

# AI for Railway Engineers, Rail Decision Makers and Operators

## Advancing AI Competencies in the Railway Sector



Focus on: **The Manager** ☒ **The Specialist** ☒ **Spotlight Programme** ☒ **Hands-on Skills** ☐

### Course Overview

Artificial Intelligence (AI) is reshaping railway engineering and operations. From predictive maintenance to intelligent traffic management, condition monitoring, and operational efficiency, AI is unlocking new opportunities for safety, resilience, and performance in the sector.

This five-day course equips railway professionals with a structured understanding of AI, mapped against the **AI Skills for Business Competency Framework**, with a clear focus on **responsible, safe, and ethical AI adoption**.

Course Objectives		This Course is Ideal For:	
1	<b>Understand the principles of Artificial Intelligence (AI)</b> and evaluate its relevance and potential applications within railway engineering, operations, and safety management.	✓	Railway engineers, technical managers, and operators looking to integrate AI into operations.
2	<b>Apply AI methodologies to real railway challenges</b> , including predictive maintenance, traffic optimisation, and intelligent condition monitoring.	✓	Rail infrastructure managers seeking efficiency and predictive maintenance solutions.
3	<b>Demonstrate awareness of ethical, regulatory, and governance frameworks</b> (EN50126, EN50716, IEC 42001, ISO/IEC 23894) to ensure safe, transparent, and responsible AI adoption across the railway sector.	✓	Logistics professionals interested in AI-driven railway scheduling and optimisation.
4	<b>Develop practical competencies using AI tools and case studies</b> , such as RAPORS for document assessment, CyRail for cyber zone modelling, and AI-driven vision systems (OLESight/OLESense).	✓	Industry decision-makers responsible for AI adoption in rail.
5	<b>Formulate strategies and business cases for AI implementation</b> that align with organisational goals, sustainability objectives, and the AI Skills for Business Competency Framework.		
Course Content			
Day	Theme	Coverage	
1	AI Foundations in Rail	• Introduction to the course and objectives.	

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		<ul style="list-style-type: none"> <li>• Overview of AI in railway engineering: predictive maintenance, traffic optimisation, safety, and logistics.</li> <li>• AI-driven decision support for railway control and scheduling.</li> <li>• Case studies of successful AI adoption in rail.</li> <li>• Fundamentals of AI and Machine Learning: supervised, unsupervised, and reinforcement learning.</li> <li>• Data in rail: sources, quality, and governance.</li> <li>• Workshop: exploring railway datasets.</li> </ul>
2	Predictive Maintenance and Condition Monitoring	<ul style="list-style-type: none"> <li>• AI for predictive maintenance in rolling stock and infrastructure.</li> <li>• Condition monitoring concepts and lifecycle management.</li> <li>• Identifying anomalies and failure patterns.</li> <li>• Real-time data analytics for railway assets.</li> <li>• Tools and applications: RAPORS for document and safety assessment.</li> <li>• Workshop: building a simple predictive maintenance model.</li> </ul>
3	Governance, Safety and Ethics in AI for Rail	<ul style="list-style-type: none"> <li>• Ethical AI: transparency, fairness, accountability.</li> <li>• Regulatory frameworks and standards: IEC 42001, ISO/IEC TR 5469:2024 Artificial intelligence — Functional safety and AI systems</li> <li>• Safety-critical requirements for AI adoption in rail.</li> <li>• Risk management frameworks and approaches.</li> <li>• Cybersecurity in AI-enabled rail systems.</li> <li>• Tools: CyRail for cyber zone modelling.</li> <li>• Workshop: governance and assurance applied to a rail AI case study.</li> </ul>
4	AI for Operations, Traffic and Logistics Optimisation	<ul style="list-style-type: none"> <li>• AI for demand forecasting and scheduling.</li> <li>• Real-time route optimisation and network efficiency.</li> <li>• AI in freight and passenger flow management.</li> <li>• Autonomous and intelligent systems for inspection and monitoring.</li> <li>• AI-powered fault detection and intervention.</li> <li>• Case studies: OLESight, OLESense, and derailment prevention systems.</li> <li>• Workshop: simulating AI-driven optimisation in rail operations.</li> </ul>
5	AI Strategy, Implementation and Future Directions	<ul style="list-style-type: none"> <li>• Developing AI strategies and business cases for railway organisations.</li> <li>• Building project roadmaps and aligning with the AI Skills for Business Competency Framework.</li> </ul>

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		<ul style="list-style-type: none"><li>• Workforce skills and organisational readiness for AI adoption.</li><li>• Sustainable and energy-efficient AI practices.</li><li>• Resilience in AI deployment: risk mitigation and assurance.</li><li>• Interactive group case study analysis and presentations.</li><li>• Multiple-choice quiz, course feedback, and certificate presentation.</li></ul>
Course Assessment		Certification
<b>Participants will be assessed on:</b>		Upon successful completion of the course, participants will receive a <b>Certificate of Successful Completion</b> , along with a <b>Transcript of Marks</b> showing the performance by grade in each element of assessment and overall.
Participation in sessions		
Completion of exercises & case studies		
Performance in assessments		
Course Instructor		
<p>This speaker is a Member of the Institution of Railway Signal Engineers (MIRSE), He holds a doctorate in Mechanical and Aeronautical Engineering and undertakes consultancy and research. He delivers specialised training in engineering, safety, risk management, interoperability, and railway legislation.</p> <p>With over 30 years of international experience, he has held senior roles in signalling, rolling stock, infrastructure, and railway systems, including Systems Assurance Manager and Head of Systems Engineering and Safety. His expertise spans metro, tram, and heavy rail, with a focus on safety, compliance, and reliability. The speaker also sits on the IEC committee for the railway OT Cybersecurity standard IEC63452.</p>		