Scheduling Of Railway Infrastructure Maintenance Tasks

Mobility is fundamental to economic and social activities such as commuting, manufacturing, or supplying energy. Each movement has an origin, a potential set of intermediate locations, a destination, and a nature which is linked with geographical attributes. Transport systems composed of infrastructures, modes and terminals are so embedded in the socio-economic life of individuals, institutions and corporations that they are often invisible to the consumer. This is paradoxical as the perceived invisibility of transportation is derived from its efficiency. Understanding how mobility is linked with geography is main the purpose of this book. The third edition of The Geography of Transport Systems has been revised and updated to provide an overview of the spatial aspects of transportation. This text
provides greater discussion of security, energy, green logistics, as well as new and updated case studies, a revised content structure, and new figures. Each chapter covers a specific conceptual dimension including networks, modes, terminals, freight transportation, urban transportation and environmental impacts. A final chapter contains core methodologies linked with transport geography such as accessibility, spatial interactions, graph theory and Geographic Information Systems for transportation (GIS-T). This book provides a comprehensive and accessible introduction to the field, with a broad overview of its concepts, methods, and areas of application. The accompanying website for this text contains a useful additional material, including digital maps, PowerPoint slides, databases, and links to further reading and websites. The website can be accessed at: http://people.hofstra.edu/geotrans This text is an essential resource for undergraduates studying transport geography, as well as those interest in economic and urban geography, transport planning and engineering.

This book presents the latest research findings in the field of maintenance and safety of aging infrastructure. The invited contributions provide an overview of the use of advanced computational and/or experimental techniques in damage and vulnerability assessment as well as maintenance and retrofitting of aging structures and infrastructures such as buildings, bridges, lifelines and ships. Cost-efficient maintenance and management of civil infrastructure requires balanced consideration of both structural performance and the total cost accrued over the entire life-cycle considering uncertainties. In this context, major topics treated in this book include aging structures, climate adaptation, climate change, corrosion, cost, damage assessment, decision making, extreme events, fatigue life, hazards, hazard mitigation, inspection, life-cycle performance, maintenance, management, NDT methods, optimization, redundancy, reliability, repair, retrofit, risk, robustness, resilience, safety, stochastic control, structural health monitoring, sustainability, uncertainties and vulnerability.

Applications include bridges, buildings, dams, marine structures, pavements, power distribution poles, offshore platforms, stadiums and transportation networks. This up-to-date overview of the field of maintenance and safety of aging infrastructure makes this book a must-have reference work for those involved with structures and infrastructures, including students, researchers and practitioners.

This book takes a scientific approach to railways, and is intended to be of use to railway managers, economists and engineers, consulting economists and engineers, students of schools of engineering, transportation and management. This revised, updated and expanded edition is still rooted in engineering but now provides a much broader context, including policy and legislation, planning and management, and forecasting demand.

Indexes materials appearing in the Society's Journals, Transactions, Manuals and reports, Special publications, and Civil engineering.

Control, Decision, Optimization, Computer Science, Information Technologies

Containing selected papers from the ICRESH-ARMS 2015 conference in Lulea, Sweden, collected by editors with years of experiences in Reliability and maintenance modeling, risk assessment, and asset management, this work maximizes reader insights into the current trends in Reliability, Availability, Maintainability and Safety (RAMS) and Risk Management. Featuring a comprehensive analysis of the significance of the role of RAMS and Risk Management in the decision making process during the various phases of design, operation, maintenance, asset management and productivity in Industrial domains, these proceedings discuss key issues and challenges in the operation, maintenance and risk management of complex engineering systems and will serve as a valuable resource for those in the field.

This report examines experience to date from around the world in competitively tendering rail services. It seeks to draw lessons for effective design of concessions and regulation from both the successful and less successful cases examined.

Efficiency in public and freight transportation systems is of great importance for a society. Railways can offer high capacity and relatively low environmental impact, but require that several technical systems are tuned and operate well. Specifically there is a tight
interdependency between infrastructure and trains. The consequences are that all subsystems must be maintained and that the coordination of infrastructure activities and train operations is essential. Railway infrastructure maintenance and train services should ideally be planned together, but practice and research about railway scheduling has historically focused mainly on train operations and timetabling while maintenance planning has received less attention and little research have considered the joint scheduling of both types of activities. Instead the traditional approach has been a sequential and iterative planning procedure, where train timetabling often has precedence over infrastructure maintenance. This thesis studies how maintenance windows, which are regular time windows reserved for maintenance work, can be dimensioned and jointly scheduled with train services in a balanced and efficient way for both maintenance contractors and train operators. Mathematical methods are used, with the aim of advancing the knowledge about quantitative methods for solving such coordination problems. The thesis contributes with new optimization models that jointly schedule maintenance windows and train services, investigates the solving efficiency of these models, and studies crucial extensions of the planning problem primarily for the consideration of maintenance resources. Furthermore, the models are applied to, verified and validated on a demanding real-life problem instance. The main results are that integrated and optimal scheduling of maintenance windows and train services is viable for problems of practical size and importance, and that substantial maintenance cost savings can be achieved with such an integrated approach as compared to a traditional sequential planning process. The thesis consists of an introduction and overview of the research, followed by six papers which present: (1) A cost benefit model for assessment of competing capacity requests at a single location; (2) An optimization model for integrated scheduling of both maintenance windows and train services; (3) Mathematical reformulations that strengthen the optimization model; (4) Extensions for handling resource considerations and cyclic schedules; (5) A case study for a major single track line in Sweden; and (6) A mathematical study of length-restricted sequences under cyclic conditions.

Efficiency in the public and freight transportation systems is of crucial importance for a society. Railways can offer high capacity and relatively low environmental impact, but require that several technical systems are tuned and operate well. Specifically there is a very tight interdependency between infrastructure and trains, which distinguishes railways from other transportation modes. Thus maintenance of all the subsystems is needed. Railways do also have some specific and complicating properties that influence maintenance and operations: Most activities need exclusive access to the infrastructure and - due to the geographic layout, safety requirements and partitioning of the subsystems - large portions of the network will be affected by each activity. Furthermore, several organisational units and resources are involved, ranging from governments and regulatory bodies, over operators and contractors to suppliers, technical experts and work forces. Thus railway maintenance is complicated to organize and consumes large budgets. This thesis treats the planning and scheduling problems that concern railway infrastructure maintenance and the coordination with train traffic. Mathematical methods and optimization are studied and used, with the aim of advancing the knowledge about models for solving such problems. The thesis contains three papers and presents: (1) A survey regarding railway maintenance activities, the major planning problems and the conducted research so far; (2) A model for quantitative comparison and assessment of competing capacity requests from train operations and maintenance; (3) An optimization model for integrated scheduling of both maintenance windows and train services. The work can be helpful for practitioners as well as researchers who want to take further steps in this interesting and challenging area. Based on the results that have been obtained, future research directions are presented that may lead towards practical use of concurrent planning of railway maintenance and train services.

Seeks to improve communication between managers and professionals in OR/MS.

Dependability and cost effectiveness are primarily seen as instruments for conducting international trade in the free market environment. These factors cannot be considered in isolation of each other. This handbook considers all aspects of performability engineering. The book provides a holistic view of the entire life cycle of activities of the product, along with the associated cost of environmental preservation.
at each stage, while maximizing the performance.

This book promotes the use of mathematical optimization and operations research methods in rail transportation. The editors assembled thirteen contributions from leading scholars to present a unified voice, standardize terminology, and assess the state-of-the-art. There are three main clusters of articles, corresponding to the classical stages of the planning process: strategic, tactical, and operational. These three clusters are further subdivided into five parts which correspond to the main phases of the railway network planning process: network assessment, capacity planning, timetabling, resource planning, and operational planning. Individual chapters cover: Simulation, Capacity Assessment, Network Design, Train Routing, Robust Timetabling, Event Scheduling, Track Allocation, Blocking, Shunting, Rolling Stock, Crew Scheduling, Dispatching, Delay Propagation.

This introductory textbook links theory with practice using real illustrative cases involving products, plants, and infrastructures and exposes the student to the evolutionary trends in maintenance. Provides an interdisciplinary approach which links, engineering, science, technology, mathematical modelling, data collection and analysis, economics and management. Blends theory with practice illustrated through examples relating to products, plants, and infrastructures. Focuses on concepts, tools, and techniques. Identifies the special management requirements of various engineered objects (products, plants, and infrastructures).

This title incorporates the 15th proceedings of the very successful International Conference on Railway Engineering Design and Operation (COMPRAIL) series, which began in Frankfurt 1987 and continued in Rome (1990); Washington (1992); Madrid (1994); Berlin (1996); Lisbon (1998); Bologna (2000); Lemnos (2002); Dresden (2004); Prague (2006); Toledo (2008); Beijing (2010); the New Forest, home of the Wessex Institute (2012) and, again in Rome in 2014. The papers presented at this conference aim to update the use of advanced systems, promoting their general awareness throughout the management, design, manufacture and operation of railways and other emerging passenger, freight and transit systems. With the conference attracting a variety of specialists, including railway engineers, designers of advanced train control systems and computer specialists, the book particularly emphasises the use of computer systems in advanced railway engineering. Topics include but are not restricted to: Advanced train control; Operations quality; Risk management; Planning and policy; Energy supply and consumption; Communications and signalling; Operational planning; Interface management; Systems integration; Maglev; High speed technology; Interoperability; Passenger flow management; Computer simulations and Driverless and automatic train operation.

This book shows how the systems approach is employed by scientists in various countries to solve specific problems concerning railway transport. In particular, the book describes the experiences of scientists from Romania, Germany, the Czech Republic, the UK, Russia, Ukraine, Lithuania, and Poland. For many of these countries there is a problem with the historical differences between the railways. In particular, there are railways with different rail gauges, with different signaling and communication systems, with different energy supplies and, finally, with different political systems, which are reflected in the different approaches to the management of railway economics. The book's content is divided into two main parts, the first of which provides a systematic analysis of individual means of providing and maintaining rail transport. In turn, the second part addresses infrastructure and management development, with particular attention to security issues. Though primarily written for professionals involved in various problems concerning railway transport, the book will also benefit manufacturers, railway technical staff, managers, and students with transport specialties, as well as a wide range of readers interested in learning more about the current state of transport in different countries.

The rail human factors/ergonomics community has grown quickly and extensively, and there is much increased recognition of the vital importance of ergonomics/human factors by rail infrastructure owners, rail operating companies, system developers, regulators and national and trans-national government. This book, the fourth on rail human factors, is
This thesis is about mathematical optimization for the efficient use of railway infrastructure. We address the optimal allocation of the available railway track capacity – the track allocation problem. This track allocation problem is a major challenge for a railway company, independent of whether a free market, a private monopoly, or a public monopoly is given. Planning and operating railway transportation systems is extremely hard due to the combinatorial complexity of the underlying discrete optimization problems, the technical intricacies, and the immense sizes of the problem instances. Mathematical models and optimization techniques can result in huge gains for both railway customers and operators, e.g., in terms of cost reductions or service quality improvements. We tackle this challenge by developing novel mathematical models and associated innovative algorithmic solution methods for large scale instances. This allows us to produce for the first time reliable solutions for a real world instance, i.e., the Simplon corridor in Switzerland.

Highlights: Decision-making in data-rich, large and complex intervention scenarios. Integration of railway technical and business drivers for optimised interventions. Optimum scheduling by sequencing heuristic and genetic algorithms. Comprehensive task cost breakdown modelling for added-value autonomy. Proof of principle validated by British rail network stakeholders. Abstract: National railways are typically large and complex systems. Their network infrastructure usually includes extended track sections, bridges, stations and other supporting assets. In recent years, railways have also become a data-rich environment. Railway infrastructure assets have a very long life, but inherently degrade. Interventions are necessary but they can cause lateness, damage and hazards. Every day, thousands of discrete maintenance jobs are scheduled according to time and urgency. Service disruption has a direct economic impact. Planning for maintenance can be complex, expensive and uncertain. Autonomous scheduling of maintenance jobs is essential. The design strategy of a novel integrated system for automatic job scheduling is presented; from concept formulation to the examination of the data to information transitional level interface, and at the decision making level. The underlying architecture configures high-level fusion of technical and business drivers; scheduling optimized intervention plans that factor-in cost impact and added value. A proof of concept demonstrator was developed to validate the system principle and to test algorithm functionality. It employs a dashboard for visualization of the system response and to present key information. Real track incident and inspection datasets were analyzed to raise degradation alarms that initiate the automatic scheduling of maintenance tasks. Optimum scheduling was realized through data analytics and job sequencing heuristic and genetic algorithms, taking into account specific cost & value inputs from comprehensive task cost modelling. Formal face validation was conducted with railway infrastructure specialists and stakeholders. The demonstrator structure was found fit for purpose with logical component relationships, offering further scope for research and commercial exploitation.

Over the past decade, China has built 25,000 km of dedicated high-speed railway—more than the rest of the world combined. What can we learn from this remarkable experience? China’s High-Speed Rail Development examines the Chinese experience to draw lessons for countries considering investing in high-speed rail. The report scrutinizes the planning and delivery mechanisms that enabled the rapid construction of the high-speed rail system. It highlights the role of long-term planning, consistent plan execution, and a joint venture structure that ensures active participation of provincial and local governments in project planning and financing. Traffic on China’s high-speed trains has grown to 1.7 billion passengers a year. The study examines the characteristics of the markets for which high-speed rail is competitive in China. It discusses the pricing and service design considerations that go into making high-speed rail services competitive with other modes and factors such as good urban connectivity that make the service attractive to customers. One of the most remarkable aspects of the Chinese experience is the rapid pace of high-quality construction. The report looks at the role of strong capacity development within and cooperation among China Railway Corporation, rail manufacturers, universities, research institutions, laboratories, and engineering centers that allowed for rapid technological advancement and localization of technology. It describes the project delivery structures and incentives for delivering quality and timely results. Finally, the report analyzes the financial and economic sustainability of the investment in high-speed rail. It finds that a developing country can price high-speed rail services affordably and still achieve financial viability, but this requires very high passenger density. Economic viability similarly depends on high passenger density.
This report captures ways in which policy makers and senior officials in railway organizations from emerging economies can accelerate modal shift to rail. Such officials, as well as the general public, aspire for more freight to be moved by rail. The environmental and societal benefits of such a shift are compelling. And yet investment in railways is often not followed by a corresponding increase in freight moved by rail. This report highlights the fact that, in a world of changing global supply chains and logistics, the approach to regaining modal share needs to be different. The expectation that lower cost and efficient rail service will automatically lead to modal shift from road to rail has not been a reality in most emerging economies. Modern railways focus on understanding the logistics of targeted freight and positioning rail transport services as part of an overall logistics system aimed at meeting the needs of customers.

The papers presented in this volume aim to update the use of advanced systems, promoting their general awareness throughout the management, design, manufacture and operation of railways and other emerging passenger, freight and transit systems. The book particularly emphasizes the use of computer systems in advanced railway engineering. Topics covered include: Communications and signalling; Operations quality; Energy supply and consumption; Monitoring and maintenance; Computer simulations Planning and policy; Operational planning; Safety and security; Rescheduling; Timetable planning.

Cities across the globe are looking to develop affordable, environmentally friendly, and socially responsible transportation solutions that can meet the accessibility needs of expanding metropolitan populations and support future economic and urban development. When appropriately planned and properly implemented as part of a larger public transportation network, urban rail systems can provide rapid mobility and vital access to city centers from surrounding districts. High-performing urban rail services, when carefully approached as development projects, can help enhance quality of life by giving citizens access to employment opportunities, essential services, urban amenities, and neighboring communities. The purpose of this Handbook is to synthesize and disseminate knowledge to inform the planning, implementation, and operations of urban rail projects with a view towards: -- Emphasizing the need for early studies and project planning; -- Making projects more sustainable (economically, socially, and environmentally); -- Improving socioeconomic returns and access to opportunities for users; -- Maximizing the value of private participation, where appropriate; and -- Building capacity within project implementing and managing institutions. This Handbook provides experiential advice to tackle the technical, institutional, and financial challenges faced by decision makers considering urban rail projects. It brings together the expertise of World Bank staff and the input of numerous specialists to synthesize international 'good practices' and recommendations that are independent of commercial, financial political, or other interests. The material presented is intended as an honest-broker guide to maximize the impact and manage the challenges of urban rail systems in cities in both developed and developing countries. Rather than identify a single approach, this Handbook acknowledges the complexities and context necessary when approaching an urban rail development by helping to prepare decision makers to ask the right questions, consider the key issues, perform the necessary studies, apply adequate tools, and learn from international good practice all at the right time in the project development process.

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