

Steam ahead with Railways 4.0 Era

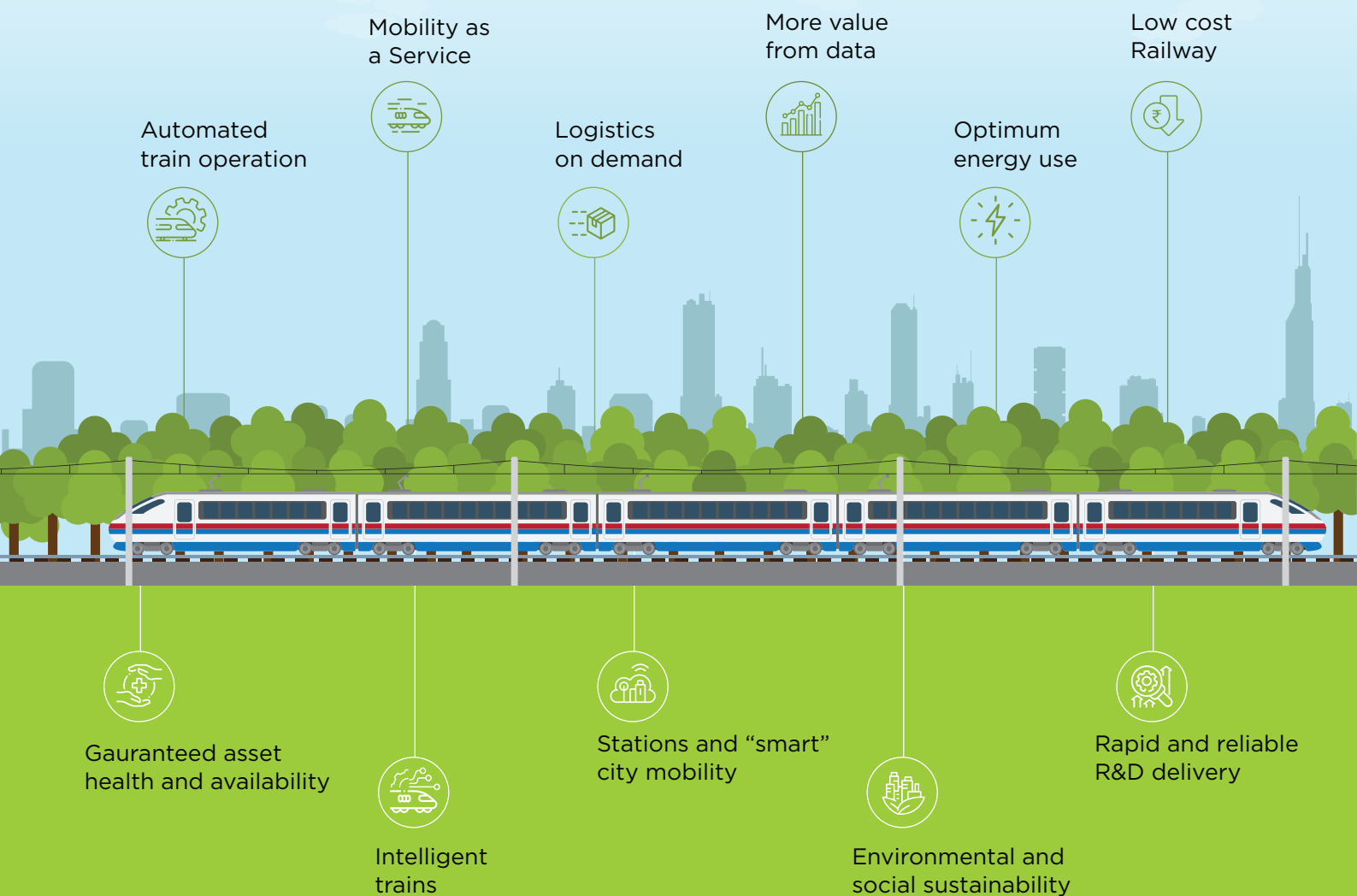


The **development of intelligent, eco-conscious, and user-centric mobility systems** stands as a top priority in the global advancement of transportation . Railways are playing a pivotal role in this trajectory, undergoing a metamorphosis amid the evolving technological landscape. They are now evolving into **smart interconnected systems** that are harnessing **cutting-edge technologies** and data to reshape the passenger experience and drive operational efficiency.

The advent of the concept of **Railway 4.0** and more recently, Railway 4.0 and digital railway, characterizes the transformation to the modern requirements of the digital economy. In order to take advantage of growing demands and increase profits in this capital- and asset-intensive industry, railways **must harness digitalisation and incorporate technologies like artificial intelligence and data analytics.**

This paper explores the merits of **smart connected railway systems**, shedding light on essential technologies and strategic approaches that empower railways to **flourish in the digital era.**

How to make this vision a reality – Railway 4.0



Indian Railways ecosystem

Indian Railways stands as the most expansive rail network in Asia and ranks as the **second-largest railway system worldwide** operating under a single administration. Three main points can be used to summarise this prominence:



Network

Indian Railways operates across more than 7,000 stations and has a vast network covering more than 67,000 kilometres.



Passengers

Transporting more people than the total world's population, it carries more than 8 billion passengers annually.



Freight

Indian Railways transports a staggering quantity of freight, transporting more than 3 million tonnes daily.

The future of the railway and its capacity to meet future transport demands depends on its ability to embrace, adapt, apply, and integrate developing technology. This extensive network requires significant infrastructure and investment.

Scope for Railway Modernisation

Passenger Convenience

- Personalised Travel Experience
- Delayed Information
- Increased waiting times and Journey times
- Ensuring Safety (Personal & Digital)



Signaling and Traffic Control

- Train traffic congestion
- Signaling for Avoiding Collision
- Signaling infrastructure maintenance and upgrades

Operations Management

- Train scheduling
- Increasing train volumes and minimizing congestion
- Managing emergencies, disruptions, and unplanned events



Environment Consciousness

- Reducing Energy Consumption and Carbon emissions
- Increased Noise and vibration
- Reducing reliance on fossil fuels and transitioning

Enabling Technologies for Digitisation



Internet of Things



Artificial Intelligence



Robotics /VR



Cloud Computing



Big Data



Rolling Stock

- IOT based remote monitoring, real-time diagnostics of rolling stock, and preventive maintenance.
- Data Analytics for automatic data visualization algorithms for preventive fault analysis



Signaling System

- Implement Enhanced Cyber security and traffic management systems.
- Communication-based train control
- Enhanced digital signaling with predictive maintenance.
- Artificial Intelligence optimization to reduce failures and operation disruption



Passenger Experience

- Accurate and up-to-date AI-enabled passenger information.
- Enabling network Connectivity Onboard
- Intelligent seat reservation with data analytics
- Enabling Cashless Commerce
- Onboard infotainment services, onboard wifi



Sustainability

- Sensor based Emission Reduction
- Drone, & AR/VR based Predictive Equipment Maintenance
- Green Air System
- Intelligent CCTVs with AI

Comprehensive, Innovative & Cost effective solutions to build futuristic railways

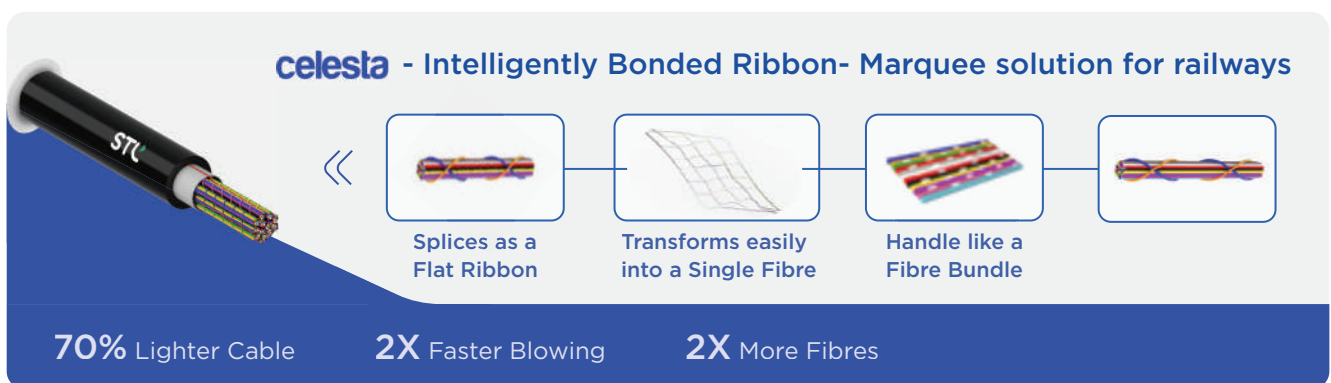
01

STL Solution Portfolio For Modernising Railways

Optical network infrastructure

The railway deploys **Optical Fibre Cables (OFC)** along its track infrastructure. STL offers comprehensive solutions for both **ADSS cable installations** and **underground deployments**, facilitates efficient data transmission, enhances signaling systems, enables effective control mechanisms, and improves passenger services.

STL's customised cable solutions cater to high-bandwidth applications of **data centers, global internet companies and ISPs, telcos, citizen network services and enterprises**. STL offers a wide range of cables that can fulfill the need of maximum fibre density in the smallest cable packaging feasible.



Multi-fiber splicing allows for shorter splicing time LIKE RIBBON but without the challenges of flat ribbon handling in the **fiber management solutions**

Handle like a Fibre Bundle Transforms Easily Into a Single Fibre Splices as Flat Ribbon

Cables For Rolling Stocks

The large amount of safety, communication, and entertainment devices on board modern trains has led to a strong increase of the number of cables needed for each carriage. It is necessary that cables ensure the highest level of security minimising risks for people, even in case of fire. They must also resist fluids, shocks and extreme temperatures providing reduced weights and dimensions.



Cables for Signaling Systems

The increase of railway traffic has led to the development of highly sophisticated signaling systems, capable of managing the run of the trains and emergency situations. It is essential to have cables with high technological content, capable of ensuring a continuous data flow between trains and stations without being influenced by electromagnetic fields generated from the power lines.

Key Features



High
Performance



Reduced weights
and dimensions



Resistance to extreme
temperatures (-40°C)



Resistance to oils,
fuels and fluids
(IRM902, RM903)



Hazard level 3
(HL3) EN 45545



Resistance
to Abrasion



Resistance to oils,
fuels and fluids
(IRM902, RM903)



Resistance to
Vibration



Resistance
to Tear



Halogen-free



Low on toxicity
(EN 50305)



Low on smoke
(EN 50268-2)



Resistance to
fire (EN 50200,
EN50362)



Flexible



Flame retardant
(EN 50266,
IEC60332-3)



STL's MAKE IN INDIA Fibre Optic Sensing Solution

The operating conditions for the railway system are exceedingly difficult because to the rise in traffic, heavier axles, and automobiles. As speed rises, it becomes much more susceptible to deterioration and failure. In response to these difficulties and the importance of the railway system's dependability, STL has developed a **Fibre Optic Sensing (FOS)**-based solution that combines cutting-edge photonics with **AI/ML algorithms**. This solution is industry agnostic and can be customised to specific use cases.

Key benefits

- These systems utilise continuously distributed sensing techniques to provide **real-time measurements and assess structural properties over extended periods**
- Ensures **early detection and information gathering** regarding movements **within designated Elephant corridors to safeguard endangered wildlife**
- Enables the **quick discovery and evaluation of initial defects** like broken rails and flat tyres, permitting quick repair and preventing **potential catastrophic failures**.
 - Allows for **extensive inspections** to find **structural deterioration**.
 - Gives **warnings in advance** and useful information for **preventative steps**.
 - **Monitors train positioning, direction, and speed** in addition to railway crossings.
- **Evaluation of railway systems, encompassing the behavior of trains and tracks**, through real-time data collection.

Key features

- Integration with a central command centre - whether a **network operations centre (NOC)**, or a **secure command and control centre (CCC)**
- **Provisions for integrations** with external or 3rd party applications such as cameras, alarm systems, video surveillance systems and GIS
- Can be tailored and enhanced to provide **early warning signals**, providing extra time for the field team to respond.



03

STL Digitisation Solution

Harnessing the power of Digitisation for Railway modernisation,

Safety Solutions with captive 4G RAN

India Railways are aiming to implement a **comprehensive security and surveillance system** called "Kavach" across all sections of the railway network. To enable this system, a captive **4G Radio Access Network (RAN)** will be utilised. STL can enable a captive 4G to help establish a robust security framework that covers all sections of the **railway network**. This comprehensive system will

Enable effective surveillance

Real-time communication

Enhanced safety measures

IOT enabled Solutions

STL can help build a connected, IoT-enabled railway of the future by partnering with partners around the globe to create solutions with maximum performance and value. These IOT-compatible products can assist with:

Equipment monitoring in real-time that use intelligent sensors

Critical train parts, like as the brakes and wheels, can be fitted with safety sensors to help operators detect any problems.

Using deep learning and AI, to measure and analyse passenger flow

Asset tracking using computer vision near real-time

Gather information from machinery, trains, and locomotives.

Big Data Analytics

STL offers big data solutions so you can leverage data-driven insights and increase efficiencies. The key benefits include

Predictive Maintenance : Leverage Big Data analytics for monitoring the health of tracks and trains and collect data from sensors for prevention of breakdowns and reduce downtimes

Train Scheduling : Big data analytics can be leveraged to understand train delays, understand train movements and weather conditions for managing train schedules and avoid disruptions. These data-driven decisions can improve service reliability leading to a seamless and reliable train schedule.

Passenger experience: Review pricing strategy , analyse passenger demands and market trends with Big data analytics for revenue maximisation

Increased Operational Efficiencies: STL Big Data analytics solutions can enable predictive maintenance to minimise downtime, and improve capacity planning and resource allocation based on real-time passenger data. These data-driven insights help reduce delays, improve asset utilisation, and enhance customer satisfaction, ultimately leading to a more efficient and reliable railway system.



Conclusion

The **digitisation of railway systems** brings about a wide range of benefits ranging from **enhanced customer experience** to an **operationally efficient** and a **secure transport system**. **Real-time data analysis** enables **optimised train routing**, **schedule adjustments**, and **improved communication-based train control**, resulting in **fewer disruptions and enhanced reliability**. By leveraging STL's solutions, railways can efficiently handle **higher demand**, ensure safety, save costs, improve scheduling, drive innovation, and contribute to a **greener future**.

About STL

STL is a leading global optical and digital solutions company providing advanced offerings to build **5G, Rural, FTTx, Enterprise, and Data Centre networks**. The company, driven by its purpose of **'Transforming Billions of Lives by Connecting the World'**, designs and manufactures in 4 continents with **customers in more than 100 countries**. **Telecom operators, cloud companies, citizen networks, and large enterprises** recognize and rely on STL for advanced capabilities in Optical Connectivity, Global Services, and Digital and Technology solutions to build ubiquitous and future-ready digital networks. STL's business goals are driven by **customer-centricity, R&D and sustainability**. Championing **sustainable manufacturing**, the company has committed to achieve **Net Zero emissions by 2030**.



STU | beyond tomorrow

