Railway Industry
White Paper

Networks and Rolling Stock:
“Challenges and opportunities”

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Synopsis

This report is intended to give a general overview of the global Rolling Stock and Railway Network market, and provide information about how Nexans is serving this market.

It opens with a brief introduction which explains the positive and negative forces operating within the complex world of railroads which affect the railway supply industry; then focuses on some major challenges. It also draws up a comprehensive list of what the railroad supply industry expects from a cable supplier. The third section gives an overview of the expertise, global presence, performance and partnership resources that Nexans has at its disposal to serve the railway industry, and presents Nexans’ overall product offer.

This report is followed by an Appendix containing a list of Nexans key products and success stories.
INTRODUCTION: AN INDUSTRY AT A JUNCTION

“The Community’s railways are experiencing a revolution. This is due to market liberalization and the increasing need for harmonization. Policies on trans-European infrastructure networks and improved transport links with Central and Eastern Europe reinforce the need for change. As a result, the prospects for the railways have never been better.” Neil Kinnock - Former Commissioner for Transport, EU « An assessment of the prospects for today’s railroad industry reveals a mixture of optimism and pessimism, good news and bad news, bright hopes and bitter disappointments. Mr. Kinnock’s past enthusiasm presents the positive side of the picture, which also gave rise to the recent EU White Paper about the European Transport Policy for 2010..»

In the face of a number of realities, like highway congestion, environmental concerns, European unity, and the globalization of the economy, the Commission sees rail transport as the logical answer – that is, if transport policy, industrial policy and research can be made to work together to provide a focal point for railways and infrastructure operators, the supply industry, and even trade unions and passengers.

As Roland Heinicsh of DB Netz and former Chairman of the World Congress of Railway Research put it: “the whole world has a problem with transport, with great expectations placed on rail.”

Another expression of this enduring but yet unfulfilled enthusiasm is the recent allocation of 600 million Euros by the European Parliament and Council for transport research. At present, the EU is contributing some 250 million Euros towards over 40 railway research projects, involving some 200 partners. This kind of investment in research is especially significant due to the fact that the European railroad supply industry has approximate 60% share of the world market, and has a definite lead in many key areas, like high-speed trains.

Grounds for this kind of enthusiasm are the numerous advantages that trains and railway systems offer both for passengers and freight, compared to other means of transport. With half of the world’s population now living in cities, highways have been strained to their limits. Although traffic jams are a sign of urban growth, they also put a gridlock on prosperity. It is estimated that every year, the US loses 7% of Gross Domestic Product due to driving delays, while the cost of congestion in Europe is 2% of GDP.

In some cities, losses can reach as high as one-third of potential output. For example, it can take up to a half day to drive across some large east-Asian cities. Similarly, in the intercity context, trucks (the main means of transporting goods in the US) have clogged busy highways, and increased the likelihood of fatal accidents, while contributing to pollution in tunnels and throughout the countryside. In the skies, too, due to serious growing ozone depletion, recommendations were recently made by regulators to restrict air travel to long-distances only. Their claim is that short intercity hops are one of the prime factors for this alarming deterioration.

1 “Great expectations placed on rail research.” Railway Gazette International, Jan. 2002
Outside the cities, efficient rail travel has reduced the number of traffic accidents and proven that it can be faster, safer and more comfortable than car travel. And in terms of freight, it can outperform truck transport in several areas. In environmentally-minded Austria, heavy trucks are now obliged to transit through the country via rail. The globalization of markets and the emergence of new industrial and product distribution patterns have also given rise to the concept of integrated freight transport chains, or “train cargo-liners.” The latter will increase frequency, achieve wider geographical spread over longer distances, and deliver higher reliability to customers.

Finally, with airports located farther and farther from city centers, fast rail services have become an important link for air passengers. The Norwegian high-speed “Flytoget” train has reduced travel to the distant Oslo international airport to a mere 20 minutes, while achieving high standards of safety, profitability and conservation of the environment. This state-of-the-art people mover (for which Nexans provided significant cabling) is now being studied by France’s RER for a faster connection between Paris and Charles de Gaulle airport.

Moreover, trains are a serious contender to intercity air travel, as well, due to increasing delays arising from long security checks and air traffic density. For example, it takes the Thalys high-speed TGV train a mere 1h25 minutes to travel between Paris and Brussels, a travel time that no airline can hope to match. Meanwhile the Eurostar between Paris and London has been equaling the time it takes by air. High-speed tracks on the English side of the channel (2003), reduces this time to 2h30, significantly outperforming air connections between the two capitals.

No country shows more room for growth than the United States. At one time, a leader in continental railway systems, the boom in automobiles, lobbying by the automotive industry, and cheap air travel has left it far behind its European and Asian counterparts when it comes to trains. Although there still seems to be little priority given for a rail renaissance (especially after the Amtrak triangle debacle, and endless bickering about public versus private financing), a modern train network would seem to be the inevitable long-term answer to congestion and pollution, especially between neighboring and middle-distance cities. For the time being, neither concern for the environment (Kyoto) or the high price of oil has been stimulating decision-makers to take action.

However, with oil supplies running out within the next half century and an international clamor for pollution control, new initiatives will have to be undertaken within a decade.

From the point of view of the cable business, positive signs like those above have made for a lively and competitive marketplace. Cables are an essential part of both rolling stock and railway networks, including everything from power cables for locomotives and drives, bushings

2 See UNIFE News, editorial, Nº 2 2002
and connectors, control and databus cables, coaxial cables, optical fiber, harnesses, jumper cables and winding wires for traction transformers and motors. On the network side, railway systems use complex Local Area Networks, distant communications backbones, catenaries, energy cables, power accessories, and signaling and switching cables. Because safety is a prime concern, railroad companies are increasingly demanding zero-halogen and halogen-free cables of all kinds for enhanced fire-performance and public safety, both onboard and in train stations and on platforms. Video-based security and public information systems are also of increasing importance.

In a parallel development, the world’s leading train companies are looking for ways of adding value to their networks and generate additional revenue. Since they already possess Right-of-Ways through cities and large swathes of countryside, trackside optical networks have opened a new and exciting area of development for cable manufacturers and installers.

In short, the railroad business is still on the verge of extraordinary growth, given the public need, the opportunities, the technology, the pressure of oil prices, the realities of traffic congestion, safety issues, and the growing concern about global warming and pollution.

Striking a gloomier note, however, the World Bank recently published a report that drew attention to some stark realities about rail that needed to be faced. After explaining the confusion of ownership and responsibilities, it drew attention to the fact that passenger and freight services are often provided at prices well below cost, with revenues from users covering as little as one-third of the cost of rail services.

Also, a study of railways in twelve countries showed that railways passenger traffic was actually decreasing (largely under pressure from the sprawling road network). While railway freight traffic was increasing in the US, China, India and Egypt it was decreasing in the Former Soviet Union and elsewhere. The study lamented the various gauge sizes around the world, and differing electric power supply systems for traction (even within the same country). It drew attention to “the continuing failure of many world railways – even in highly-industrialized countries – to provide competitive transport services at competitive prices…” In short, the World Bank studies urged the rationalization and the modernization of the industry so that it could operate as a “customer-driven commercial enterprise,” arguing that it was about time, since most world railways were built over a hundred years ago.3

Meanwhile, the giants of the railway supply industry have been undergoing mixed fortunes, receding profits and cutbacks. This includes Siemens Transportation Systems, Alstom Transport, and Bombardier (the latter’s troubles partly due to the Amtrak fiasco which has dashed hopes for a high speed train in the US in the near future). Smaller players, like wagon builders Greenbrier and Thrall, were forced to retrench and retreat from their European ventures, as their baseload from the North American Home market collapsed.4


4 “Railway sector is ‘not considered strategic’” from Railway Gazette International, August 2002.
Some recent positive developments worldwide

All the same, any survey of what’s actually going on in the industry, does paint a brighter picture globally. For example, light rail transit, and subway/metro systems, seem to be doing quite well as the world becomes increasingly urbanized. And there have been solid sales in railway network infrastructures, as railways around the world seek to upgrade safety, routing, and automatic train control functions. Nor must one forget that the rail supply industry is a relatively low-growth, low-profit, capital and labor intensive industry.

Despite productivity gains, new designs, large acquisitions, restructuring and cost-cutting the big players are by and large modest performers. Many believe that the industry will eventually turn itself around, probably under the pressure of impossibly congested road and air systems, when weary travelers switch to rail.

In fact, some optimism is justified by the hundreds of improvements, upgrades and new developments underway in the world of rail transport. An shortlist would include the following:

♦ **India** is inaugurating 29 new trains, upgrading technology (including booking via the Internet), and boosting tourism through its new observation “saloon” and “Palace on Wheels” concept; it is also installing right-of-way (ROW) optical fiber along much of its 62,000 km network.

♦ There are several new high-speed maglev projects in **Germany, Japan** and **China**

♦ A 32 km metro is being installed in Guangzhou, **China**

♦ **New York City** Transit has launched a 20 year program to resignal its entire 370 km subway network

♦ **Hong Kong** is linking its new Mass Transit Railway to the existing rail network

♦ **Australia** is creating an Alice Springs – Darwin line to create a freight land bridge between Asia and Australia’s southern states

♦ **Austria** has undertaken a huge program to upgrade its Westbahn, including ambitious track quadrupling

♦ **The Netherlands** has launched construction of a new high-speed line for completion in 2005

♦ A line across the roof of the world (over 4,000 m altitude) is being built across the **Tibet** plateau

♦ High speed rail links are now under construction in seven **European countries**, bringing the total length of new high speed trains to 3,260 km

♦ **Belgium**’s second purpose-built 300 km/h line (Leuven–Liège) will bring the capital of Europe closer to the East.

♦ **Korea** is beginning trials on a home-grown 350 km/h high-speed train

♦ **Barcelona** has recently begun a 282 km expansion of its metro
♦ **France** has started civil engineering for its TGV Est.

♦ **RailNetEurope** has launched a common infrastructure for the joint marketing of train paths, uniting representatives from 18 countries

**Meanwhile, the railway supply industry has been remarkably active in recent months:**

♦ Alstom has won a total of 362 million Euros from Finnish Railways and the **Washington DC metro**

♦ Siemens has been awarded contracts for 15 new light rail transit vehicles from the SNCF and supplied a new operations control system for the 12,000 km long **Canadian National railroad**

♦ Bombardier has sold some 355 million Euros of trains to Connex South Easter and won a contract for heavy maintenance and refurbishment of 75 passenger coaches in the **UK**

♦ Alcatel has sold an advanced electronic interlocking system to **German Deutsche Bahn AG**

♦ Koncar of **Zagreb** is receiving 112 million Euros to produce 70 trams for the Croatian capital

♦ The French group, Connex, has won a call to run two railway lines in **Sweden** for 175 million Euros over five years

♦ A **Japanese** consortium has won a contract to build part of Taiwan’s 13 billion Euro high-speed railway

♦ In the two years since its opening (2000) the Öresund Bridge has carried 10 million rail passengers between **Denmark** and **Sweden**
CHALLENGES AND CUSTOMER EXPECTATIONS

Challenges of railways companies

According to analyst Andrew F. Saxe in his annual look at the railway supply industry, the key challenge facing the industry is the fact that rail suppliers, whether upstream or downstream, are captive to their customers – in this case, the final user, the passenger, as well as their governments. He explains. He adds that rail operators have been slow to improve performance and cut unprofitable routes, the consequence being that rail continues to lose share and money, while deferring investments. If suppliers maintain unneeded capacity, and the market continues to depress prices, profits will also decline. His central argument is that the overall industry, and especially the rolling stock supply industry still suffers from overcapacity. The solution to this must be the streamlining of costs and a substantial increase in demand from major economies, like Russia and the US.

A second challenge comes from the neglect that has been endemic to the industry since highway systems were prioritized for moving both people and freight in most countries. One recent study of the Railway Forum, remarked that apart from the relatively high rates of expenditure in the late 50s and 60s (for dieselization and electrification) and sums coming from privatization, the train system in the UK and many other country’s is in poor condition. There seems to be clear signs that if “sustainable mobility” (i.e. regularly moving the maximum number of people in the most efficient and comfortable way possible) is to be achieved, there will have to be a heavy re-investment in upgrading everything from track infrastructure and train control/communications systems to new generations of coaches, drives and locomotives. These first two challenges seem to contradictory and uneasy to attain, but some trade-off between strategic cost-cutting and re-investment seem essential if new levels of train attractiveness are to be achieved.

«At present, the rail sector has simply not convinced the world of its power as a mode of transport, except in congested urban centers and on a few inter-city routes, where genuinely high speed running coupled with high-quality service has been implemented.»

5 See Andrew F. Saxe: “Railway sector is ‘not considered strategic’” from Railway Gazette International, August 2002.
A third challenge comes from the integrating tendencies of both the European and global economies, deregulation, competition and harmonization. Increasingly railways need to take a systems approach to their business. This means more interoperability as trains increasingly cross international borders. This kind of integration touches everything from the provision of energy, uniform track gauge, the standardization of wagon type, shared safety and communications systems, and inter-connective, off-the-shelf solutions wherever possible. A systems approach also applies to two other key areas: modularity, so as to reduce the cost of maintenance repairs; and intermodality, i.e. rail systems have to seamless merge with other forms of rail services (metros, light transit), the automobile network, airports, sea transport, etc.

Since sustained business success demands continuous customer orientation, the fourth challenge involves vastly improving customer service. This takes the form of quicker, safer, more secure train travel, or added levels of comfort. In the light of recent tragic train disasters in Norway, the UK, and India, passengers are demanding more safety guarantees in trains, which can range from failsafe communications and switching to fire-safe materials. Speed means not only better train designs capable of handling high velocity transport and rough terrain, but also the kind of data infrastructure that can increase frequency, on-time performance and guaranteed connections without compromising train safety. Security can include onboard and platform surveillance. Passengers are expecting better information onboard, and all of the amenities, including entertainment and Internet facilities. Customer service applies to main-line, mass transit and metros, and equally involves freight operators, who want their goods shipped safely and speedily, with an electronic identification system available.

The fifth challenge is innovation. Experts are predicting that in 10 years time, rolling stock must be 50% cheaper to buy and maintain, and achieve 30% energy savings. It is unlikely that “steel-on-steel”, driven by electric or diesel motors will disappear. However, trains will have to be cheaper to buy and operate, with new levels of environmental-friendliness. Much of this will be achieved by technological advances: intelligent suspension, more efficient motors and transformers, composite body shells, lighter electronic equipment and cabling, and numerous IT-based onboard devices. Experts say that in a decade, electrical equipment will have to weigh a quarter of today’s and be equally reduced in size. Innovation applies to the infrastructure as well, from field equipment like axle counters and counting points to the LAN networks that provide automatic train control, train routing and network management.
Customer expectations of cable suppliers

Whether it is in the area of fire-performance cables, onboard or trackside energy, various control functions, communications, and complete networks, cable has a large role to play in meeting the challenges facing rolling stock manufacturers, train network installers (infrastructure) and the railway supply industry, in general.

Indeed they all have high expectations of a cable manufacturer:

- Rather than just being a reactive supplier of off-the-shelf products, they want a proactive partner who can co-design and manufacture cabling systems with a high value-added component

- Given the need to cut costs and improve designs, they want intensified R&D to develop light-weight and modular solutions

- Since electricity and data are often twinned in the world of railroads, they demand a complete mastery of both worlds

- In keeping with the harmonization, “continentalization” and globalization of the industry, they want common, interoperable systems that can meet international standards

- So as to generate extra revenue that need creative products which use the infrastructure resources available, for example fiber optic networks on existing train right-of-ways (ROWs)

- Since the electronics and IT input of trains and networks is increasing, they need cable system integrators that are also familiar with intermodal solutions (e.g. familiarity with metros, light rail, mass transit, and even automotive and marine transport)

- High standards of public safety, protection of equipment, and environmental friendliness, a cable supplier must have a full range of fire-safe cabling and safe manufacturing and recycling processes

- As a part of cost-savings and strategic re-investment, a cable supplier must be able to guarantee cable durability, easy refitting and retrofiting, low maintenance

- To meet the special challenges of the train environment (extreme conditions, vibration, oil, corrosion, etc.) the railway industry expects a full knowledge of materials and special industry-tailored designs

- Because of the diversity of cabling in both trains and rail network, cable manufacturers must have an extremely broad range of products

- To satisfy the increasingly international nature of the industry, cable producers must have a full mastery of standards locally, nationally, and internationally
For Rolling Stock

Nexans produces a full range of data and energy cables and components found in modern rolling stock, from thinwall technique up to 45 kV. This includes both standard and thinwall control cables with or without shielding; databus cables; UIC cables; optical fiber cables; special power cables; sheathed singlecore and multicore cables; high-voltage cables and systems; complete harnesses with their connections and sealing ends; jumper cables for carrying control and power functions between cars; signaling cables (in keeping with the Eurobalise project for interoperability) and data transmission (twinaxial and optical cables). Virtually all cables are Zero-halogen-free (0ZH) for the highest standards of safety.

For Railways Networks

Also, Nexans manufacturers a wide range of telecommunication and energy cables and components found in modern railway networks: LANs for communications and control functions; overhead catenary cables, and diverse low, medium and high-voltage energy cables for track-feed, traction and equipment; signaling cables; telecommunications cables (copper and fiber, leaky/radiating cables); and halogen-free fire-performance cables for public safety.

In addition, Nexans provides customized engineering, turnkey installation and maintenance, and does ongoing R&D to keep all products competitive, compatible and environmentally-friendly.
An integrated four-point approach for the industry

Nexans takes an integrated four-point approach to meet the extensive needs of demanding Railway customers: expertise, performance, global presence, and partnership – which goes far beyond the cable products, themselves, and includes a number of important behind-the-scenes services, like ongoing research, testing, standards, information-sharing and advanced delivery logistics.

1 - Expertise means being able to manufacture a broad range of cables adapted to this specific market. The fact that cables are its core business means that Nexans has the special and accumulated skills to supply nearly every cable and cable accessory found in rolling stock and network infrastructure. Many of these energy and data cables must function under extremely trying conditions of heat, oil, and vibration, etc. Special concern is given to interoperability, standards and eco-friendliness.

Expertise also implies “integration” at several levels. Since the company controls the entire production chain from the molecular structure of the raw materials to final installation, every aspect of the cable is optimized to offer the highest product quality, which is essential in an industry where delays and breakdowns can be extremely costly and frustrating to passengers. Integration is also evident in Nexans ability to supply both the energy and telecom sides of the railway industry, often via independent systems, but also through integrated products, like locomotive harnesses. Finally, integration means the ability to combine complex functions in a unified, compatible way, often facilitating remote monitoring and control. Not just an off-the-shelf supplier of cables and components, Nexans often works closely with its customers to design, develop and install complete systems which require expertise in several different areas.

2 - The second approach followed by Nexans concerns quality performance guarantees through constant innovation and a respect for the environment. Nexans heavily reinvests in R&D to constantly develop new products for the railway industry. Theoretical research is done in close cooperation with universities and international railway research organizations in areas like polymers, plastic optical fiber, tunnel technologies, safe and non-polluting materials, etc. Meanwhile, applied research is done in Nexans’ International Research Center in Lyon, France. Once feasibility is proven, responsibility is transferred to 10 competence centers located in 10 countries.

Know-how, experience, and special skills often lead to custom-tailored products. Safety standards are largely beyond the highest public safety criteria set down by national and international bodies. The fact that many of Nexans cables must remain onboard for 20 years and more means that there is an extra concern with reliability, and durability (especially in tough railroad conditions).

3 - The third approach adopted by Nexans is its global presence, to serve an industry that by its very nature operates internationally. Nexans has the broadest geographical presence in the cable industry, with plants on five continents, and representatives in over 65 countries. Not only can original manufacturers and the railway supply industry fill every cable need from a single vendor, but they can count on the logistics necessary to get what they need when they need it to meet production schedules, or to rapidly carry out essential repair work, without having to tow equipment back to train repair yards.

Global presence also requires a mastery of international standards, and here Nexans has obtained approval certificates from the IEC and critical ISO 9001 qualifications, and also all of the main classification bodies, including North American and Asiatic standards. Moreover,
as an active member on world standards committees, Nexans has pioneered many breakthroughs, including Halogen-Free, Flame-Retardant cables which are continuing to play an important safety role.

4 - Finally, Nexans is dedicated to partnership with its customers. During its 40-year involvement in the rail industry, the company has gained invaluable experience by working closely with engineers, rolling stock and rail network designers, construction yards, repairers – and especially the major manufacturers, themselves – to find solutions which respect their many priorities, which extend from concerns of cost, efficiency and safety to wider issues of reducing CO₂ emissions.

With its customers, Nexans is anxious to see “sustainable mobility” achieved in the face of transportation gridlock and bottlenecks, especially in major conurbations, but also for main line railways, both traditional and high-speed. It recognizes that rail transport has major advantages in the urban context, including environmental-friendliness, land-use efficiency, safety and energy conservation. It has special experience in metros and light-rail systems that can make a contribution towards the development intermodal urban mobility systems which meet the expectations of tomorrow’s citizenry. At the same time, it has been deeply involved in main line intercity projects in creating networks for management, energy and operational functions.

Increasingly Nexans, has been recognized and appreciated as an industry leader and “privileged supplier” by its many clients. To fulfill this role, it strives to understand the entire “supply chain,” especially from the customer’s point of view. Rather than assume that buyers are looking for the cheapest product, Nexans recognizes that expensive breakdowns, accidents, and short-lived cabling and equipment pose real threats to long-term viability. That is why the products, technologies and systems that Nexans offers are intended to reduce loss, prolong product life, and above all assure the highest standards of safety.

Nexans strongly believes that the future of the industry will largely rest on a cooperative network for railway vehicle and assemblies production. This means that a new industrial paradigm centered on concepts of partnership between independent companies – both suppliers and customers – will prevail. It strongly believes in the sharing of data in the rail sector so that costs, skills and access to global markets can be pooled and exploited, thus allowing each partner to contribute its core competence towards a “best of everything” solution for the railway industry.

**CONCLUSION**

Nexans sees its role in the next quarter of a century as a “privileged supplier” to the railway industry as it continues to more towards global procurement policy, integrated buying and shared responsibilities. More than ever before, Nexans believes that there is a need to go “beyond cable” in order to add value to products, do innovative research, and provide a host of behind-the-scenes services – ranging from new product design to the kind of long-term support that railroads need to meet future opportunities.
APPENDIX

Key Nexans products

For Rolling Stock:

In the area of power cables, Nexans provides a wide range of flexible, Class 5, tinned copper monoconductors to meet the power needs of today’s locomotives and drives. This includes cables that can handle 3-phase drives, with variable frequency.

- To deal with extreme temperatures and weight constraints (especially for ultra high-speed trains), Nexans has developed a new generation of **high-temperature power cables** for locomotives and drives: **compact silicon cables** which can operate in temperatures of up to 140°C (tested to 180°C). Used on France’s highly successful TGV trains, these cables have been able to achieve 10% to 20% weight reduction for the 2 tons of cabling which are standard for this type of locomotive.

- To carry electricity from the roof-mounted pantograph to the locomotive’s transformer, Nexans manufactures **flexible high-voltage cables (up to 25 kV)** which are sold as a pre-mounted, pre-tested set, with bushings and connectors. Nexans 700 series of **connectors**, extensively used on trains in Europe, China and Australia, are now used by British Rail on their locomotives. They are known to be light, compact, vibration-proof and extremely safe, with a 25-year life-span.

- Nexans’ wide range of **standard and thin-walled low voltage (up to 750 V) cables** (with or without shielding) provide energy for communications, public address, automatic doors, lighting, etc. Where space is limited, thin-walled designs have a tough but flexible high-tech coating.

- To assure surveillance and a video liaison between both extremities of a train, Nexans has developed a **copper, twisted-pair databus cables** which is made to the highest standards of guaranteed impedance.

- For communication purpose, Nexans provides standard **coaxial cables** able to suit standard connectors, but with an adapted jacketing meeting general requirements in terms of security (zero halogen, fire and flame retardant).

- Instead of a **twisted-pair bus cable**, rolling-stock

- Manufacturers can use **high-performance multimode optical fiber cable** to carry vital onboard data. In the long term, optical fiber offers important advantages like no electromagnetic contamination (EMC), high data speeds, compactness and low weight.
Rolling stock harnesses consolidate wires, connectors and identification systems not only in the locomotive, but in drives and black boxes throughout the train. Nexans designs, manufacturers, pre-mounts and end-tests a complete family of harnesses. For the high-speed German BR 101 locomotive, Nexans helped custom-design a complete system of cables and harnesses which greatly simplified assembly.

Short jumper cables between cars carry information and energy in an open, moving environment. Nexans jumpers use a special construction and materials for high flexibility, strength and durability. These cables are especially appreciated for ultra-speed trains in France, South Korea, Spain, etc.

Nexans also manufactures winding wires for traction motors and transformers, the latter using Continuously Transposed Cables (CTC).

To protect people and equipment, Nexans rolling-stock cables are halogen-free. This means that they are flame and fire-retardant, emit low smoke and toxicity, and are non-corrosive in the event of fire.

For Railway Networks:

To serve complex signaling and communications, Nexans has developed Local Area Networks (LANs) based on the latest multimode optical fiber technology. The Lisbon inter-model station (Gare do Oriente) uses a Nexans-installed LAN to manage 8 railway lines, a subway and surface mass transit.

Nexans FiberArt routing technology optimizes fiber routing through the physical network, thus guaranteeing network integrity. This fiber management module is easily implemented as an end-to-end solution in distribution frames, splicing closures and subscriber access points.

Modular optical fiber distribution frames provide a complete architecture for main exchange nodes or point of presence applications, while a range of splice protection closures are available for use along the line or at access points to the local loop, including in-line and dome closures for individual fiber management.

Copper, multi-pair signaling and switching cables are hybrid energy/telecom cables providing low-voltage energy and two-way telecommunications for filed equipment. Nexans cables (from a single to 56 pairs) are sheathed and shielded to protect them both against induction (for ultra-fast TGV trains) and the elements.

Nexans produces complete catenary systems. Pure copper and various copper allows are used for increased tensile strength and security at ultra-high speeds.

To meet the extended needs of railways (who are often power producers themselves), Nexans provides a full range of low, medium and high-voltage energy cables. Special insulated cables have been designed to withstand oil, heat, mechanical stress and freezing conditions.

Nexans produces low-voltage accessories, cabinets as well as low-voltage straight and branch joints for underground cables using a series of internationally recognized technologies.
Nexans produces **medium and high-voltage connectors** to connect insulated cables with distribution and transmission equipment (transformers, switches), as well as joints and terminations. The medium-voltage joints and terminations use the “cold-shrinkable” technology which does not require special tooling, and guarantees the quality and safety of the installation. This material complies with European and international standards.

In tunnels and public areas, **fire-performance cables**, i.e. halogen-free, flame-retardant (HFFR) cables ensure the functioning of energy, emergency and communication equipment. The cannel tunnel between France and England uses Nexans HFFR cables for public safety and to protect equipment.
Success stories

2004
Nexans delivers an important order of motor winding wires to ThyssenKrupp for Shanghai Transrapid
Approximately 1,000 km of 20kV winding wires (long stator) is installed along the total length of the track (30 km between the Shanghai railway station and the Shanghai airport). These wires are key components in the magnetic levitation technology providing non-contact driving power for the planned operating speed of 420 km/h and maximum speed of up to 500 km/hr. This is the first time that a highly automated laying technique has been used in this kind of large-scale project. Nexans also supports system installation for the Sino-German group.

Inauguration of the Korean High Speed Train
Nexans has signed a contract with Alstom for the Korean TGV project. For the infrastructure of the project Nexans provided in particular the catenaries, which are specific to high speed lines, and contacts wires. Nexans also made separate contracts with ROTEM for the rolling stock cables in addition to Alstom.

2002
Nexans wins 30 million Euro contract for integral cabling for the new Lötschberg railway tunnel (Switzerland)
Nexans wins a contract from the Swiss railway company BLS Alptransit to supply the high, medium and low-voltage cables and all the optical fiber links to equip the first trans-Alpine rail link on the Basel-Milan axis. The 35-km tunnel will be the longest in Europe when it opens in 2007. Nexans is member of the contracting group in charge of installing the railway track, the catenary line, and all the power and telecommunication infrastructure. Presently, Nexans is clearly leader on the Swiss railway cables market.

Nexans teams up with Alstom/National Rail to specify cables for locomotives running along the West Coast Line (UK)
Alstom in Charleroi (Belgium) is charged with developing all onboard systems for the ERTMS program (European Rail Traffic Management System), and with Nexans is designing a complete range of cables to link the various equipment on the locomotive. The outcome is that Alstom and UK National Rail have specified eleven Nexans cable types for locomotives. ERTMS allows up to four times the number of trains to be run down a section of line at any one time, and is an upgrade of the existing Automatic Train Protection systems based on axle counters. These cables are now being system-tested on the West Coast Line, along with the complete operating system. In the next five to seven years, government finances permitting, some 1,200 locomotives will be upgraded to ERTMS. Most of these cables have already equipped, or will soon equip many trains in Spain, France, Italy, Switzerland, etc.

Nexans obtains important axle counting cable for UK National Rail signaling system
Having been invited to design and bid for axle counting cables by National Rail (formerly Railtrack), Nexans wins the contact based on a superior design due to manufacturing processes that give definite advantages in terms of cable size and performance. With previous extensive experience in the manufacturing of this type of cable for Spanish, French and German railways, Nexans Santander (Spain) factory was chosen for the requirement. In addition, this project has led Nexans UK to work closely with National Rail engineering and their sub-contractors, two of whom, Westinghouse and Balfour have purchased £250,000 (163,350 Euros) of axle counting cable from Nexans. The Westinghouse project, called the
West Coast Line project, is the largest ongoing project in Europe at present. The Balfour project, known as the Wellington Signal Upgrade, is also ongoing.

**Optical fiber cable links for Deutsche Bahn AG**
Nexans receives an order for special jointing sleeves to be used in an optical fiber link of Deutsche Bahn AG, a part of the Cologne-Brussels TGV line. This reliable jointing sleeve technology constitutes an important part of this railway link. The technology is used for single circuit and single fiber management. Subscribers along the link can be connected to the communication network in the near and distant future since those jointing components store fiber in an accessible and economic way.

**Nexans teams up with Alstom/National Rail to specify cables for locomotives unning along the West Coast Line (UK)**
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**2001**
**Nexans combines two proven solutions for a new contact wire in the high-speed Madrid-Barcelona line**
Due to the high coefficient of security requested in Spain the consortium of Spanish companies Euroasce, in charge of the construction of the first line qualified for 350 km/h, needed a contact wire with a high breaking load of 75 kN. In France the norm is section 150 mm$^2$ with 64.5 kN and in Germany section 120 mm$^2$ with 60 kN. The Nexans solution combines a section of 150 mm$^2$ as used in France with the same alloy used in Germany to obtain the extremely high tension factor of 75kN for the line.

**2000**
**Nexans signs a contract to provide turnkey cabling on a new 41 km long railway route between Bern and Zurich**
Under the leadership of the construction group Zschokke Locher, Nexans obtains an important cabling contract on the 41 km Rail 2000 trunk between Mattstetten and Rothrist. The cable package includes low-voltage security cables, fiber optic and copper signaling cables, and the whole telecom infrastructure, including radiating coaxial cables for radio communications.

**Balfour Beatty awards Nexans contact wire contract for remodeled Euston station**
Nexans obtains a contract from the engineering company Balfour Beatty UK for the remodeling of the approaches to one of London’s busiest commuter and mainline terminals. Forty kilometers of copper cadmium contact wire will be replaced by a cadmium-free alloy. This is the first time that a copper tin contact wire has been used in the UK. The replacement of a well-known alloy CuCd used for more than 50 years by a non-toxic alloy CuSn with the same characteristics is an important safety enhancement for the railway environment.
1999

**Nexans provides Iranian Railways with superior copper trunk cable**

Nexans is providing plastic insulated composite trunk cable consisting of balanced elements (special star quads) and coaxial pairs. This new generation cable enables the railway authorities to operate broadband telecommunication transmission circuits on the one hand, and to serve control systems via the same cable on the other. Since cables are subjected to temperatures of up to 80 °C, no jelly filling material can be used. Therefore the cable link is supervised by a special air pressure system. In the case of sheath damage the internal air flows out, thus avoiding any moisture penetration into the cable core. In order to withstand the permanent gas pressure of approximately 60 kPascal, a seamless aluminum sheath combined with special steel armoring has been manufactured.

1995

**For Indian railways, Nexans provides special composite paper/plastic long-distance cables for reliable control and signaling**

This special Nexans product consists of composite paper/polyamide long-distance telecommunication cables with lowest screening factors achieved by a seamless covered aluminum tube and steel tape armored construction. These cables are highly influenced by electromagnetic fields caused by train electrification systems and thus the copper transmission elements have to be protected accordingly. OF cables cannot serve since they cannot carry energy for control and power feeding operations. Since cables have to withstand high temperatures, no plastic and jelly-filled cables are acceptable.

1992

**Radiating cables allow communications for high-speed trains even deep inside tunnels**

For Deutsche Bahn AG, Nexans installs radiating cable links inside of railway tunnels. For instance within the high-speed railway line Hannover-Würzburg the tunnel sections have been cabled with special radiating cable constructions in order to assure vital communications, even at high train speeds (TFS 91). When conventional antennas cannot function because of confined or winding spaces (as tunnels), these special trackside cables carry signals for ERTMS applications for train control and signaling.