

University of Applied Sciences and Arts
of Southern Switzerland

SUPSI



competence centre
sustainable mobility and railways
innovation

2nd Version

TRSM

An Advanced Studies Program in Transportation



An integrated approach for the
next generation of mobility professionals.

With the support of



SBB CFF FFS

SWISSRAIL
Industry Association

The Transportation, Railways and Sustainable Mobility Program TRSM

TRSM is part of the SUPSI RSM Continuing Education Program.

An investment tailored to your individual requirements.

TRSM is a unique program in Transportation, Railways and Sustainable Mobility that allows organization to customize and shape their own training within defined context. It allows organization to define the focus of the modules contents and their level of expertise.

Flexibility, short reaction time, efficiency and innovative thinking are key factors in business environments as well as in continuing education. Therefore, the understanding, the management, and the development of a sustainable mobility are key aspects for corporate and industrial success.

Transportation is becoming a multisector and interdisciplinary industry, with continuously new products and concepts coming to the market. New pioneering approaches are urgently required to tackle the challenges of the next decades. Therefore, preparing the next generation mobility experts is becoming the central aspect for a flourishing economy.

As a holder of a degree of the TRSM Program, you are a recognized specialist in this discipline. You have a proven ability to master complexity and you are equipped with the fundamentals for further professional development.

With TRSM you grow to new dimensions: not a mobility manager, a mobility and technical leader!

RSM, exploring mobility.

Advanced Studies SUPSI in Transportation, Railways and Sustainable Mobility TRSM

Introduction

The Program on Transportation, Railways and Sustainable Mobility (TRSM) trains both technical and management leaders, intended for careers in the transportation industry and in the public/private sectors of mobility & transportation. This program is part of and is based on the SUPSI RSM Program and is specifically developed for international customers and organizations.

The RSM Program is a part-time program that allows for work-life balance and professional development. Six independent CAS, respectively two integrated DAS, are aligned to build a complete MAS. Students need to complete 5 CAS and a Master Thesis to obtain the MAS in Railways and Sustainable Mobility RSM.

Objectives

Students acquire the skills needed for careers in departments such as research and development, production, consultancy, and public institutions and are capable of taking responsibility to lead teams, to strategize concepts, and to manage complex interdisciplinary projects.

- > Understand and apply the concepts of integrated mobility
- > Acquire the latest skills and competencies in the mobility Sector
- > Immediately apply the new acquired competencies in the respective sector
- > Be familiar with the technical standards of railway and transportation system
- > Understand, and apply the latest technologies applicable to the mobility sector

Students will also be able to bring back innovative approaches to problem solving and technical challenges. Furthermore, the TRSM program wants to:

- > Create a network and establish a common platform of professionals
- > Promote an engineering mobility innovation thinking
- > Provide opportunities of workshops/intern positions in Swiss and European organizations (operators, manufacturers, maintainers)

Intended Audience

The TRSM program is devoted to managers and experienced employees from the railways and mobility sector as well as to people interested to work in this sector through the acquisition of the knowhow provided by this course.

Application Requirements

Bachelor Graduates from Engineering Programs, Management, or other Technical and Scientific faculties. Non-graduates Professionals and Manager from the fields Railways and Mobility with at least 3 years of experience based on a complete Dossier submission. The course is held in English (lessons and documentations) therefore good command of English is required.

Requirements might be changed in accordance with the international organization that submit a customized program.

Certificates

Diploma of Advanced Studies SUPSI in Railways and Sustainable Mobility RSM (30 ECTS). Certificate of Advanced Studies SUPSI in Railways and Sustainable Mobility RSM (10 ECTS). The University of Applied Sciences and Arts of Southern Switzerland (SUPSI) has university status in accordance with Article 2, Para 2, Let. b), is accredited in accordance with Article 28, Para 1, Let. a) of the Federal Act on the Funding and Coordination of the Higher Education Sector (HEdA) of 30 September 2011 and is recognized by the Confederation and by the Cantons.

The RSM Program in short

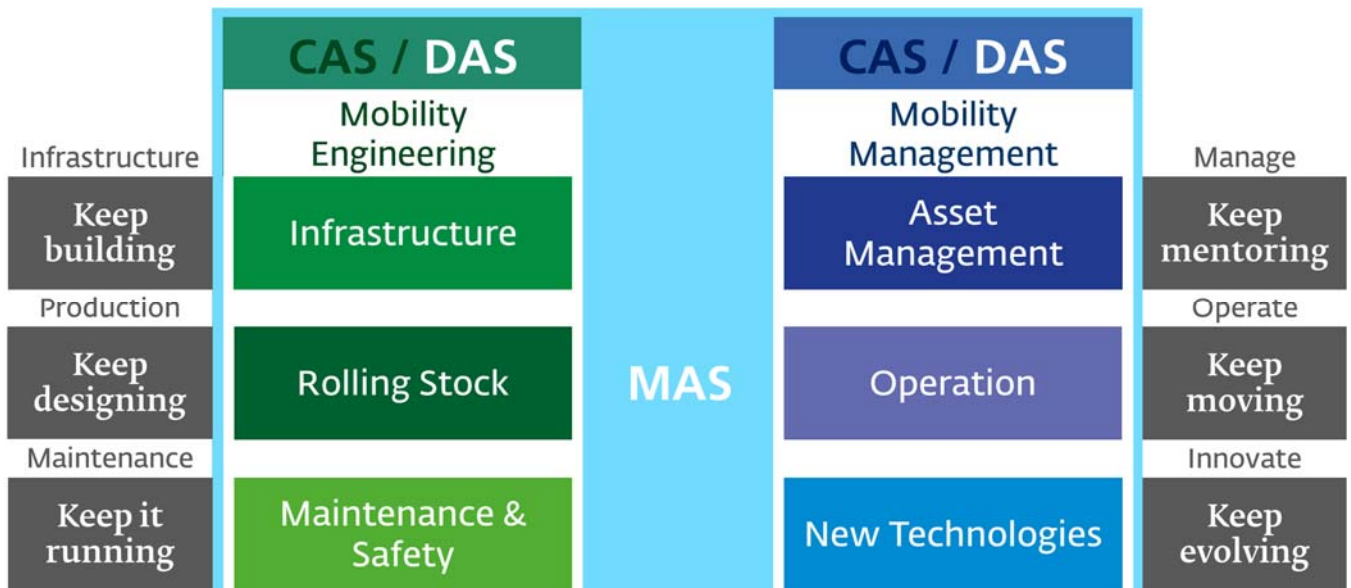
The course is divided into 6 specializations group. Each of which can constitutes a Certificate of Advanced Studies (CAS):

1. [Asset Management / Mobility Management \(MoMa\)](#)
2. [Operations / Operation Management \(OMa\)](#)
3. [New Technologies / Mobility Advanced Technologies \(MAT\)](#)
4. [Rolling Stock / Railway Vehicles Technology \(RVT\)](#)
5. [Maintenance & Safety / Integrated Technology \(InTech\)](#)
6. [Infrastructure / Infrastructure & Controls \(InCo\)](#)

CAS Programs can also be offered as SUPSI “Summer School” in the period between June and August in Switzerland.

Upon completion of 5 CAS and a Master Thesis, the attendee will receive a Master of Advanced Studies (MAS) SUPSI in Railways and Sustainable Mobility RSM.

RSM Structure



Duration

Each CAS must have a minimum of 120 hours of lessons, which accounts for 10 ECTS. The DAS shall have a minimum of 360 hours of lessons equaling to 30 ECTS.

Teachers / Lecturers

Industrial experts and academic specialists in the topics covered by the specific certificates modules.

Responsible & Contact

Simone Bernasconi

Managing Director msfi

Competence centre msfi

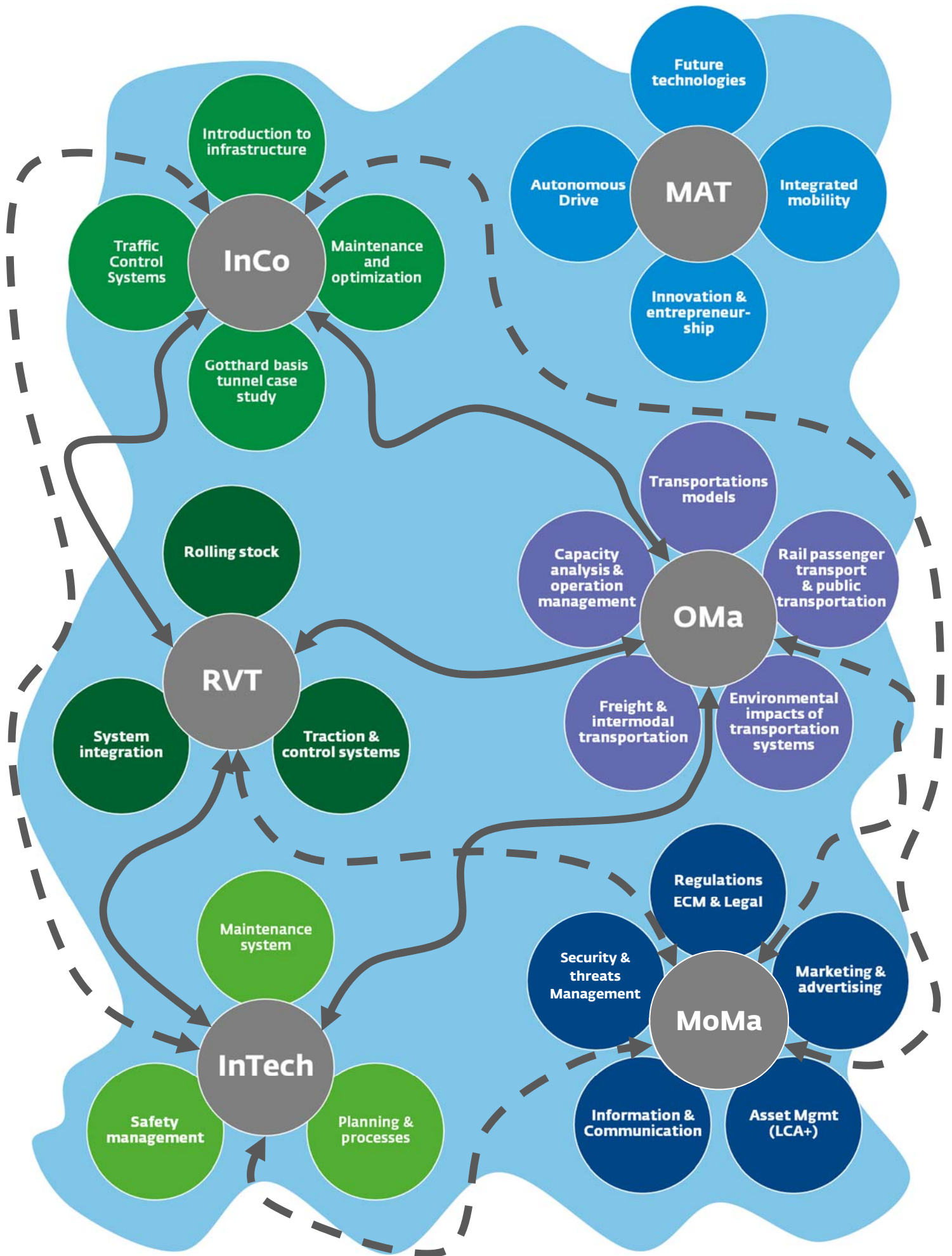
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Modules, CAS & interdependency



Schedule overview

4 days plan

TRSM			2019 Month			
#	Start	Finish	D1 Sun	D2 Mon	D3 Tue	D4 Wed
1	08:00	08:45		X	X	X
2	08:50	09:35		X	X	X
3	09:40	10:25		X	X	X
X	10:25	10:40				
4	10:40	11:25	X	X	X	X
5	11:30	12:15	X	X	X	X
L	12:15	13:15				
6	13:15	14:00	X	X	X	X
7	14:00	14:45	X	X	X	X
8	14:45	15:30	X	X	X	X
X	15:30	15:45				
9	15:45	16:30	X	X	X	
10	16:30	17:15	X	X	X	
hrs	35		7	10	10	8

5 days plan

TRSM			2018 Month				
#	Start	Finish	D1 Sun	D2 Mon	D3 Tue	D4 Wed	D5 Thu
1	08:00	08:45		X	X	X	X
2	08:50	09:35	X	X	X	X	X
3	09:40	10:25	X	X	X	X	X
X	10:25	10:40					
4	10:40	11:25	X	X	X	X	X
5	11:30	12:15	X	X	X	X	X
L	12:15	13:15					
6	13:15	14:00	X	X	X	X	X
7	14:00	14:45	X	X	X	X	X
8	14:45	15:30	X	X	X	X	X
X	15:30	15:45					
9	15:45	16:30	X	X	X	X	
10	16:30	17:15					
hrs	43		8	9	9	9	8

5 days intensive plan

TRSM			2019 Month				
#	Start	Finish	D1 Sun	D2 Mon	D3 Tue	D4 Wed	D5 Thu
1	08:00	08:45	X	X	X	X	X
2	08:50	09:35	X	X	X	X	X
3	09:40	10:25	X	X	X	X	X
X	10:25	10:40					
4	10:40	11:25	X	X	X	X	X
5	11:30	12:15	X	X	X	X	X
L	12:15	13:15					
6	13:15	14:00	X	X	X	X	X
7	14:00	14:45	X	X	X	X	X
8	14:45	15:30	X	X	X	X	X
X	15:30	15:45					
9	15:45	16:30	X	X	X	X	X
10	16:30	17:15	X	X	X	X	X
11	17:15	18:00	X	X	X	X	X
hrs	55		11	11	11	11	11

Modules

Mobility (Asset) Management

1	Module	Asset Management (LCA+)	LCA
	Contents	<ul style="list-style-type: none">> LCA methods: general, directional tools, proxy and matrix methods, ISO 14044.> Technical fleet planning: “static” and “dynamic” modelling, trades-off, commonalities, impact of changes in the economic, ecologic, and technological environment.> Investments & leases: lease vs. buy analysis, understand NPV, leases investment types, maintenance, and other costs.> Long-, mid-, short-term planning: definitions and application, planning and scheduling, availability, reliability.> Optimization of investment: continuous improvement, operating margins, repair costs.	
2	Module	Information & communication	ICO
	Contents	<ul style="list-style-type: none">> Internal and external communication: how to convey messages, timing, means.> Traditional and new media: newspapers, brochures, radio and TV, digital media, online platform, best usage of media-mix, identification of rights mean.> Press releases: structure, addresses, languages, interaction with the media, follow-up, objectives.> Communication techniques and elements: verbal, non-verbal, written, graphic; techniques such as mirroring, silence, compelling humor, cultivate curiosity.> Communication in crisis: responding on transportations Issues; strategies; interview guidelines.> Planning: emergency response plan ERP; preparedness, response, recovery, and prevention PRRP circle; communications and media plan; interaction with emergency respond teams; intervention planning; accident response plan.> Response to an accident/incident: parties involved; media coverage and information; crisis team and process; care team and victims support; operational stability.	
3	Module	Marketing & advertising	MB2
	Contents	<ul style="list-style-type: none">> Marketing B2B & some B2C: national and international marketing; markets research; government interactions.> Marketing for transportation industry: application for rail; aviation; road; sustainable transport.> Sales concepts: Product strategies; corporate communication; key account and sales management.> Presentations, sales pitch: techniques to present services and products, basics of design, storytelling, use of media tools.> Digital age M&A: use of social media in advertising, difference between classic and digital marketing, application of new advertising technology in B2B.> Reputation management: ethics, responding to public criticism, influencing public perception.	

Mobility (Asset) Management

4	Module	Security & threats management	STM
	Contents	<ul style="list-style-type: none"> > Security system implementation: Intrusion detection, access control; physical security, procedures. > Threats ident & mgmt.: loss prevention, security risk management, types of risks, risk options, terrorism, assessments. > IT security: elements of IT security such as applications, network; disaster recovery, wireless, DB, malware, virus, ransomware.... > Response to an accident/incident: emergency evacuations, continuity, protection, casualty and injured. > Investigation & analysis: event review and forensics, evidence protection, coordination with authorities, repetitiveness avoidance, lesson learned > Lesson learned: scheduling review, review contents, proactive approach. > Security case study: airport, nuclear plant, major event, state visit. 	
5	Module	Regulations/ECM & Legal	REL
	Contents	<ul style="list-style-type: none"> > Laws and their relationships: legal basis; international agreements; local and national laws; participation in governmental decisions; law and markets interaction; laws applications, compliance. > Law, innovation, and economics: laws, regulations influence on innovation, protection of intellectual property, risks. > Public policy: areas of interest such as public transport, private motorized transport, or non-motorized traffic; health, safety, and environmental regulations. > Governments approach: Swiss transport legislation, EU normative, international regulations. > ECM: description of the Certification of entities in charge of maintenance, Regulation EU/445/2011. 	

Railway Vehicles Technology

1	Module	Rolling stock	ROS
	Contents	<ul style="list-style-type: none"> > Railway vehicles: locomotive, wagon, multiple-unit trains, freight wagon. > Vehicles systems & characteristics: aerodynamics; bogie; brakes; pantographs; cabin; undercarriage; main structure; seats; information equipment; monitoring equipment. > Design & engineering: process, requirements, production, tests, validation. 	
2	Module	Traction & control system	TCS
	Contents	<ul style="list-style-type: none"> > Power: Basics of power electronics, power train; power supply and auxiliary power supply; electrical/diesel engines; energy sources. > Control: communication systems; train control system; ETCS; system compatibility; diagnostics. 	
3	Module:	System integration	SYI
	Contents:	<ul style="list-style-type: none"> > SI & terminology: validation; verification; qualification; certification objectives; evidence; regulatory agencies and factory acceptance. > Integration process: phases process; top-down and bottom-up approaches; process and steps design. > Hardware, software, and method: components qualities; system qualities; failure modes and patterns; HW-SW integration. > Integration strategy: vertical, horizontal, star integration; fail early - risk reduction; static & dynamic behavior; products and components; robustness of integration. > Environment and configurations: test configurations; modeling; configuration management; change management; obsolescence. 	

Mobility Advanced Technologies

1	Module	Innovation & entrepreneurship	INE
	Contents	<ul style="list-style-type: none"> > Innovation & technology: technological change; cultural approach; governance; micro/macro innovation levels; cross-functional collaboration; organization; strategy. > Digital business: conventional vs. digital; information representation; automation; processes; industry 2025 (4.0); mobility industrial applicability; industrial internet of things (IIoT, IoT); big data. > Entrepreneurship: from the idea to the design and launch of a new business; exploration vs. exploitation; business & financing models; crowdsourcing; legal aspects; commercialization. > Try-and-fail: lesson learned; failure analysis; sharing experiences; repetitive failure; profit from failure. > Disruptive approaches: new markets; value network; new entrants; risk association; market penetration. > Innovation process: idea, invention, innovation; creative approach; guidelines; iterative process. 	
2	Module	Integrated mobility	IMO
	Contents	<ul style="list-style-type: none"> > Services: mobility; complementary; integration of different transport services; ancillary services. > Sustainability: new mobility; e-mobility; H₂(O)-mobility; shared, pooled, individual mobility. > Ownership and accessibility: concepts, costs analysis, mission and economics; mobility as service. > Experience the journey: mobility as an experience; productivity on route; freedom of choice; quality of service. > Origin-to-destination: cooperation between operators; common platforms; flexibility of transport system; sustainable and efficient journey. > Integrated Channels: mobile ticketing; automatic CI-CO; coordinate timetables > Complementary transportation: from air to rail; from rail to road; from road to human. 	
3	Module:	Future technologies *	FUT
	Contents	<ul style="list-style-type: none"> > Technology trends: emerging technologies; predictions; future business requirements; history developments, hypes vs. coherence. > Diversification of applications: application of new technologies derived from other industries; use of processes/procedures/innovations established in related sectors. > Technology evaluation and use: estimate a technology potential, commercial application of ideas, evaluation models. > Efficiency improvements: innovations implementations that help sustainable development and productivity. 	
	*	Contents will be updated on a yearly basis to cope with the technology development pace and innovation rhythm.	

Mobility Advanced Technologies

4 Module	Autonomous Drive	ADR
Contents	<ul style="list-style-type: none">> Vehicle systems and integration: components & systems; redundancy; reliability; security & safety; sensors.> Infrastructure: requirements; support functions; oversight; ground structure; conflicts; data storage; IT security.> Networks & communication: standards; protocols; interconnections; platforms; tools; standardizations; IT security.> Human-Vehicle interfaces: information exchange; visual aids; intuitiveness; interactions; external influence.> Basics of Artificial Intelligence (A.I.) & data science: decision making; reliability; data processing; algorithms.> Technology for road and rail: differences and commonalities; basic structures; examples of application; requirements and investments.> Level of Automation (L1 to L5): 0 No Automation; 1 Driver Assistance; 2 Partial Automation; 3 Conditional Automation; 4 High Automation; 5 Full Automation.	

Integrated Technologies

1 Module	Planning & processes	PLP
Contents	<ul style="list-style-type: none">> Production methods: Job production; batch production; flow production; lean production; interactions of methods.> Industrial processes: analysis; elements; design new plants; automation.> Manufacturing techniques: casting; imaging and coating; molding; forming; machining, joining; additive manufacturing.> Process management: Business process management (BPM) and business process reengineering; application of knowledge, skills, tools, techniques and systems to define, visualize, measure, control, report and improve processes> Process design: block flow; diagrams; specifications (In/Out); objectives and constraints.> Project management: basics of PM; The 4 P's of project management; approaches; process groups; tasks; risks; portfolios.	

2 Module	Maintenance system	MXS
Contents	<ul style="list-style-type: none">> Maintenance approach: elements; scheduled; preventive; predictive.> Maintenance management: planning; interaction with OPS & product; regulatory aspects; outsourcing; cost vs. services.> Maintenance 4.0: definition; applicability; methods & tools; IT integration; changes.> Maintenance HF: skills; competencies; fatigue; behaviors.> IT support: controlling software, requirements.	

3 Module:	Safety management	SAM
Contents	<ul style="list-style-type: none">> Risk, hazard assessment and mitigation: perception of hazard & risk; assessment methods; decision making; qualitative & quantitative approaches.> Safety elements: development and implementation of SMS; SMS tools; safety strategies.> Human factors: Introduction to HF problems and methods; task analysis; error identification; situation awareness; fatigue; performance.> Safety management manual: elements and components of a SMSH; documentation management; implementation and distribution.> Safety culture: work methods, management systems, communications, Leadership; Responsibility; Accountability; Ethics.	

Operations Management

1	Module	Transportations models	TXM
	Contents	<ul style="list-style-type: none"> > Transportation modes: international; intercity; interregional; regional; metropolitan; urban; local; last-mile. > Transportation vehicles: “space”; aircraft; drone; vessel/ship; high-speed train; conventional train; metro; tram; bus; car; motorbike; bike; trolley; walking). > Intermodality: ship-train; train-car/bus/tram; aircraft-train/tram/bus; car-bike. > Transportation systems and issues: selection of means; travel demand; environmental issues; tourism/commuter/long-distance; economics development; system safety. 	
2	Module	Rail passenger transport & public transportation	RPP
	Contents	<ul style="list-style-type: none"> > Supply & demand: over- and under-capacity, capacity adjustments > Pax flow: critical flow; security and safety issues; short-term adaptations. > Interconnections: coordination; commonalities; stations types; communication of information (ITCS & RBL) > Exchanges; hub & stations: transportation services, ancillary services; > Routes: transportation planning and development; route design, systems availability; investments and efficiency. > Traffic & Pax trends: forecasting (short-, mid-, long-term), identification of trends, adaptation of offer. > Infrastructure planning: demand and infrastructure; limits of infrastructure; planning framework; short-term solution; alternative solutions (cost efficient). 	
3	Module:	Freight & intermodal transportation	FIT
	Contents	<ul style="list-style-type: none"> > Freight transportation vehicles: road, rail, sea, air; characteristics; advantages and disadvantages > Freight hubs: logistic centers; transfer centers; territorial planning; infrastructure rationalization; transport quality; intermodality development. > Freight transportation models: modeling based on production, distribution, modal split, assignment. > System management: logistics management & coordination; SCM. > Alpine freight transit: examples of different North-South routes > Rail & road: differences; applications; competition; integration. 	
4	Module	Capacity analysis & operation management	COM
	Contents	<ul style="list-style-type: none"> > Timetables: creation of timetable depending on demand, costs, service; stability in normal operation; > Traffic simulation: real examples of timetable creations/simulation; learn the utilization of TRENOLab© > Traffic optimization: changes to schedule; impact on the overall system; > Slot & costs: availability; fares/charges. > Integration of different systems: conflicts of operations; > Irregularities: handling of irregularities; impact evaluation; timetable stability; prioritization. 	
5	Module	Environmental impacts of transportation systems	EIT
	Contents	<ul style="list-style-type: none"> > Transportations issues: congestions; utilization; load factor; coordination; taxation. > Sustainable investment: development of renewable energy, efficiency, carbon emission offset control, public transport vs. individual motorized vehicles > Energy sources & utilization: electrical; renewable; fossil; fuel cell; nuclear. > Transportation of “things”: routes; time; frequency; load factor; reliability. > Emissions, Footprint: greenhouse gas emissions; recycling; optimization. 	

Infrastructure & Controls

1	Module	Introduction to infrastructure	RI1
	Contents	<ul style="list-style-type: none">> Infrastructure concept: the concepts and designs of infrastructure for mobility.> Manufacturing & engineering: the design, validation, pre-production and execution of building or structures.> Interchanges & stations: transport system interconnection platform, planning, flows, capacity, basics of architecture.> Roads and rail: basics of infrastructure, commonalities, possible synergies.> Basic signaling: basics signaling used for rail and roads.	
2	Module	Maintenance & optimization	MAO
	Contents	<ul style="list-style-type: none">> Maintenance of infrastructure systems/building: why maintenance? typical activities; special tools; skills required; maintenance plan establishment; safety approach.> Maintenance optimization: cooperation with partners; efficiency improvement; maintenance plan optimization; cost reduction> Buy or make (applies on buildings and equipment): tools for decision making (as a support) which considers the entire life-span and the social implications.> Scrap or repair (applies on buildings and equipment): tools for decision making (as a support) which considers the entire life-span and the social implications.	
3	Module:	Gotthard basis tunnel case study	GCS
	Contents	<ul style="list-style-type: none">> Case study of the Gotthard Base Tunnel: the new tunnel; the access tracks; the economy implications; changes to the original plan; costs; timeline.> From planning to operation: political decision; financing; implication for the local industry; planning & design; build; EIS; operation; maintenance.> Challenges of topology: the Gotthard, due to his unique topology, has posed new challenges to manufacturing; this section discuss how this hurdle has been overcome.> Emergency: security system; evacuations planning; safety concepts.> Technology development: new equipment development; new manufacturing processes; innovation @work.	
4	Module	Traffic Control Systems	TRC
	Contents	<ul style="list-style-type: none">> ETCS (European Train Control System): system description, understanding of operation; engineering; installation; deployment.> Signaling technologies: definition of actual and new technologies and their applications; limits and advantages; national differences.> Control center, integration: network management; coordination; system integration (infrastructure side); conflict resolution; irregularities; timetable stability.> Processes: in relation to traffic control – economics, safety, management, maintenance, security.> Future developments: what are the next generation of control systems? standardisation is possible?> IT security: due to consolidation of control power, a large amount of systems are interconnected and therefore open to IT threats.	

Mandatory 1-day practical experience

Students shall choose one of the following experiences (one for each 10 ETCS):

Train conductor, Train driver, Traffic engineer, Train controller, Client advisor, Transport police

Location/Place

At customer location or in Bellinzona, Switzerland (in the Industry Plant of the Swiss Federal Railways SBB)

Costs

To be discussed with the partner organization. Special conditions apply.

The hosting organization shall bear the transportation, accommodation and meals costs of the lecturers if the course is not held at msfi headquarters.

Conditions

A Memorandum of Understanding (MoU) and a Non-Disclosure Agreement (NDA) (regarding the course contents) between the parties shall be established before msfi and SUPSI starts officially developing the customized program.

Preparation time required

Upon contract signature **6 months** time is usually required to prepare a customized course. This timeline can be reduced upon agreement between the parties.

Information

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M **o** **M** **a** **R**
A **a** **In** **Tech**
T **n** **C** **o**

A unique program conceived with and by the
mobility industry.

With the support of



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SWISSRAIL
Industry Association