This issue of Current Topics includes over 70 abstracts of reports, conference papers, books and journal articles that focus on the development and implementation of new railway signalling technology including integrated communications systems and linked railway / highway traffic control systems. The use of digital radio technology, upgrading of existing signalling, development / testing of the European Rail Traffic Management System / European Train Control System, harmonisation of signalling technologies, computerisation, remote monitoring of signalling systems, use of light emitting diodes, and simulation of signalling systems for testing and training purposes are included. These items have been selected from the material added to the TRL Library Database between 2000 and 2004. Much of the relevant English language published literature from the UK, USA, Australia and Europe is included; some of the non-UK literature is included courtesy of the OECD International Transport Research Documentation (ITRD) database.

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RAILWAY SIGNALLING TECHNOLOGY
(2000-2004)

Integrated transit priority and rail/emergency preemption in real-time traffic adaptive signal control
Mirchandani, PB
Lucas, DE
Journal of Intelligent Transportation Systems: Technology, Planning and Operations
Taylor & Francis Inc, 325 Chestnut Street, Philadelphia PA 19106, USA
2004-04 v8 n2 p101-15 36 refs
ISSN 1547-2450

The article discusses a strategy, referred to as Categorized Arrivals-based Phase Reoptimization at Intersections (CAPRI), which integrates transit signal priority and rail/emergency preemption within a dynamic programming-based real-time traffic adaptive signal control system. The system takes as input sensor data, from detectors, automatic vehicle locators, transponders, etc., for real-time predictions of traffic flow, and "optimally" controls the flow through the network using signal phasing. The system utilizes a traffic adaptive signal control architecture that (1) decomposes the traffic control problem into several subproblems that are interconnected in a hierarchical fashion, (2) predicts traffic flows, at appropriate resolution levels (individual vehicles, platoons of vehicles, transit vehicles, emergency response units, and trains) to enable proactive control, (3) supports various optimization modules for solving the hierarchical subproblems, and (4) utilizes data structure and computer / communication approaches that allow for fast solution of the subproblems, so that each decision can be implemented in the field within an appropriate rolling time horizon of the corresponding subproblem. Simulation-based analyses illustrate the effectiveness of the CAPRI system. (A)

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Rail communications for the 21st century
Garstenauer, J

European Railway Review
Russell Publishing Ltd, Court Lodge, Hogtrough Hill, Brasted, Kent TN16 1NU, United Kingdom
2004 n2 p50-4
ISSN 1351-1599

Until recently, most communication systems used by rail operators in Europe used analogue radio technology. More than 35 different interoperable systems were in use. GSM-R was selected for development as a single uniform communication system that could be adopted by all European rail operators. The development and implementation of GSM-R was conducted under the auspices of the international railway union UIC. UIC instigated two projects for the development of a uniform European rail communications standard: EIRENE (European Integrated Railway radio Enhanced Network) and MORANE (Mobile Radio for Railway Networks in Europe). Progress with implementation of GSM-R in different European countries is outlined. Applications of GSM-R, including voice and data services for train operation and the provision of a standard platform for all future control and signalling tasks, are discussed. The GSM-R technology and the benefits of the system are described.

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Resignalling the Cherwell Valley
Cordner, K

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom
2004-08 v61 n671 p47-52
ISSN 0026-8356

The Cherwell Valley resignalling project to resignal the line between Banbury and Leamington, UK, is described. The section of line was the only section between Bournemouth and Edinburgh still controlled by semaphore signals and had become a capacity bottleneck. Resignalling was a priority with completion scheduled in time for the start of the West Coast blockade at Tring. Funding was provided by Network Rail and the Strategic Rail Authority. Phase 1 involved the resignalling of the

Ref: E121035
Ref: E121374
Ref: E121795
Banbury-Leamington line, including an extended loop and new crossover at Fenny Compton and an additional cross over at Leamington Spa. Control was transferred from Fenny Compton to Leamington Spa using the Westcad VDU-based system. The new signalling headway is designed for 15 trains per hour on four-aspect signalling. Details are given of the development of the project, development issues, choice of technology, improved performance, the use of new light emitting diode signals from Dorman Traffic Products, and possessions and stageworks. The project was completed on time and on budget.

Ref: E123147

Filling the technology gap

Renon, R

European Railway Review
Russell Publishing Ltd, Court Lodge, Hogtrough Hill, Brasted, Kent TN16 1NU, United Kingdom
2004 v10 n3 p56-61
ISSN 1351-1599

Trenitalia has plans to expand beyond the Italian market and has focused on investing in technology at two different levels: a general one through projects relating to process reengineering and railway traffic innovation and a business-focused level. Examples are given of all-purpose projects: new onboard signalling gear (ERTMS/ETCS), rolling stock technology development (EDIP project, European Distributed Power Control), and rolling stock management process reengineering (RSMS project, Rolling Stock Management System). Examples of investment and improvements relating to rolling stock by Trenitalia Passenger Division, Trenitalia Regional Transport Division, and Trenitalia Cargo Fleet are outlined. Trenitalia has been awarded the 'Committed to Excellence' certificate by the European Foundation for Quality Management.

Ref: E123157

Signalling: one crisis succeeds another

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom
2004-07 v61 n670 p20-3
ISSN 0026-8356

This article discusses the signalling policy of Railtrack in the UK in relation to the West Coast Main Line, the radio transmission based train control system and its subsequent cancellation, the single control room or Network Management Centre, the Integrated Electronic Control Centre, Automatic Route Setting, and the Control Centre of the Future. The low cost signalling initiative launched in 1997 and the introduction of contracts for computer-based interlockings are described. Network Rail's solution to the expense of signalling was to focus on the hardware: the interlocking controls, point ends, signals and level crossings. The costs of signalling initiatives in the UK are compared with those in Europe.

Ref: E123158

ERTMS: can it be made cost effective?
Within the European Rail Traffic Management System (ERTMS), the European Train Control System (ETCS) is the common signalling system that will allow a train to run anywhere in Europe. The attitudes of German, Swiss and French rail operators to ETCS are outlined. The business and safety reasons for implementing ERTMS are considered and the reasons why ERTMS is unaffordable in the UK are described. The best benefit cost ratios came from installing Level 2 System D in the three UK main lines in the Trans European Network, with the rest of the network following as signalling came up for renewal. The testing of ERTMS Level 2 fitted temporarily to 218km on the Cambrian line is discussed.

Ref: E116144

Can ERTMS/ETCS become URTMS/UTCS?

Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-02 v43 n2 p28-9
ISSN 0744-5326

Efforts are being made by the International Union of Railways (UIC) and the train control manufacturing and supply industry to have the European Rail Traffic Management System (ERTMS) and the European Train Control System (ETCS) adopted globally. This was discussed at a conference on railway signalling at Beijing, China in December 2002. Presentations at the conference focussed mainly on the most advanced ETCS and GSM-R radio communications projects. It is considered relatively easy to implement the new technologies on track and rolling stock where no system existed or where the existing system was obsolete and had to be replaced. Divergence was clear in a number of presentations from various countries finding their own solutions. The European systems are regulated by EU laws and directives and change is strictly controlled. In relation to China, further study was considered necessary and the same GSM-R frequencies could not be used as in Europe as they had already been allocated to other purposes in China. Japanese signalling systems are also discussed.

Ref: E118146

Singapore still testing 20km automatic metro

Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-05 v43 n5 p29-30,32,35
ISSN 0744-5326

Singapore's North East Line (NEL), the longest and highest-capacity fully automatic heavy rail metro in the world, is due to open in 2003. The opening was delayed due to problems with the signalling. NEL serves the developing northeast of the island and has 16 stations with platform screen doors. SBS Transit has formed a rail division to operate and maintain NEL under a 30-year concession. The history of the NEL project, part of a long-term strategy to integrate transport and land use planning, is outlined. The innovations on NEL include moving block ATC with fewer track circuits than traditional signalling, computer-based interlocking, microwave slot counting used with wheel rotation for train displacement measurement, microwave communication between trains and fixed signalling equipment, station-based automatic train supervision, built-in test and diagnostic equipment and spot transmission based on the Euro-balise standard. The trains are from Alstom's Metropolis modular platform. Train and network maintenance is discussed.

Ref: E118873

Development and introduction of digital ATC at East Japan Railway Company

Matsumoto, M
Oba, Y

Rail International
International Railway Congress Association, 85 Rue De France, Section 10, Bruxelles B-1060, Belgique
2003-5 p3-9
ISSN 0020-8442
East Japan Railway Company (JR East) has developed a new digital automatic train control (ATC) system. The new ATC system is in use on the Morioka-Hachinohe extension of the Tohoku Shinkansen line and there are plans to replace existing ATCs with digital ATCs on JR East's other Shinkansen lines. The problems with the conventional ATC are outlined. The advantages of the digital ATC include perfect control of the brakes allowing headway and travel time to be reduced, improved operability through sensitive ATC brake controls, and less expensive ground equipment. The design of the ground equipment and the on-board device is described. The functions of the digital ATC are considered: train detection, determination of the location of stopping points, transmission of digital ATC signals, recognition of the train's position, speed check and brake control, on-board display of signals, shunting within station and train depot. The safety of the digital ATC and the schedule of its introduction on JR East lines are outlined.

Ref: E119671

Delivering capacity improvements with ERTMS/ETCS and intelligent traffic control systems

Mitchell, I

European Railway Review
Russell Publishing Ltd, Court Lodge, Hogtrough Hill, Brasted, Kent TN16 1NU, United Kingdom
2003 n3 p68-71
ISSN 1351-1599

This article considers the developing European Train Control System (ERTMS/ETCS) with the associated interlocking which controls route availability through the network and the traffic control system which aids signal control. Reasons for using ERTMS/ETCS include interoperability for international trains, safety in the form of automatic train protection, reduction in whole-life cost, increased speed and enhanced network capacity (using GSM-R radio communication). ERTMS/ETCS is not a complete control, command and signalling system: it operates alongside an interlocking which locks and releases routes, preventing conflicting movements. It in turn is controlled by a traffic control system, which passes advisory information to the train driver on route capacity, speed and advance warning of stopping; and to passengers. The optimum package of features that can be achieved is measured on an operations simulator.

Ref: E120039

JR adopts Hitachi's integrated digital ATP

Kera, K

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-09 v43 n9 p35-6
ISSN 0744-5326

Japanese Railways has introduced Hitachi's Integrated Digital ATP (automatic train protection) on the Morioka-Hachinohe extension of the Tohoku Shinkansen high-speed line. The system uses information and communications technology to improve transport capacity and ride comfort. The benefits of the Digital ATP over conventional ATP are considered. Digital ATP transmits stopping point information to the onboard device by a digital telegram via the rail, and the onboard device selects the optimum restricted speed profile from the onboard database and applies assured braking. As the assured braking is not bound by the length of the block section, higher density train operation and a reduction in track circuit equipment can be achieved. Details are given of the Digital ATP system requirements and field equipment.

Ref: E120251

SBB harnesses technology to increase capacity

Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-11 v43 n11 p24-5
ISSN 0744-5326

This article reviews progress in the development of the railway network in Switzerland. Budget cuts have caused a reallocation of priorities. The planned railway development programme, Rail 2000, requires major changes in the national timetable from December 2004 and considerable retraining of drivers, with testing of new signalling
and train control equipment. Introduction of the new services will turn the national railway network into a national rapid transit system with short headways and improved journey times. A new traffic control system based on a central Rail Control Centre and four regional sub-centres will optimise train journeys and clear paths for individual trains to provide more capacity. Some of the development projects may have to be delayed or reduced to meet financial constraints.

Ref: E120254

Rail requires a common language
Raith, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-11 v43 n11 p36
ISSN 0744-5326

This short article discusses the need for European private rail freight operators to work together to create a viable freight network. Barriers to international operation include regulations, equipment and language. Priorities for standardisation are seen as being national rail regulations, signalling and train control systems, and power supply systems. Private sector companies should forge strategic alliances to ensure a presence on a wide range of routes via partners. The European Union should be supporting private enterprise and not allowing its hindrance by national governments and railways.

Ref: E120258

ETCS offers railways long-term benefits
Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-12 v43 n12 p17-8
ISSN 0744-5326

This article reviews the implementation of the European Train Control System (ETCS) on Europe's railways as part of the European Rail Traffic Management System (ERTMS). Several high-speed and conventional rail corridors have been selected as priorities. ERTMS will achieve interoperability at the technical level at first but this will expand into regulatory aspects. ETCS has been designed with two levels of application to make it usable with all infrastructure. Lineside signals are retained in Level 1, while full cab signalling functionality is offered in Level 2. Currently full cab signalling covers less than 4% of all tracks. Co-ordination is being developed to upgrade links between ETCS-equipped lines to Level 1: this will allow simplification of command and control (CC) equipment on international trains. To improve ETCS interoperability, ETCS should be implemented for safety purposes on new high-speed/high-density lines, to replace existing CC systems and to be basic equipment in new rolling stock.

Ref: E120260

ERTMS/ETCS installation in full swing
Pore, J

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-12 v43 n12 p20-1
ISSN 0744-5326

This article describes the equipment installation needs of the European Rail Traffic Management System/European Train Control System (ERTMS/ETCS). Swiss Federal Railways is launching a project to improve operation and train connections, and is implementing ERTMS/ETCS. Trackside signals are replaced by train movement control through a radio block centre, which controls all train movement authorisations. Trackside Eurobalises provide train positioning information. All classes of rolling stock are being upgraded to use the equipment, involving considerable modification of older stock. Tests have started on sets of ERTMS/ETCS equipment alongside a Eurobalise transmission model fall-back system. Lessons learned include the needs to validate on-board and radio system equipment, to train drivers and signalling staff thoroughly, and to implement communication between drivers and the control centre.
**Back to the future with relay interlockings**

Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2003-12 v43 n12 p29-30 1 refs
ISSN 0744-5326

This article considers the comparative advantages of relay interlockings and computer-based interlockings (CBIs) in controlling lineside signalling in the UK. Delays in the approval of new CBIs in the UK stem from the need to adapt foreign products to British standards. Current CBI systems are dependent on manufacturer-specific equipment and processes. Relays offer the advantages of low technical safety risk, overall operational performance and long economic life. Relay interlockings could be made compatible with the European Rail Traffic Management System in ways similar to current CBIs. Disadvantages to relay interlockings include longer line closure for integration testing, and the interface with VDU-based control and indication equipment and automatic route-setting systems. Relay technology could be used to advantage in certain complex locations.

Ref: E120270

**Computerisation of Chinese Railways**

Wang Lin Shu

Rail International
International Railway Congress Association, 85 Rue De France, Section 10, Brussels B-1060, Belgium
2003-11 v34 n10 p36-43
ISSN 0020-8442

This article details the applications of information technology (IT) in the Chinese railway network. Planning for implementation of IT started in 1975 and developed to become a computerised traffic management network covering the whole railway. This comprises freight traffic management, ticketing and sales, freight marketing and production management. The administration system refines the data as it is processed from stations and departments and it is then used to control traffic movement. The system also handles container and station management. Operational transport information includes data on traffic across the network, statistics, timetable planning and logistics. Automatic vehicle identification enables location of trains and freight wagons in the network for security and commercial confidence. Further computerisation projects include remote signal control and registered luggage transport.

Ref: E826110

**Equipment & materials guide : grade-crossing surfaces, communications and signaling equipment, fillers and housings**

Railway Track & Structures (RT&S)
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York, NY 10014, USA
2003-06 v99 n6 p32-47
ISSN 0033-9016

This guide offers updated information on grade-crossing surfaces, communications and signaling equipment and warning devices, fillers and fasteners, and housings and foundation. It also provides dimensional and structural data on highway grade-crossing surface materials, as well as flangeway-filler material that is available nationally. The data is designed to help railway and highway engineers in their selection of appropriate materials for specific projects.

Ref: E123761

**Proceedings of the International Conference and Exhibition Railway Engineering 2003, held London, UK, 30 April - 1 May 2003 - CD Rom**

Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2003 + refs

This conference proceedings consists of five keynote papers and sections on: the influence of rolling stock on rail and track; rail inspection; safety; changes in railway operation in Europe; rolling stock and noise; electrification and lighting; signalling; rail design; asset management; track investigation and inspection; trackbed modulus determination; rail maintenance; track route
construction, bed properties and improvement; earthworks assessment and management; earthworks stabilization; non-destructive testing and monitoring of rail bridges and retaining walls; bridges; tunnel investigation; and tunnelling - ground movement and vibration.

Ref: E123764

**A systems approach to monitoring asset reliability**

Bell, CR


This paper outlines some of the issues involved in taking a whole system approach to produce successful remote asset monitoring systems for the rail environment with reference to switching track on the UK's railways. Monitoring systems are not signalling systems, but many of the safety requirements for vital signalling equipment apply, but equally many do not, making safety approval challenging. Monitoring systems can produce vast quantities of data in remote outside locations where conventional IT equipment cannot be used for data reduction. This problem is compounded by the low bandwidth communications links generally available. Information about an asset is frequently of interest to different parts of the organisation. Monitoring can provide information about physical movement, interlocking with the signalling system and heating in cold weather. System design and operation must cover the differing requirements of all interest groups.

Ref: E112948

**Modernisation gathers pace in Italy**

Glover, J
Heaps, C
Wynn, A

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom 2002-01 v59 n640 p46-9 ISSN 0026-8356

The Italian railways are undergoing major restructuring. Under the overall control of FS Corporate (Ferrovie dello Stato), the railway is being broken up into four main divisions: infrastructure (Rete Ferroviaria Italiana, RFI), a railway operating company (Trenitalia), station management, and real estate and engineering services. A new high-speed line is being constructed between Rome and Naples. The new line is 203 km long, with 38 km in tunnels and 20% on viaducts. The line is expected to be fully open in 2007. The new Ansaldo interlocking system at Roma Termini is described. The new signalling system has achieved a 15% improvement in the timetable and a 50% improvement in the capacity. The modal split in public transport (metro, railway, buses, trams) in Rome is outlined. The city rail services are provided by two metro lines, three suburban railway lines operated under concessions.
and rail services on seven longer distance lines operated by Trenitalia.

Ref: E112829

**National gauging project aids Britain's rail network**

Bennett, S

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2002-03 v42 n3 p44-5
ISSN 0744-5326

The National Gauging Project computer software is designed to enable maintenance to be carried out far more efficiently on the national rail network of the UK. Track condition changes caused by damage or maintenance will be detected and monitored, and new lines and infrastructure upgrading will be assessed at the planning stage. A virtual railway system can be designed, which includes signalling, electrification and power supply, on the basis of mapping information from precise locations on the rail network. A signal layout design system and a route learning tool for drivers have also been devised. A driver training simulator is proposed.

Ref: E113836

**JR East expands ATOS train control system in Tokyo**

Kamijou, K

Ishikawa, T

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2002-06 v42 n6 p12-3
ISSN 0744-5326

An autonomous decentralised transport operating control system (ATOS) has been developed by JR East to modernise train control on conventional railway lines in the Tokyo suburban area, where passenger traffic is very heavy. The new system is being extended throughout the suburban network. It has become the largest decentralised system for ultra-high-density traffic control, covering 150 stations and 572km of lines throughout the Tokyo suburban area, and 4781 set routes (4481 passenger services) per day. The train operating status received by the central controllers is also distributed to stations, train drivers and conductors, and maintenance depots. Passengers receive precise train operating information through automatic announcements and LED passenger information displays on platforms. ATOS is linked via various communications networks. In the event of an accident, the train timetable can be adjusted easily by clicking with mice on the graphic displays. The adjusted data are transmitted directly to drivers, conductors, stations and passenger information. The system also enables the start and finish of maintenance work to be registered via radio or phone lines from portable terminals so that signals can be turned to red to protect maintenance workers. The installation of the system is described. The ATOS interlocking equipment is a continuous control system based on a system of reservation of track circuits.

Ref: E114914

**UK maps a rational ERTMS strategy**

Hope, R

Railway Gazette International
Reed Business Information, Quadrant House, Sutton, Surrey SM2 5AS, United Kingdom
2002-06 v158 n6 p314-5
ISSN 0373-5346

The report of the joint inquiry into train protection by Lord Cullen and Professor John Uff said that the UK’s West Coast and East Coast main lines should be equipped with the European Train Control System (ETCS) by 2006 and that other lines should be equipped by 2008. It was clear that this would be damaging to UK railways because of the impact on funding for other purposes and the pressure on signalling resources. The variants of the European Rail Traffic Management System (ERTMS) are outlined. The costs and safety implications of implementing the UFF/Cullen plan mainly using Level 1 ERTMS were compared with those of implementing a Level 2 ERTMS scheme over a longer timescale were examined. The effects on existing rail passengers and train staff, capacity implications, and safety effects were considered. The preferred option was to develop Level 2 allowing most key routes to be fitted by 2015.
Advanced automatic train control pioneered in San Francisco

Baker, JK

Railway Gazette International
Reed Business Information, Quadrant House, Sutton, Surrey SM2 5AS, United Kingdom
2002-06 v158 n6 p311-2
ISSN 0373-5346

The development of Bay Area Rapid Transit's Advanced Automatic Train Control (AATC) moving block control system in conjunction with GETS Global Signaling is outlined. The system is based on a robust radio network providing data communication and radio-ranging determination of train location. Computers installed at stations collate location and status messages from trains, calculate train speeds, and control the moving blocks. Each computer is connected to two station radios, which serve as master radios in the network. Spread-spectrum and time division multiplexing are used to communicate with trains every half second. The system was developed to meet the needs of the urban transport industry, rather than for a single customer. Phased installation can reduce disruption. AATC can overlay existing in cab signalling. Station computers are designed to interface to the existing signally for tracking unequipped trains and can also be operated as a stand-alone control system.

C2C: triumph after adversity

Briddes, S

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom
2002-08 v59 n647 p35-7
ISSN 0026-8356

Measures taken to upgrade the London, Tilbury and Southend (LT&S) railway line in the UK are described. GEC Alstom Signalling won the contract to resignal the entire line. The renewal was completed in 1996. Searchlight signals with relay based signalling were replaced by colour light signals with solid state interlocking. Simplified bi-directional signalling has been introduced. Points motors and track circuits have been replaced. The LT&S route was selected as an early candidate for privatisation. Prism Rail was granted a 15-year franchise in 1996. In 1997, Prism placed an order with Adtranz for 44 four-car 'Electrostar' electric multiple units. This number has been increased to 74. The service was rebranded as C2C. Reliability and punctuality have been increased, station environments have been improved and the track is being upgraded. Current services operated on the line are described and fare innovations are outlined. National Express took over Prism in 2000.

New signalling system under test in North America

Polivka, A

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2002-12 v42 n12 p31-2
ISSN 0744-5326

This article describes the operation of a new train control system currently being developed and tested on North American railways. The project uses communication-based architecture and operates on closed loop principles at multiple levels. Each train independently determines its location and transmits it to the server, which adjusts movement authority limits in accordance with the position of other trains and speed limits. The system is able to apply the brakes to stop a train if the crew do not take action. Two modes of operation are accommodated, integrated and stand-alone. Position information is obtained not only from global positioning satellites but also from ground-based and train-based sensors.

A hi-tech solution for low-density lines

Pore, J

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
This article describes a newly developed train control and signalling system, Atlas 400, produced by Alstom for specific use on low-density-traffic rail lines. A European research and development project, Locoprol, is contributing to the development of the product. Atlas 400 can be offered in a variety of configurations and will be available as a basic system with optional enhancements. The main technology is train positioning based on satellite positioning. Communications costs will be kept low by avoiding the need for a permanent communications link and using public media. System requirements are based on specifications from potential customers and from European specifications. The modularity of the system should allow adaptability to customer needs.

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Ref: E818980

Sharing tracks with driverless trains

Schmidt, K
Beismann, H

Metro Report : A Railway Gazette Yearbook
Reed Business Information, Quadrant House,
Sutton, Surrey, SM2 5AS, United Kingdom
2002 v158 p11-12
ISBN 0-617-01298-9

The city of Nurnberg has developed plans to phase in the first fully-automatic metro line in Germany. In November 2001, the city's public transport operator, VAG, awarded a contract to Siemens Transportation Systems to supply 30 two-car driverless trains and to equip two metro lines for fully-automated operation. One existing line runs from Nurnberg airport in the north to Rothenbach in the southwest. When a second, fully-automatic line is constructed it will operate as branches off the first line, which will not be converted to a fully-automatic line until 2007. As a result, conventional trains and fully-automatic trains will share track across the city center for a time. Siemens designed a signaling package for these hybrid operations that is based on inductive loop transmission.

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Ref: E819215

ASES advanced speed enforcement system combining intermittent cab signaling system with continuous cab signaling system for advanced train control

Gillen, HC

Commuter Rail/Transit Conference Proceedings.
Location: Baltimore, Maryland. Held: 9-13 June 2002
American Public Transportation Association, 1666 K Street, NW, Washington, DC 20006- USA
2002-06 6P
ISBN 1931594066

This paper describes Union Switch Signal's (US&S) Advanced Speed Enforcement System (ASES), which is currently in revenue service on New Jersey Transit. The paper explains how ASES provides Positive Stop enforcement. The ASES system integrates European transponder (balise) communication system technology with continuous cab signal technology to provide an Automatic Train Protection (ATP) system that meets the requirements for positive train stop enforcement. The paper describes additional speed enforcement functionality (e.g. civil speeds, temporary work speeds and expanded signal speeds) that are provided by utilizing information available from the transponders such as position information, distance to next signal, other speed restrictions, and grade. The paper also identifies potential additional functionality that can be obtained with an ASES system that includes a data radio interface to the wayside.

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Ref: E819231

New application of proven technology easy entry to CBTC

Leung, P
Hart, H

Commuter Rail/Transit Conference Proceedings.
Location: Baltimore, Maryland. Held: 9-13 June 2002
American Public Transportation Association, 1666 K Street, NW, Washington, DC 20006-, USA
2002-06 5P
ISBN 1931594066
Urban Rail Transit Operators can now upgrade to introductory Communications-Based Train Control (CBTC) cost-effectively with easy-to-install technology that is based on proven methodologies. The objective to this paper is to describe a scalable, components-based system that allows operators to conveniently upgrade from Automatic Block Signaling (ABS) operation to intermittent Automatic Train Protection (ATP) functionality - an entry point to CBTC technology. Operators will then have the flexibility to migrate to higher level CBTC functionality such as continuous ATP, Automatic Train Operation (ATO), integrated interlocking and Automatic Train Supervision (ATS), or fully automatic driverless control. To exemplify the application, the paper describes a Civil Speed Enforcement system and components selected by the Toronto Transit Commission (TC) for their entire subway. The present TTC subway signal system is very similar to the New York City type of signaling application. The project demanded a Civil Speed Enforcement system that could be upgraded to higher CBTC functionality while retaining the original investment. The new system will permit the elimination of their current Grade Timing technology.

Ref: E819277

Impact of using light emitting diodes (LEDs) on recognition of colored light signals by color vision deficient drivers
Andersen, CK
16th Biennial Symposium on Visibility and Simulation. Location: University of Iowa, Iowa City. Held: 2-4 June 2002
University of Iowa, Iowa City, Center for Computer Aided Design, 116 Engineering Res Facility, Iowa City, IA 52242-, USA 2002 11P

Traffic signals must provide a conspicuous signal to a wide variety of drivers over a broad range of environmental and geometric conditions. The incandescent traffic signal, developed from existing maritime and railroad signaling systems, was a compromise between luminous efficiency and color saturation. While higher color saturation might result in an improved recognition level, with incandescent systems it also results in a lower intensity--which decreases detection and recognition distances. The use of direct-emitting sources may allow for rejection of such compromises. This paper evaluates the impact of using Light Emitting Diodes (LEDs) as the source for traffic signals, on drivers with color vision deficiency. While traffic lights are presented at suprathreshold levels, much of this work is pertinent to other forms of transport signaling, including lights producing a far lower illuminance at the observer’s eye.

Ref: E823025

An evaluation of light rail transit signal control options
Bauer, T
Fuller, P
Institute of Transportation Engineers, 1099 14th Street, NW, Washington, DC 20005-3438, USA 2002 12P
ISBN 093540371X

The cities of Phoenix, Tempe, and Mesa, Arizona, are proposing a new light rail line, part of which will follow Central Avenue, a major north-south corridor in Phoenix. The service is expected to initially operate with approximately 6-minute headways in both directions. The LRT tracks will be in the center median and will require the incorporation of either train preemption or priority into the signal control system. This paper reviews the evaluation of 3 distinct LRT signal control strategies based on microscopic simulation analysis of future traffic and transit operations through the Central Avenue corridor. The individual simulation models include a detailed emulation of LRT priority or preemption logic of current off-the-shelf signal control equipment. The 3 LRT signal control strategies are evaluated based on measures of effectiveness such as LRT and general purpose traffic travel time, average intersection delay, and queue lengths at key approaches such as left-turns across the LRT tracks.

Ref: E823659

Overview of recent signalling and telecommunications technologies
Takashige, T
As part of its effort to promote research and development of low-cost and high-performance signaling and telecommunications technologies for railway operations, the Signaling and Telecommunications Technology Division of the Railway Technical Research Institute conducted a survey of recent developments in signaling and telecommunications. The survey is part of a series of reports centered around the potential use of the computer and microwave balise aided train control system (COMBAT) that uses radio for detecting trains and overall centralized traffic control as well as other software and maintenance systems. A one-stage brake control system for automated trains is a digital system that permits trains to perform most of the processing, reducing the time needed to actuate brakes. A new automatic train stop system superimposes digital signals on the legacy systems enabling multiple, simultaneous operation of different types of systems used by different types of trains. A new system to detect obstacles in railroad crossings won’t be as adversely affected by weather and climate as the old ones. Finally, there is the promise of wireless Bluetooth service using xDSL for radio access to in-cabin networks and transmission between the ground and trains in stations, ticket issuing machines, control circuits and others. Issues remain about the quality of service and the integrity of communications security over such networks.

Ref: E823662

Application of formal methods to the railway signalling systems

Terada, N
Fukuda, M

Quarterly Report of RTRI
Railway Technical Research Institute, 2-8-38, Hikari-cho, Kokubunji-shi, Tokyo 185-0034, Japan
2002-12 v43 n4 p169-174
ISSN 0033-9008

To better analyze the reliability of software used in automated train operations, formal methods need to be developed and applied by which specifications for the software can be described in a way that makes it possible to use automatic proofs to verify the software’s performance. This paper reports on proof obligations that have been developed for the digital automated train control track database. An outline of the formal methods for systematic analysis is given. Specifications are written in mathematically or logically structured terms, so that they can be checked by a computer using a syntax. Although it may take more time initially to describe the specifications with formal methods, it is good at detecting errors, which can save time and money later. Formal methods are hoped to reduce errors caused by mistaken specifications. The report then applies the use of formal methods to
specifications for the digital automated train control track database which is different from the previous track database in that calculations that determine what instructions should be issued to trains sharing blocks of track are issued on board the train, meaning that on-board software must operate safely. Describes the structure of the database and gives examples of formal specifications. Proof obligations are generated. Shows the graphical user interface of the automatic proof generating function, which is a toolkit based on high order logic. Next are interactive proofs, which has a proof tree and whose screen is shown. In the test of the formal specifications for the digital automated train control track database, 188 proof obligations are generated and 90% are proved automatically and the rest are proved interactively. The proof engine needs more work to speed the interactive proving process and to extend the engine's scope to other specifications.

Ref: E823691

**Progress under control : after completing several successful pilot programs, railroads seek to expand communications-based train control system capabilities**

Kube, K

Progressive Railroading
Trade Press Publishing Corporation, 2100 West Florist Avenue, Milwaukee, WI 53209-, USA 2002-12 v45 n12 p33-36
ISSN 0033-0817

With the success of several pilot programs, communications-based train control systems are being deployed in freight and passenger settings. The question is no longer if they will become common in the industry, but when, and in which form. The North American Joint Positive Train Control project recently tested a 15-mi. section of track that can support 110-mph operation of Amtrak trains in Illinois. The train in the test used communications-based controllers, which worked well. The federal designated high-speed corridors are expected to be big users of these systems to enforce speed restrictions, activate grade crossings and, if needed, stop a train in an emergency. The goal is to have all elements on the test section operational by summer 2003, and trains in revenue service will gradually increase their speeds to 110 mph. In a first for North America, Amtrak has been using positive train control along a 97-mile right of way in the Midwest in revenue service with train speeds that go up to 90 mph. One safety element is an automatic sensing system that connects crossing gates with trains, so that if the gates have remained down for more than five minutes, the point at which motorists start to drive around them, the train is signaled to slow to 15 mph. The new control system that is being installed in Bay Area Rapid Transit (BART) trains allows for smoother acceleration, in 1 mph increments rather than 4. The new system will also allow it to increase capacity by as much as 30% by running trains with shorter headways. Meanwhile, interoperability and open architecture are being called for, especially by larger operators such as New York City Transit, which wrote open architecture into its specs. The next big hurdle, once the individual agencies have incorporated positive train control, is creating a network wide system.

Ref: E825389

**Railway operation and control**

Pachl, J

VTD Rail Publishing, 3604 220th Place, SW, Mountlake Terrace, WA 98043-, USA 2002 239P
ISBN 0971991510

The purpose of this book is to provide the basic knowledge in the science of railway operation in a close connection to signaling principles and traffic control technologies. The book identifies three essential elements: the infrastructure with the track work; the rolling stock with cars and locomotives; and the operating rules and procedures for a safe and efficient operation. Explained are the basic terms of track layouts, signal arrangements and movements of the railway vehicles. A more detailed explanation of how railway operation is controlled, planned and protected is also provided. The appendix provides the explanation for the symbols which are used in track and signal diagrams.

Ref: E122683

This CD-ROM contains 111 papers presented at the conference on topics including maintenance of railway tracks, use of recycled materials in embankments, ballast, detection of defects in railway tracks, railway track design, design and maintenance of railway bridges, soil stabilization, slope stability, management of vegetation including leaves on the line, use of geotextiles, signalling systems, electrical power supplies, non destructive testing of railway assets, design of high speed railways, upgrading of existing railways, historic structures including arch bridges, design and construction of new bridges, the wheel rail interface, risk assessments, software for decision making, and railway station construction methods.

Ref: E122718

The management of electromagnetic compatibility (EMC)

Marshman, CA

Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2002 3p 4 refs
ISBN 0-947644-49-0

Electromagnetic compatibility (EMC) must be maintained between the railway infrastructure: OLE, power supply; signalling or train control system; rolling stock and other electrical/electronic systems situated adjacent to the railway, in order to ensure system functionality and safety. In addition all electrical/electronic systems in use on European railway networks must conform to the essential protection requirements of the EMC Directive 89/336/EEC and the national implementing regulations; SI 1992 no.2372 in the UK. CENELEC, the European electrical standards organisation, has adopted a series of EMC standards for railways: EN 50121 parts 1-5. Meeting these standards indicates minimum criteria for the equipment to function satisfactorily and safely in the railway environment and when the results are incorporated in a Technical Construction File (TCF), the minimum criteria for conformance with the EMC regulations. In addition to these standards it will be necessary to meet the specific EMC infrastructure requirements e.g. Railtrack Group standards GM/RC 1500, GM/RT1031 and GS/ES 1914 or LUL M 1027 A2. Achieving EMC and conformance with the appropriate standards and the regulations will only be achieved by using EMC management within the design of equipment and systems. It will be necessary to generate the appropriate documentation in order to deal with the EMC aspects of the Safety Case (e.g. EMC hazard closures for the hazard log) and to demonstrate conformance with the EMC Regulations.

Ref: E122741

Increasing the traffic capacity of London Euston Station - track and electrification systems

Davies, G
Warburton, K
Marsh, R
Clark, T
Curzon, A

Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2002 18p
ISBN 0-947644-49-0

The Euston Station terminus of Railtrack's West Coast Main Line (WCML) has been upgraded and enhanced to cater for the proposed overall increased capacity of the route and the greater diversity of trains using the route. This increased capacity has been achieved by modifying the track layout and enhancing the electrification system in conjunction with a new signalling system. The project was one of the most complex ever undertaken at an operational station. This paper discusses the track remodelling and the impact of this on the electrification system in the light of the increased capacity requirements. The paper concludes that it is practical to design and implement an increased capacity scheme, whilst complying with standards and continuing to provide an operational railway.

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Rail lighting applications - an LED specialist's perspective
Logan, PM
Proceedings of the International Conference
Railway Engineering 2002, held London, UK, July 2002 - CD Rom
Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2002 6p
ISBN 0-947644-49-0

Advances in light emitting diode (LED) technology have opened up exciting opportunities for many areas of rail industry lighting. The development of LED systems to create alternatives to traditional light sources includes replacements for incandescent (filament) lamps, fluorescent, electroluminescent and even paraffin lamps. Inherent reliability, efficiency, and resistance to vibration are characteristics which attract interest from operators and maintainers alike. Proven retrofit examples exist in signals, signal box indicators and rolling stock lamps. The LED, however, is not a natural direct replacement for existing equipment, and if users are to benefit fully from the many advantages inherent in LED technology, full and diligent specialist design activities must be undertaken. For example, many special measures must be taken to ensure suitable intensity, colour, proving circuitry and electrical interface requirements are met. Experience gained in other industries may be readily applied to rail lighting projects - both for new equipment and retrofit systems. This paper examines the profound differences between LED and other lighting technologies, suggests some innovative solutions, and offers some thought-provoking predictions for the future.

Uninterruptible power supplies for rail signalling systems
Tanzer, R
Proceedings of the International Conference
Railway Engineering 2002, held London, UK, July 2002 - CD Rom
Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2002 9p
ISBN 0-947644-49-0

Uninterruptible power supplies (UPS) provide a well proven way of ensuring continuity of power for rail applications, particularly where safety is paramount. However, the provision of UPS to rail circuits often involves the integration of a many systems, and this aspect is not often considered in the design of UPS installations. This paper considers the application of UPS to railway signalling systems and provides a methodology for the design of UPS systems for railway signal supply. It also includes a case study on the installation of a UPS to a signalling circuit at Selby Junction, North Yorks.
of supply whilst the diesel generator starts up. A UPS can be retrofitted on any site as long as the generator is of sufficient quality and capacity to support the existing signalling system. Chloride Power Protection have now developed and proved UPS systems that are designed to accept the very poor quality 25kV traction supply and convert it into clean, stable and highly accurate sinusoidal source of AC power that is suitable for all types of signalling equipment or computer/communications systems loads. Although many new Railtrack applications in the future will probably operate at 400V 3 phase, most existing Railtrack systems currently operate at 650V 1 phase. For these reasons, Chloride Power Protection have developed a number of different UPS solutions that are very specific to the requirements of the rail industry. Manual Maintenance Bypass Switches (MBS) are always incorporated into the design of UPS systems for rail applications. This facility allows for power to the system load to be maintained without break whilst the UPS is isolated from the system for service/maintenance.

Ref: E109203

The first green light

Harris, K

Rail Bulletin
Mack-Brooks Publishing Ltd, Forum Place, Hatfield, Hertfordshire AL10 0RN, United Kingdom
2001-02/03 v13 n1 p34-5
ISSN 0963-9578

The introduction of Siemens SIMIS W system of electronic interlocking on the 13.5 km length of railway track from Hinton Admiral to Parkstone, Dorset, employs technology used successfully in 13 countries. The system makes use of the Siemens COPAS real time operating system configured to suit signalling rules, and will include Siemens AzSM axle counters for train detection instead of traditional track circuits. The Area Signalling Centre (ASC) control at Bournemouth Station area will replace two signalboxes, will control 60 signals and replace 32 sets of points. The ASC will also manage the rolling stock movements at Branksome. Also included in the contract is an upgrade of operational telecommunications and the recovery of the signalling equipment currently in use. It is also reported that the communications section of Siemens Transportation Systems is to upgrade six cab-secure radio systems in Railtrack's Southern and East Anglia zones, covering the replacement of management and signal processors as well as upgrading the software of fixed-base radio stations.

Ref: E111097

Digital radio shows great potential for rail

Guillaumin, B

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-05 v41 n5 p50-1
ISSN 0744-5326

This article discusses the use of digital radio for communications functions on moving trains. Recent developments in multiple-path technology enable use of wireless radio devices on trains, which have always been poor situations for reception. Specific wireless protocols need to be designed for this application to cope with the shape of trains and tracks, the frequent need for uninterrupted communication, the variability of the radio environment and the need to protect communications from external intruders. Examples are given of railways in Europe which are experimenting with or using digital radio. Other applications could include digital wireless video, to detect track hazards or to offer passenger information or entertainment; and rapid transit signalling and train control as a safety measure.

Ref: E111857

Traffic growth and automatic train protection

Glover, J

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom
2001-08 v58 n635 p31-3
ISSN 0026-8356

This article reports a talk given to the Railway Study Association by Sir David Davies. The frequency and severity of UK rail accidents has diminished over the last half century. Driver skills
in controlling accident prevention are complex and all have to be included in any automatic system. Most incidents of signals passed at danger are minor, without personal injuries or fatalities, and only a fraction of accident risks could be prevented by automatic train protection systems. Three systems are available currently: Automatic Train Protection, trials of which have been run on two UK railway lines; Train Protection and Warning System (TPWS); and the European Train Control System (ETCS). In the long term, the European system is seen as the best option but it will not be available for another ten years. TPWS is not compatible but is available within the next two years. It could be considered advantageous to delay implementation of a system until the ETCS is ready.

Ref: E112096

**Distance-to-go signalling rivals moving block benefits**

Gillan, D
Railway Gazette International
Reed Business Information, Quadrant House, Sutton, Surrey SM2 5AS, United Kingdom
2001-10 v157 n10 p689,691-2
ISSN 0373-5346

Westinghouse Rail Systems Ltd and Dimetronic Signals have developed TBS100, a transmission-based train control system that can operate in three modes: speed signalling, distance-to-go (DTG) or moving block. The extension of Madrid Metro's Line 10 in Spain will be equipped with the system. The principles of speed signalling, DTG and moving block are described and the relative advantages of DTG and moving block over speed signalling are outlined. TBS100 consists of standard modules that may be configured to make up any of the standard elements of an ATP (automatic train protection) or ATO (automatic train operation) system. DTG and moving block require extra data transmission from track to train and require that the precise location of the train is known. With moving block systems, train detection systems may be removed.

Ref: E812827

**Digital radio shows great potential for rail**

Guillaumin, B
International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-05 v41 n5 p50-51
ISSN 0744-5326

Radio has been used for voice communication by railroads for decades. But only recently have wireless communications been considered by the railroad industry as being able to perform multiple functions. This article discusses some of the applications available today, such as data transmission for monitoring and traffic control, vital information such as signaling, automatic train operation, and brake control, and video communications. The availability of digital radio transmission is recognized as the main reason for this communications revolution.

Ref: E812826

**PKP gets the latest electronic interlocking**

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-05 v41 n5 p1
ISSN 0744-5326
The article describes the new Simis W electronic interlocking technology that was commissioned on the Polish State Railways in March 2001. This represented the start of a new era in Siemens' interlocking technology. The modular microprocessor based system which has been under development for the past 15 years, is expected to provide economic benefits for railways as a result of reduced infrastructure investment and lower life cycle costs. The interlocking can be adapted to meet technical requirements or environmental conditions, and it will reduce costs by using integrated trackside modules. The system has already attracted orders from railways in other countries ranging from Romania to China.

Ref: E812825

New ATC promises significant benefits

Ito, J

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-05 v41 n5 p48-49
ISSN 0744-5326

Automatic train control (ATC) has ensured safety of train operation in Japan's Tokaido Shinkansen since the service started in 1964. This article discusses the current ATC ground facilities that are in the need of replacement, and that are being replaced with a newly developed ATC system that will apply technologies such as the latest microelectronics for higher reliability to match the demands of the 21st century. Not only higher reliability but improved passenger comfort and greater flexibility in train scheduling are promised by the new system being developed by Japan Railways Central.

Ref: E812824

UIC debates ERTMS progress in Florence

Bennett, S

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-05 v41 n5 p41-45
ISSN 0744-5326

This article discusses the development of the European rail traffic management system (ERTMS) which is expected to provide Europe with a standard signaling and train control system to enable services to operate more easily and at higher speeds across the national borders. ERTMS will comprise the European train control system, a railway satellite telecommunications system, and a traffic management system. The specifications have been agreed to by the users' group, and have been incorporated in the technical specifications for interoperability, which means that they are mandatory for interoperability on Trans European Network routes. The article examines the operational advantages of this unified signaling and train control system for the European Union.

Ref: E814500

Alcatel TAS tests CBTC on the Paris Metro

Nuttall, C
Ludokar, P

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-10 v41 n10 p42-43
ISSN 0744-5326

Alcatel Transport Automation Solutions (TAS) is one of three companies demonstrating state of the art train control technology on the Paris Metro which needs a new communications based train control (CBTC) system to replace old signalling and increase line capacity through automatic train control as well as automatic train supervision. The article discusses the second formal demonstration of Alcatel's logical block signalling system.

Ref: E816193

World's first ETCS level 1 project is completed

Knutton, M

International Railway Journal
Simmons-Boardman Publishing Corporation, 345 Hudson Street, New York NY 10014, USA
2001-12 v41 n12 p43-44
ISSN 0744-5326
More than a decade after the European Union launched the ETCS (electronic train control system) project as a key step toward interoperability, the world's first application of ETCS Level 1 has been completed. This major milestone of railroad signalling was reached in Bulgaria in October 2001 with the completion of work on a 250 km section of the 430 km Sofia-Burgas line. The article provides descriptions of the three levels of ETCS.

Ref: E816504

Timing of traffic signal preemption at intersections near highway-railroad grade crossings

Seyfried, RK

Institute of Transportation Engineers, 1099 14th Street, NW, Washington, DC 20005-3438, USA 2001-08 22P
ISBN 0935403620

At locations where a signalized highway intersection is in close proximity to a railroad grade crossing, the railroad signal control equipment and the traffic signals controlling the highway intersection should be interconnected, and the normal operation of the traffic signals controlling the highway intersection should be preempted to operate in a special control mode when trains are approaching or occupying the crossing area. A preemption sequence compatible with the railroad grade crossing active warning devices, such as flashing lights and gates, is extremely important to provide safe vehicular, pedestrian, and train movements. Such preemption serves to ensure that the actions of these separate traffic control devices complement rather than conflict with each other.

Ref: E116944

Railway signalling - achieving concurrent safety and reliability

Cook, SR

Railway Safety - Papers from the Railway Technology Conference held at Railtex 2000, National Exhibition Centre, Birmingham, UK, 21-23 November 2000
Professional Engineering Publishing Ltd, Northgate Avenue, Bury St Edmunds, Suffolk IP32 6BW, United Kingdom 2001 p97-102 3 refs
ISBN 1-86058-349-0
ISSN 1356-1448

This paper considers the developments required to improve the safety and reliability of railway signalling systems. System architecture must use transmission based signalling, as traditional signalling, relying on driver vision, is not reliable. Diverse principles are needed as there is both a driving and a protection function in a system. A common set of performance characteristics is
assumed in order to consider relative merits of different architectures. Meeting both safety and service reliability requirements needs the use of a 2 out of 3 voting system: however, this may be seen as too expensive and a 1 out of 2 system at each end of a train achieves similar results in a simpler manner.

Ref: E117519

Data over voice

Lindsey, R

International Railway Congress Association, 85 Rue De France, Section 10, Brussels B-1060, Belgium
2001 p160-5

The core infrastructure for a North American railroad consists of voice radio for communications and transitional signalling technology, discrete wayside readers and manual reports for positioning. Wireless data networks are not used for providing timely data as to train position, speed and status. A new approach using Data Over Voice (DOV) for structuring a train-management strategic vision is presented. Data requirements and sources are considered. A 24-hour train lineup for a portion of CSX's operations between Chicago and Memphis was developed using different time intervals for reporting train positions. Increasing the reporting frequency improved train movement efficiency. The principles of DOV are outlined. The costs of providing timely information are discussed.

Ref: E117539

Development status of GSM-R and ETCS. Prospects for the Central European railway corridors

Winter, P
Froesig, P

International Railway Congress Association, 85 Rue De France, Section 10, Brussels B-1060, Belgium
2001 p228-39

The EU has initiated a process for technical harmonisation in international rail transport. With regard to signalling, train control and train radio, specifications have been drawn up and new system developed under the title ERTMS (European Rail Traffic Management System). The two principal components of the concept are the new digital railway radio GSM-R and the new standard train command and control system ETCS (European Train Control system). The legal basis for European signalling, train control and train radio interoperability is described. The development status of GSM-R and ETCS is outlined and current tests and pilot applications in western Europe are reviewed. Problems of migration from existing systems are discussed. The potential for GSM-R and ETCS in railway corridors in central Europe is considered.

Ref: E123736

Impact of traction current in tracks as return circuit of overhead contact line on track circuit used in signalling and safety systems

Gavrilovic, BS


Engineering Technics Press, 46 Cluny Gardens, Edinburgh EH10 6BN, United Kingdom
2001 + refs
ISBN 0-947644-45-8

The 45 papers in this conference cover the construction and maintenance of railway tracks, bridges and tunnels. Different railway track construction methods, measurement of track condition, remote sensing of defects, non destructive testing, ballast cleaning, embankment stability, slope stabilisation, repair of settlement, the construction of high speed lines, signalling systems, electrical power circuits, risk analysis, wheel rail interactions and reducing maintenance costs.
This work describes results of mathematical modelling, established at the Technical Faculty in Cacak which examined impact of return traction current through railway tracks on functioning of signalling and safety systems in track circuit. This mathematical model has been tested through experimenting in electrified tracks belonging to the Yugoslav Railways. It can be confirmed that it enables to define, in a reliable way, the level of disturbances of track circuit operation in a wide span in stationary regimes of work of single-phase electric tractive systems of 25 kV, 50 Hz. Due to the type of mathematical modelling, the results of this research are applicable to other electric tractive systems as well.

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Ref: E123749

Data reporting, analysis and corrective action systems (DRACAS) in relation to railway signalling equipment

Giles, KV


In order to achieve safe, effective and reliable signalling systems, it is essential that all design, safety and reliability issues are understood and handled effectively. A DRACAS system is designed to record all incidents, design problems or concerns, normally (but not always) in a database. The system ensures that everyone is made aware of issues that affect them, as well as what actions they need to take and when. The system also considers the implications for other related products or systems, and includes a 'closed loop' approval mechanism, to ensure that a nominated person takes responsibility for the closure of the incident. The DRACAS concept has its roots in the aerospace and defence industries and, like other techniques such as Reliability Centred Maintenance, is now beginning to show the benefits it can bring to the rail industry. Using a real DRACAS system and some historical rail infrastructure data, this paper describes the basic elements of a 'closed loop' DRACAS system, show how it is applied in practice and the benefits it can bring for rail systems. The paper also aims to show some techniques that are applied successfully in other industries, and which can bring benefits for rail.

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Ref E104520

ATP options

Bradley, R

Rail Bulletin Mack-Brooks Publishing, Forum Place, Hatfield, Hertfordshire AL10 0RN, United Kingdom 1999-12/2000-01 v11 n6 p21-3 ISSN 0963-9578

Recent rail accidents in London have sharply focused the need to provide more effective train protection systems. This article examines the technologies available to help improve the safety of rail travel in the UK. Automatic train protection (ATP) systems are additional to lineside signals, and aim to prevent movement of trains across tracks unless the signals are also set correctly. The earliest form of ATP appeared around 1900. In the 1950s, British Rail began to introduce automatic train control (ATC), which would automatically apply the brakes within 4s if the train passed a caution signal. The form of ATP used by London Underground Ltd (LUL) has a mechanical 'trainstop' operated for each signal. The London Docklands Light Railway introduced automatic train operation (ATO) in the mid-1980s, using principles like those introduced by LUL in the 1960s. Automated train operations, including ATP and ATC, later moved away from fixed to moving block signalling, then to cab signalling based on transmission and communications. Several recent systems integrate with both block signalling and transmission-based signalling; they include TVM, LZB, ZUB, IMU, and SACEM. One of the most successful ATP systems is Sweden's ABB Ebicab. ETCS ATP modules have been developed at the heart of the emerging European ATP standard.

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Ref: E105501

Railways agree ERTMS specifications
This article discusses the new phase which the European rail traffic management system (ERTMS) is now entering. On 31 March 2000, the specifications for its interoperable 'core' were completed and agreed by all railways in the ERTMS Users' Group. They have been incorporated in the Technical Specifications for Interoperability (TSIs), which are demanded by EU Directive 96/48/EC. Thus they are already mandatory on Trans European Network (TEN) routes, and will also become required on conventional lines. Work is now being accelerated on installing and commissioning ERTMS at trial sites, and implementing it commercially. ERTMS comprises the European train control system (ETCS), a railway satellite telecommunications system (GSM-R), and a traffic management system (ETML). Tests by the signalling partners assessed the performance and technical compatibility of the components supplied by the vehicle manufacturers. The first part of this project was very successful, and final laboratory tests are being completed. A full functionality test of ETCS Level 1 was conducted on the Vienna-Budapest trial site in November 1999. The article describes several trial sites established by members of the ERTMS Users' Group in Italy, Germany, The Netherlands, France, and Spain, a planned site in the UK, and certification procedures.

Ref: E105506

Signalling - the way forward

Abbott, J

Modern Railways
Ian Allan Publishing Ltd, Riverdene Business Park, Molesey Road, Hersham, Surrey KT12 4RG, United Kingdom
2000-05 v57 n620 p35-6
ISSN 0026-8356

This article shows how Railtrack is planning the application of a new signalling strategy for British railways, which was developed with the help of the McKinsey consultancy. It reports an interview with the Head of Railtrack's Signals Assets Group. Railtrack's policy will be mostly targeted renewals of signalling systems, supplemented by complete area renewals where appropriate. Railtrack is devoting much effort to assessing the state of its assets; without this information, its new policy would not work. WS Atkins has been working with Railtrack on a signalling asset plan, which outlines what must be spent to maintain mean equivalent asset value (MEAV). This predicts the total spending requirement, but does not identify which schemes to pursue or consider any need to enhance assets. Railtrack has also selected four sites where overseas technology will be applied, to supplement the extensive work that will be done by British companies. A chart in the article lists the signalling technology options for freight routes, rural routes, suburban routes, secondary main lines, and high-speed lines. For each type of line, the table lists the existing technologies and the options for short-term, medium-term, and long-term renewals.

Ref: E106076

Integrated signalling, APT and train radio on the Oresund Link

Hove, K
Buch, NB

Railway Gazette International
Reed Business Information, Quadrant House, Sutton, Surrey SM2 5AS, United Kingdom
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The opening of train services across the Oresund Link on 2 July 2000 physically connects railways in Denmark and Sweden. This article discusses the ingenious integrated signalling, communication, and train protection systems that are required to ensure that trains can run seamlessly between the two countries at speeds up to 200kph. Types of trains that will use the Link include: (1) a specially designed 180kph dual-system EMU; (2) the EG locomotive of Danish State Railways (DSB), which has been developed to haul freight trains from Sweden through Denmark to Germany; (3) some modified X2000 tilting trains from Swedish State Railways (SJ); and (4) some of DSB's IC3 diesel train sets. To ensure fully flexible operations, train drivers have to be able to drive in both countries, but this has not been easy to achieve, because of different safety systems and signal meanings. The traffic management centre in Copenhagen controls trains west of Peberholm station, and the overhead
power supply for the whole Link. Other functions are controlled from Malmo. Special training was used to develop a common language for train drivers. The article also discusses train equipment, signalling systems, automatic train protection (ATP) compatibility, train radio, power supplies, traffic control, and regulatory authorities.

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Supervisory control and data acquisition (SCADA) system for the centralized traffic control (CTC) equipment

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American Railway Engineering and Maintenance-of-Way Association, 8201 Corporate Drive, Suite 1125, Landover, MD 20785-, USA
2000 17p

Modern railway networks are equipped with Centralized Traffic Control (CTC) systems to facilitate train traffic control. Railway companies rely on various labor-intensive and highly repetitive maintenance programs to ensure safe and reliable service. In order to improve the productivity of such maintenance activities, as well as to provide the highest level of service reliability, a Supervisory Control and Data Acquisition (SCADA) system for the CTC field equipment is envisioned to be an essential tool for the maintenance work force. This paper presents the vision, concept and the prototype development of a SCADA system designed to monitor different CTC field equipment for the Signals and Communications (S&C) maintenance work force. Using the prototype CTC SCADA system, performance information of the power switches, track circuits, battery conditions and relay contact positions can be monitored locally or remotely. Implementation and monitoring results are also presented and discussed.

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ETCS Level 2 replaces flawed vision

Ford, R

West Coast Route Modernisation. A Special Report from Railway Gazette International
Railway Gazette International, Quadrant House, Sutton, Surrey SM2 5AS, United Kingdom
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This report describes progress with Railtrack's plans for ressignalling the West Coast Main Line in the UK. The company's original transmission-based signalling strategy collapsed when it was estimated that Alstom Signalling would have only a 5% change in having the moving-block system operational by 2005. The history of the West Coast ressignalling project is outlined. Following the collapse, the simpler European Train Control System (ETCS) Level 2 was selected. This retains conventional lineside interlockings, but transmits the signalling aspects to the train by radio for display in the cab. The signalling requirements for ETCS Level 2 and progress with the Network Management Centre and radio communication hub at Saltley, near Birmingham, are described.

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ERTMS - a contribution to the creation of tomorrow's railway

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ITS America, Suite 800, 400 Virginia Avenue, SW, Washington DC 20024-2730, USA
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This paper gives an overview of the Community's European Railway Traffic Management System (ERTMS) programme. ERTMS is an umbrella programme that brings together three main streams of development activity in the areas of signalling and command/control (ERTMS/ETCS), telecommunications (GSM-R) and traffic management (ERTMS/ETMS). The programme is being implemented through a Master Plan, which defines in a systematic way the scope of the work to be performed up to the certification/commissioning of the different components of ERTMS, its timing and the role and
responsibilities of the main actors involved. Particular reference is made in the paper to the set of key technical and management principles which underpin the structure of the Master Plan as well as to the main achievements and progress to date.

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