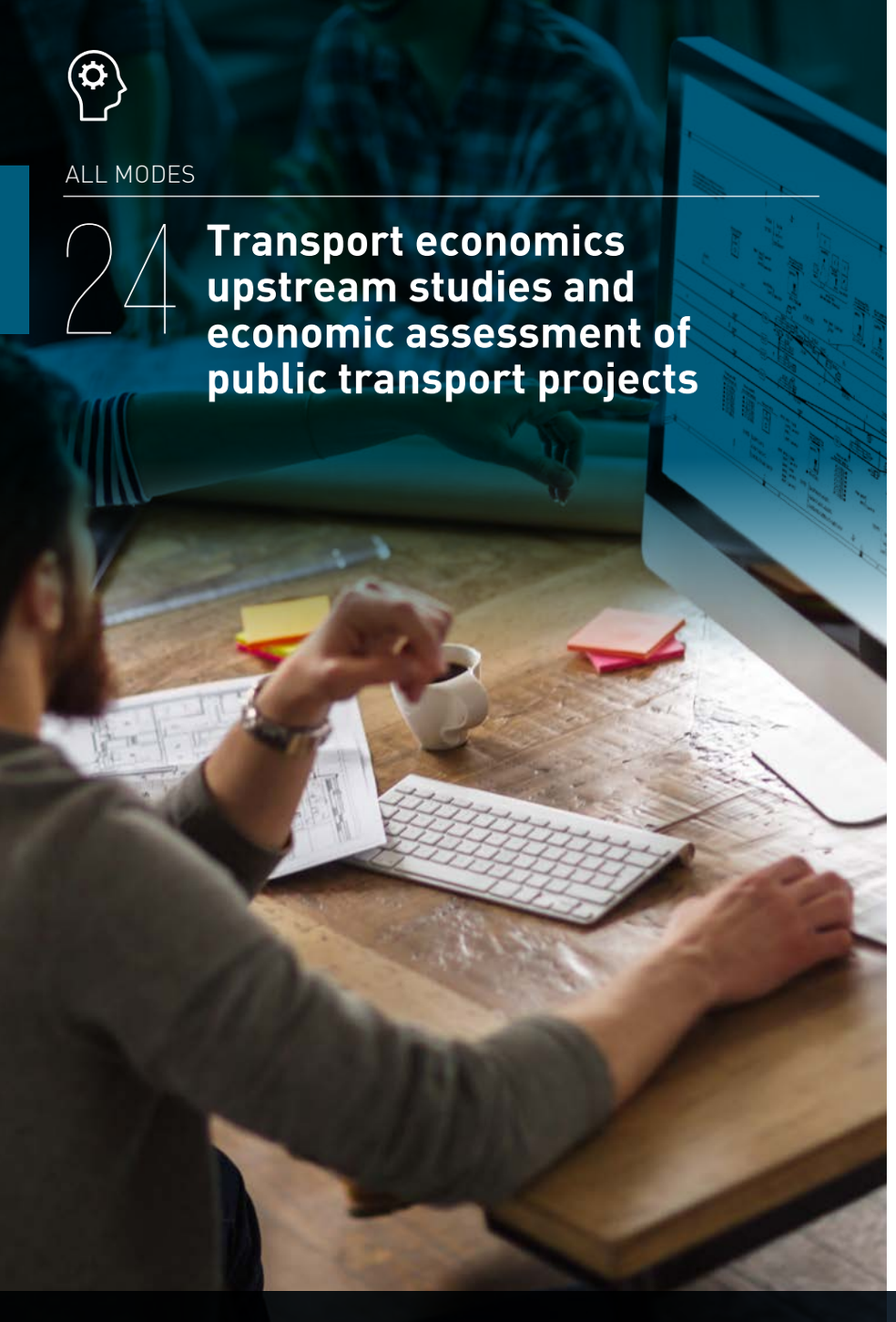
Understand the importance of cybersecurity and the specific aspects of its application to the transport sector.

Become familiar with all the different dimensions of cybersecurity (methodological, regulatory, organisational and technical) and with the approaches that need to be implemented in order to comply with statutory obligations

- Acquire knowledge of the main concepts and references
- Become capable of conducting a macroscopic assessment of the situation
- Become capable of defining an action plan

PROGRAMME

- **Overview of cybersecurity and cybercrime**
- **Standards, industrial information system templates,** frames of reference, best practices
- **LPM** (French Military Programming Law), NIS directive, GDPR
- **Institutional players, service providers,** management
- **Technical founding principles, equipment,** technical rules
- **Implementation**
- **Application of knowledge** acquired during a workshop



ALL MODES

24 Transport economics upstream studies and economic assessment of public transport projects

DURATION

1 day

OBJECTIVES

Before carrying out detailed design studies for a transport project, upstream studies must be carried out to determine the main characteristics of the project and compare the possible alternatives (alignment, mode, etc). Some of these studies involve identifying travel needs within a particular area, establishing ridership or revenue forecasts, and carrying out socioeconomic and financial assessments, which are essential tools for comparing different alternatives, assessing the impact of the project or optimising the project selected.

In particular, socioeconomic assessments are an integral part of the evaluation and optimisation of a transport project.

This training course provides an understanding of the mechanisms of a socioeconomic assessment and how to interpret them.

PROGRAMME

Transport economics upstream studies

- **Presentation of the main professions** in transport economics (socioeconomics of territories, definition of transport policies, ridership forecasts, socioeconomic assessments, etc.)
- **Presentation of the main types of analysis** (diagnoses, identification of travel needs, matching transport supply and demand, socioeconomic and financial assessments, optimisation of revenue or passenger numbers, LOTI assessments, etc.)
- **Focus on input data:** main data, risks and associated difficulties
- **Focus on traffic forecasting studies** and traffic modelling

Socioeconomic assessment

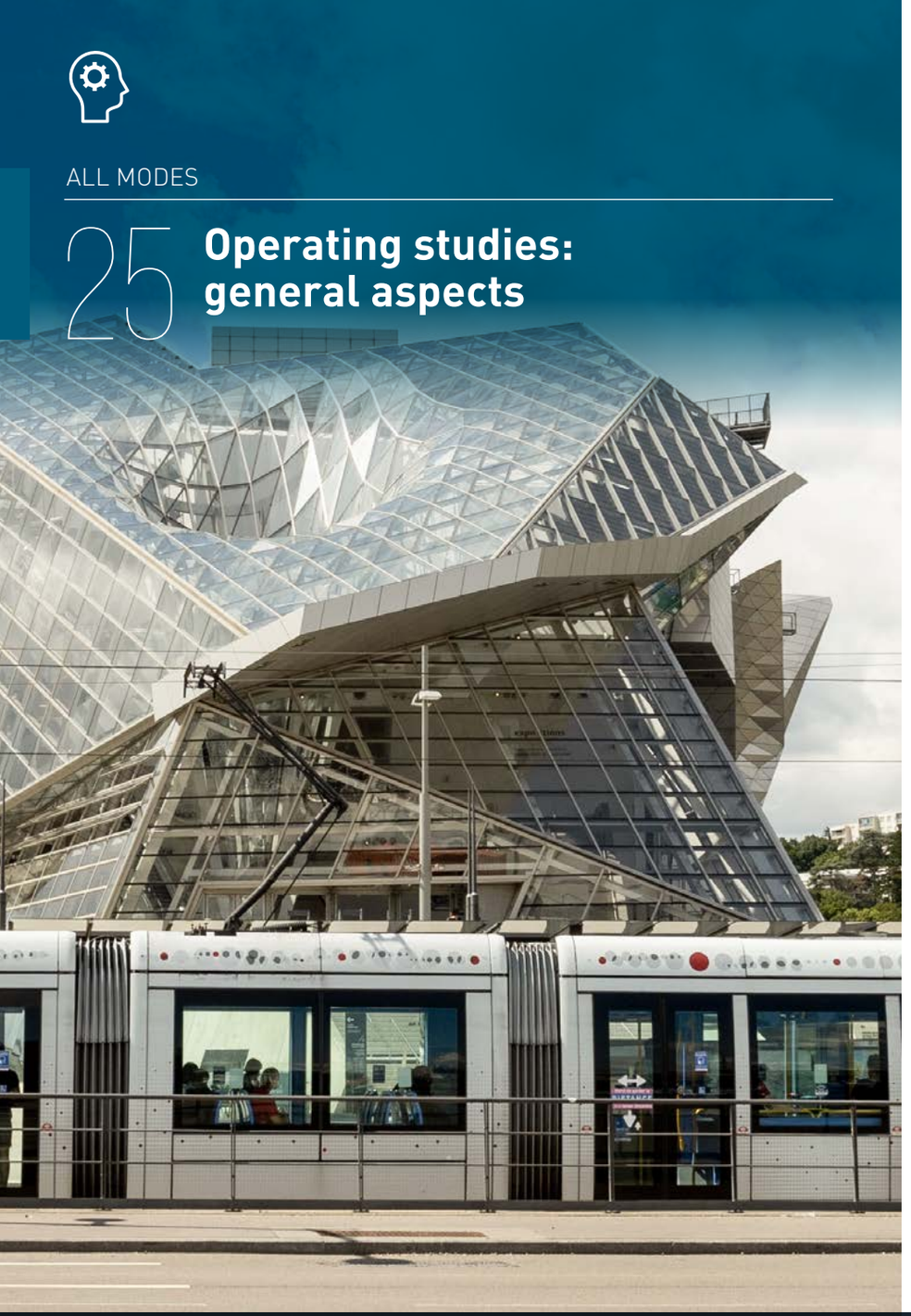
- **Presentation** of the 2014 Framework Instruction
- **Objectives** of socioeconomic assessment
- **Limitations** of the socioeconomic assessment
- **Best practice** sharing

Socioeconomic analysis / project prioritisation

- The **main objectives** of the socioeconomic analysis
- The **main principles** of monetization, discounting and the main reference values
- The **main indicators** (NPV, SEB)
- **The use of these indicators** to compare projects

ALL MODES

25 Operating studies: general aspects



DURATION

1 day

OBJECTIVES

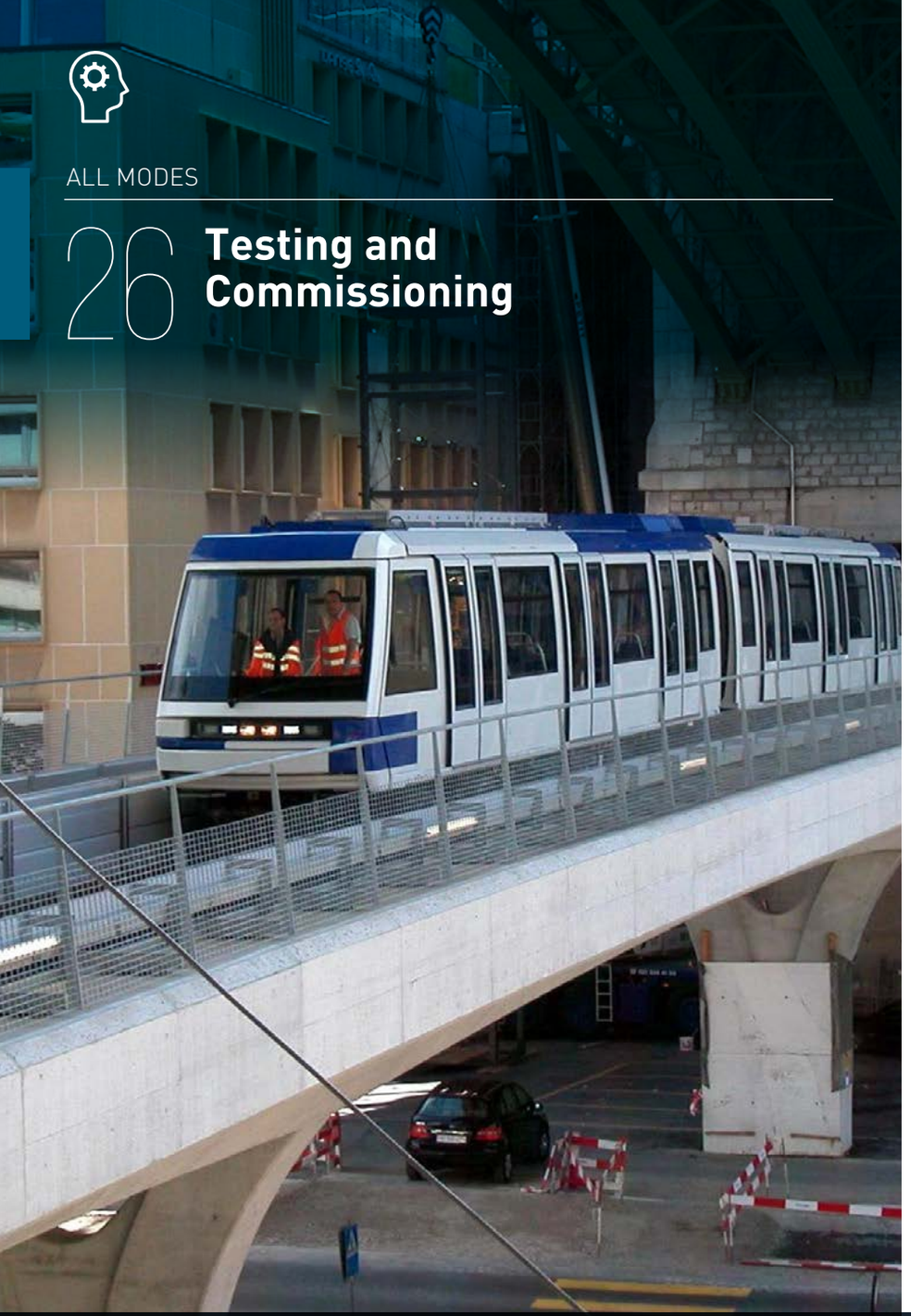
The operating studies are an essential phase of any rail or urban transport project, in particular during the decision-making and programme finalisation stages (preliminary studies and designs). To understand all the studies performed for each mode of operation (Metro, Tramway, Railway), a solid grasp of the main principles of operation is required.

On completion of this course, participants will:

- Be familiar with the operating principles (all modes) involved in designing transport systems
- Be familiar with the issues at stake and the content of operating studies in order to incorporate the operation dimension into the preliminary assessments and design studies

PROGRAMME

- **Principles of operation**
- **Conducting operating studies:** inputs, outputs, simulation tools
- **Integrating operating studies into projects:** when should an operating study be conducted?
- **Operating urban transport systems:** the specific characteristics of tramway and metro systems
- **Operating a railway line:** specific characteristics



ALL MODES

26 Testing and Commissioning

DURATION

1/2 day

OBJECTIVES

The main objective of tests is to demonstrate that the transport system as a whole fulfils the requirements defined at the beginning of the project.

With this course, participants will understand:

- The test strategy
- The fundamentals of temporary operation
- The schedule

PROGRAMME

- **Definitions:** V&V definitions T&C definitions
- **Test strategy:** main purpose / main actions / milestones / test track
- **Temporary operation:** why & how
- **Main system test:** opening / integration / performances
- **Schedule**
- **Return of experience**

ALL MODES

27 Integrated logistics support management on transport systems

DURATION

2 days

OBJECTIVES

For a transport system to be maintained in optimal conditions, the expectations and constraints of maintenance operators must be taken into account by industrial players right from the equipment and systems design stage. The assessments, tools and documentation used for maintenance are just some of the "logistics support" components that are fundamental for maintenance operators, but which are all too often addressed at the end of a project.

Integrated logistics support (ILS) management aims to make sure that designers integrate – from the outset of project design – the future issues inherent to maintaining the systems in operating conditions throughout their entire life cycle, from routine daily maintenance through obsolescence management to large-scale renovation operations.

On completion of this course, participants will:

- Understand the issues inherent to ILS activities on transport projects
- Have acquired an overview of ILS activities as they relate to systems and contractors, from the general design phase through to the end of the defects liability period
- Have the skills required to take ILS activities into account in the tender documents and in contract management & monitoring

PROGRAMME

- Issues and objectives of implementing an ILS approach on a transport system project
- Useful notions and definitions
- The main components of ILS
- "I" for "Integrated": integration of Logistics Support in design activities
- Planning and managing ILS during the general design phase
- Formalising ILS objectives in our specifications and tender evaluation processes
- Monitoring industrial players during the detailed design and manufacturing phases

ALL MODES

28 From BIM to digital twin: the deployment of a digital twin for your transport project

DURATION

1 day

OBJECTIVES

This course, intended to be both interactive and operational, will enable attendees to

- Understand the benefits of a "digital twin"
- Identify the role of a "twin" and areas of complementarity with traditional CMMS, Facility management, Asset management and EDM tools
- Find their way through the trends in terms of technology, practices and standards: BIM, GIS, IoT, interoperability, platforms, etc.
- Understand the life cycle of a digital twin
- Acquire knowledge on the success factors for a digital twin approach in project phase or following commissioning
- Put theory into practice

PROGRAMME

- **Practical application** with a role-play in a digital model: the digital twin for an easier contractor tendering process
- **Standards,** technologies and uses
- **Personal account from** a project manager on the contribution of digital tech to the design phase of a tramline
- Workshop **"The digital twin for a transport authority or operator:** benefits and obstacles"
- Ingredients for **successful implementation**

ALL MODES

29 Rolling Stock Mechanical System Design

DURATION

2 days

OBJECTIVES

The major objective of this course is to describe major aspects of rolling stock in order to give attendees general knowledge of rolling stock architecture.

On completion of this course, attendees will:

- Have a fundamental knowledge of main mechanical components
- Understand main physical phenomena that can affect safety and passenger comfort when a train is operating
- Understand the process of carbody design
- Understand how FEAs have to be managed to give accurate results
- Have knowledge of the main properties of steel and aluminium

PROGRAMME

- **Overview of major aspects of Rolling Stock:** main components and mechanical interfaces with infrastructure
- **Fundamental mechanical components:**
  - Brake system
  - Bogies
  - Current collection
  - HVAC
  - Doors
  - Coupler
  - Sanding
  - Greasing
- **Principle of vehicle dynamics and Noise and Vibration**
  - Vehicle Dynamics
  - Gauge
  - Noise
  - Vibration
- **Fundamental of Carbody design**
  - Carbody elements
  - Functions of carbody
  - Carbody design
  - Crashworthiness
  - Mechanical assemblies
  - Materials
  - Carbody measurements
- **FEA and material properties**
  - FEA Modelling
  - FEA Calculations
  - Specificities of dynamic FEA
  - Materials properties
- **Case study**

ALL MODES

30 Rolling Stock Electrical System Design

DURATION

2 days

OBJECTIVES

The major objective of this course is to describe the major aspects of rolling stock in order to give attendees general knowledge of rolling stock architecture.

On completion of this course, attendees will:

- Have a fundamental knowledge of main electrical components
- Understand complete electrical system architecture by studying diagrams and identify vital and non-vital systems that can affect safety and/or passenger comfort when a train is operating

PROGRAMME

- **Overview of major aspects of rolling stock**
  - Rolling stock general overview
  - Rolling stock main components
  - Rolling stock electrical control
- **Fundamental electrical components**
  - Power supply and distribution
  - High voltage supply components
  - Electronic components
  - Traction motors
  - Pulse Width Modulation (PWM) control
- Vehicle **electrical system diagram**
  - Basis of electrical system diagrams
  - Rolling stock diagrams
  - Software presentation
- **Basic understanding** of electrical control for the trains to its brakes, to OCC, to doors, and other components to trains
  - Presentation of control and command interfaces
  - Onboard data-systems and control
  - Onboard data systems on railway applications
  - Functional constraints and performance analysis
- **Case study**

ALL MODES

31 Depot equipment and service vehicle design

DURATION

2 days

OBJECTIVES

- Describe the general considerations for depot equipment and service vehicle design
- State interfacing requirements between depot equipment and civil works
- Explain the use of service vehicles during maintenance works
- Discuss strategies to facilitate maintenance needs in consideration of planned and unplanned works
- Explain the various functions of the depot and distinguish the merits and demerits between different depot layouts though case study examples
- Explain operation research techniques to maximize depot equipment utilization rates and reduce turnaround time in consideration of overall maintenance provision of the rolling stock
- Explain strategies to optimize depot equipment and service vehicle provision
- Explain the use of locomotives, wagons and other depot vehicles for Track Related Installation Programme (TRIP)

PROGRAMME

- **Principles of Depot Equipment** and **Facilities**
  - Description of main functions in depot
  - Different between Depot Types
  - Types of Depot Layouts
  - Types of Depot Equipment
  - Types of Depot Facilities
  - Civil and E&M Interface
- **Typical Maintenance organization**
  - Maintenance Standards
  - Typical Organization
  - Main Roles and Functions
  - Preventive Maintenance
  - Overhaul - Refurbishing
- **Maintenance Strategies**
  - Maintenance strategies
  - Straying of maintenance costs
  - Evaluation of maintenance performances
  - Improvement of maintenance activities
- **Case study**
  - Maintenance organizations
  - Pros and cons of depot layouts
  - Optimization of depot functionalities and depot equipment

ALL MODES

32 Rolling Stock: Finite Element Analysis and Non-destructive Testing Techniques in Practice

DURATION

2 days

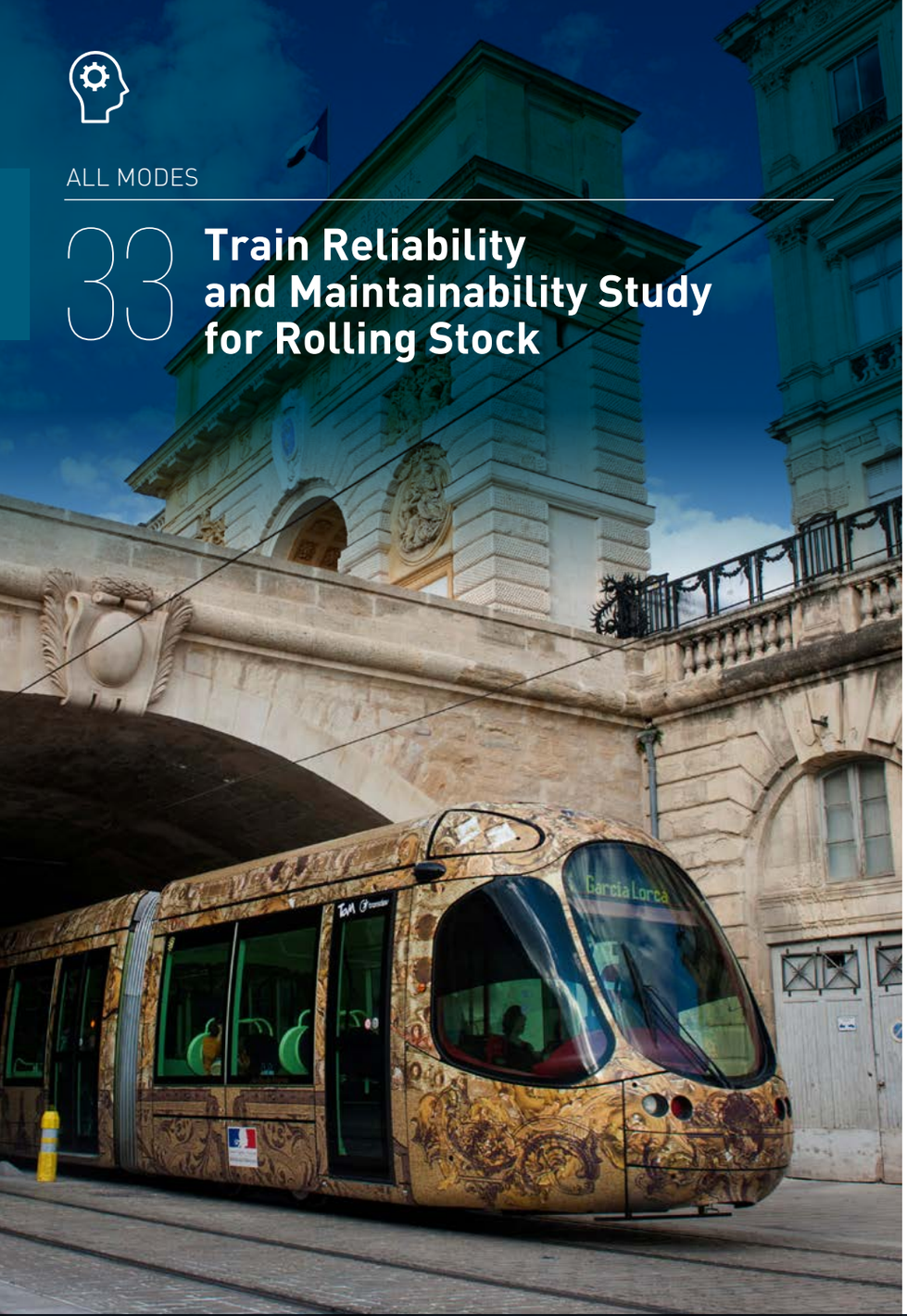
OBJECTIVES

The objective is to understand how the quality of rolling stock welding is ensured through the complete process from design to final inspection.

Participants will also understand when and for which cases Finite Element Analysis (FEA) for welded joints can be used.

PROGRAMME

- **Typical structure assembling, Standards and Testing**
  - Applicable Standards
  - Quality Requirements and Certification
  - Design Requirements
  - Production Requirements
  - Inspection, Testing and Documentation
- **Case studies**
- **Finite Element Analysis (FEA)**
  - FEA modelling
  - FEA calculations
  - Specificities of dynamics FEA
  - Materials properties
  - Typical steel and aluminium used for rolling stock underframe and carbody
- **Non-destructive testing (NDT)**
  - Type of tests
  - Certification requirements
  - Test description
  - Standards
  - Typical rolling stock railway application



ALL MODES

33 Train Reliability and Maintainability Study for Rolling Stock

DURATION

2 days

OBJECTIVES

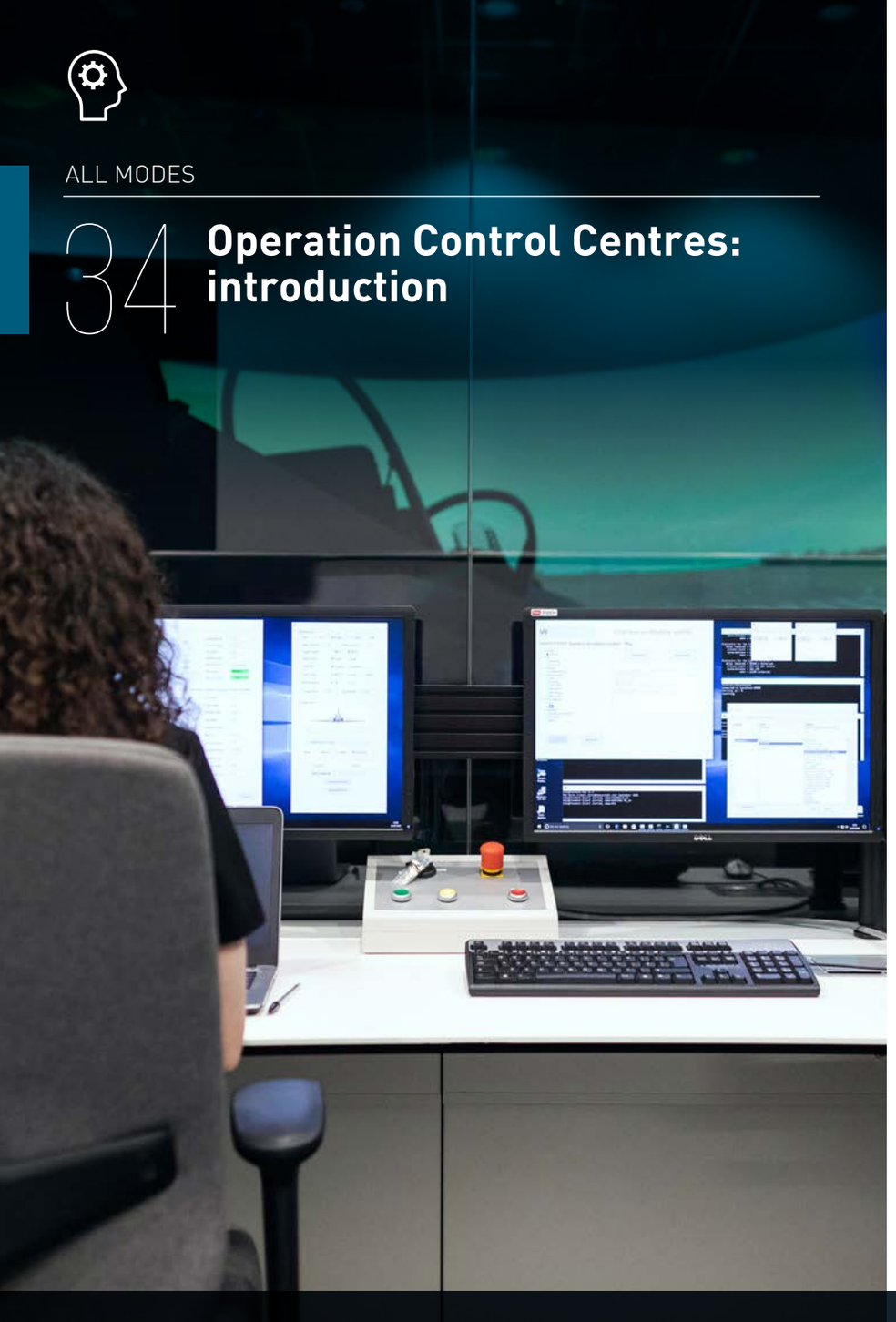
- Illustrate the system engineering approach in train design
  - Integration of mechanical and electrical sub-systems
  - Design considerations to facilitate operations and maintenance
  - Reliability considerations
- Explain Reliability, Availability, Maintainability and Safety (RAMS) requirements
- Describe the principle of redundancy in design
- Provide a basic understanding of conducting rail investigation studies
- Apply learning to a case study on a major train breakdown/incident

PROGRAMME

- **Principles and Standards** of RAMS activities
- **Standards**
- **Integration** of RAMS principles in Rolling Stock Projects
- **How to define and measure RAMS activities**
- Operation and Maintenance **Concept**
- The **principle of redundancy** in design
- Rail **investigation studies**
- **Case studies:** through different rolling stock applications, presentation of major cases of incidents of design errors

ALL MODES

34 Operation Control Centres: introduction



DURATION

1/2 day

OBJECTIVES

This course will enable attendees to acquire the basics to understand the constituent parts of a control centre.

PROGRAMME

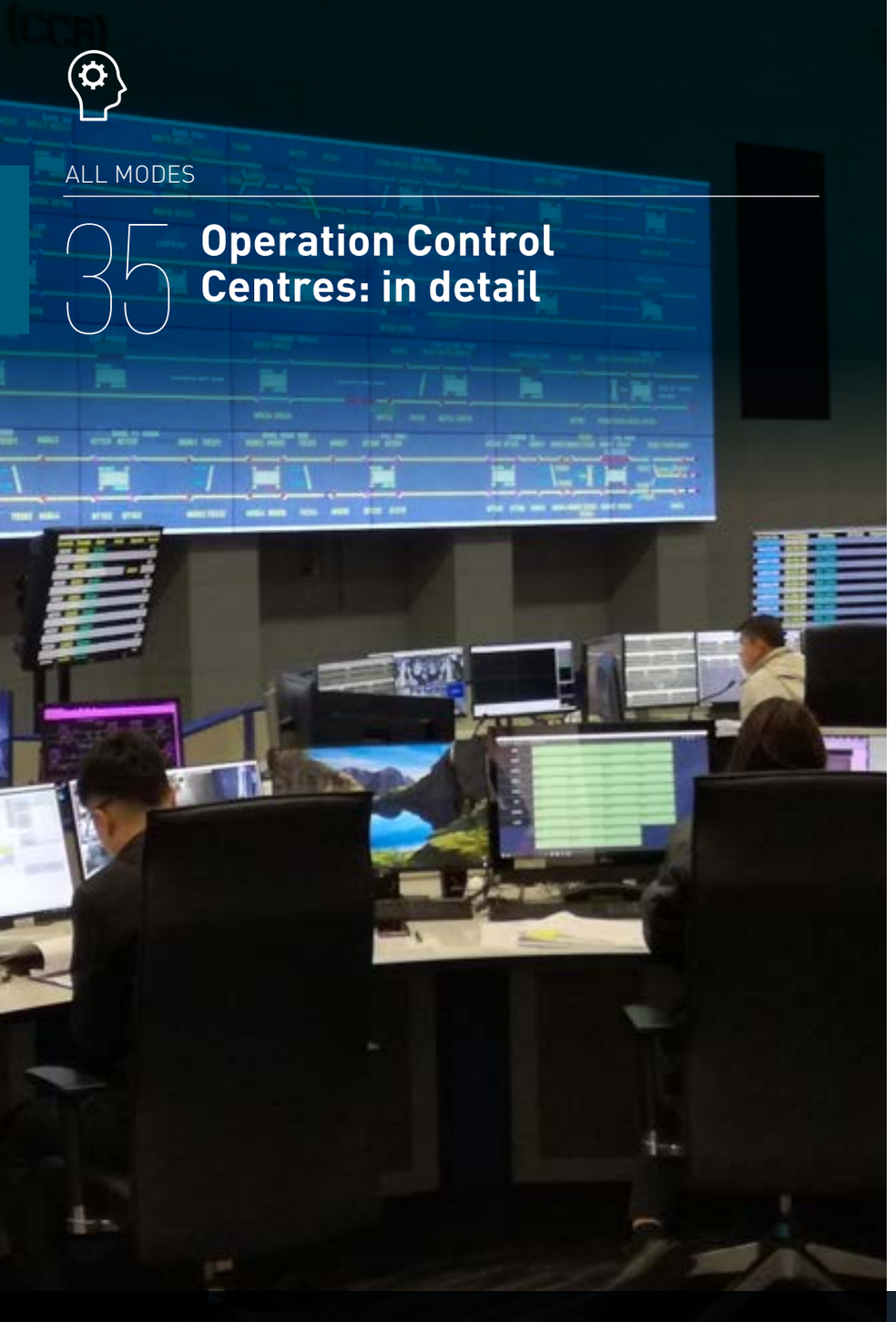
Presentation of operating areas of a control centre:

- **Train supervision, power, communications**
- **Traffic control**
- **Power distribution and control diagram**
- **Station control**
- **Maintenance control**
- **Simple technical précis**

A train-metro parallel can help to comprehend the cross discipline nature of OCCs

This initial training course can be supplemented by two other sessions on control centres:

- **In-depth knowledge of control centres**
  - operations and technical issues
- **OCC technical consulting** on a requested subject:
  - Ergonomics and HMI,
  - Train operation,
  - Testing and commissioning of an OCC,
  - Specific subject on request



ALL MODES

35 Operation Control Centres: in detail

DURATION

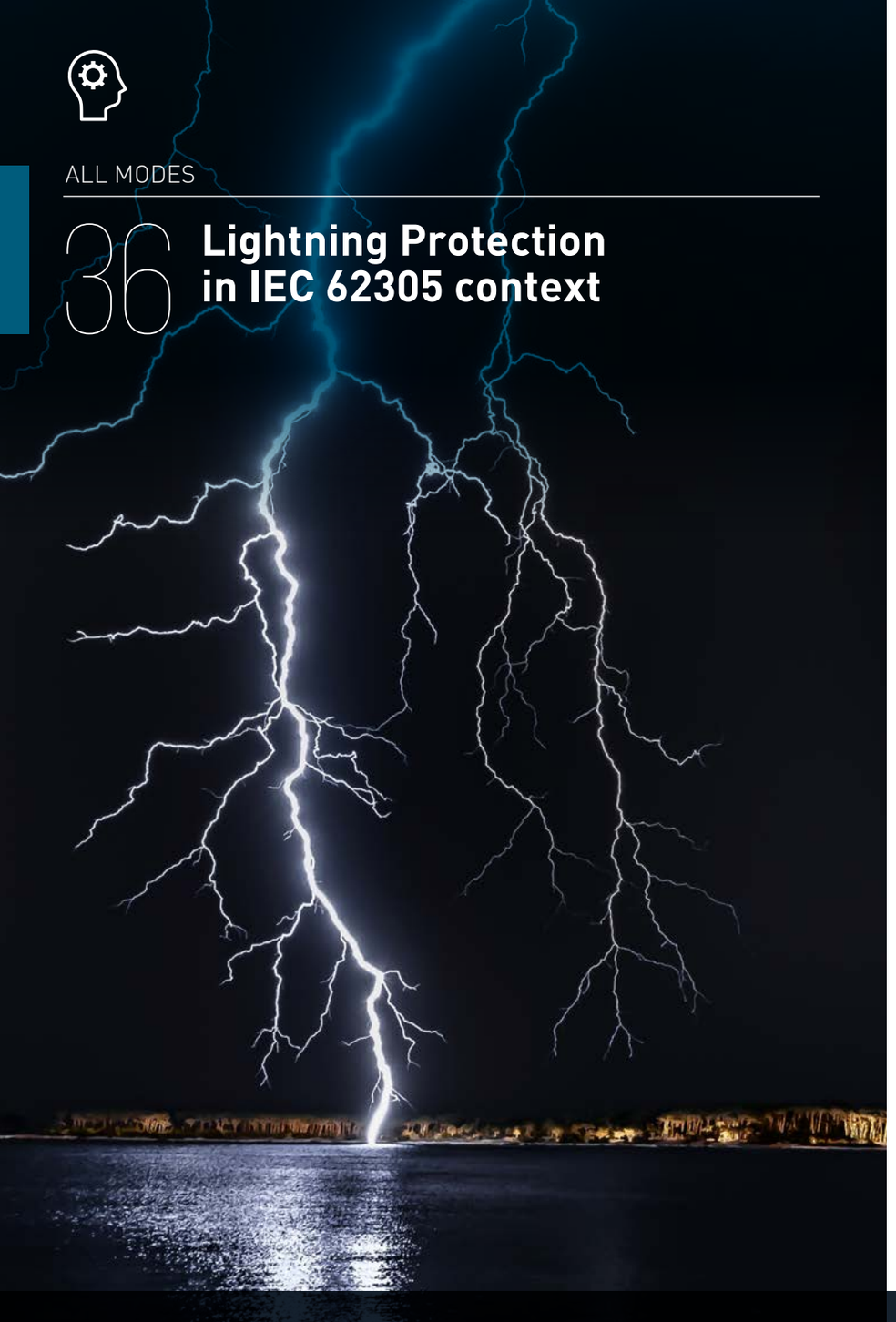
1 day

OBJECTIVES

This course will allow attendees to develop the key aspects of an OCC and discover a practical case study of an extension of a line under operation.

PROGRAMME

- **Establishment of main elements of a railway control centre –** HST, cross-country, metro, tramway
- **Consolidation of system** and technical knowledge
- **Case study of an extension** of a line under operation
- **Key points**
  - System extension
  - Tests on the whole project: from factory to trial run tests
  - Operation maintenance
  - Railway safety: EN 50128
- **Questions and discussions**



ALL MODES

36 Lightning Protection in IEC 62305 context

DURATION

2 days

OBJECTIVES

The learning objectives of this course are to:

- Raise awareness of the audience on the lightning risks and help them understand and choose adequate mitigations, in the context of IEC 62305 and SS 555 series
- Detail the methods available for the lightning protection of building structures and networks
- Present some case study examples

PROGRAMME

- Lightning **phenomenon** and effects
- Lightning **protection standards**
- Lightning **risk assessment**
- **External lightning protection system** – elps
- **Internal lightning protection system** – ilps
- **Controls** and **verification**

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