Sixth International
Heavy Haul Railway Conference

"Strategies Beyond 2000"

6 - 10 April 1997
Cape Town, South Africa

Conference Papers

Hosted by:

SPOORNET

In conjunction with:
The International Heavy Haul Association
HEAVY HAUL STRATEGIC

RESTRUCTURING THE RAIL INDUSTRY: THE U.S. EXPERIENCE, by J.W McClellan

INDUSTRIAL AGE MEETS INFORMATION AGE: HEAVY HAUL AS SURVIVAL STRATEGY FOR FREIGHT RAILWAYS, by R.D. van derMeulen

IMPLEMENTATION OF THE TOTAL QUALITY MANAGEMENT AT THE CARAJAS RAILWAY, by Lauro J.V. Fassarella and J. Giovanni A. Albarelli

RAILWAY PRIVATIZATION - THE CN EXPERIENCE, by John A. Reoch

STRATEGIC OBJECTIVES OF CHINA'S RAILWAY HEAVY HAUL TRANSPORTATION BEYOND 2000, by Qian Lixin
SUBSTRUCTURE: SUBGRADE

REHABILITATION DESIGN OF HIGH EMBANKMENTS AND A COAL LINE TRACK FORMATION, by J. P. Lourens and J. S. Maree

TRACK INFRASTRUCTURE MAINTENANCE REDUCTION STRATEGIES THROUGH FORMATION STABILISATION OF HEAVY HAUL ROUTES, by Timothy John Griffin

LIME STABILIZATION OF RAILWAY TRACK SUBGRADE, by Theodore R. Sussmann and Ernest T. Selig

CONE PENETROMETER TESTING FOR TRACK SUBSTRUCTURE DESIGN AND ASSESSMENT, by S. M. Chrismer and D. Li

LOCOMOTIVES

HEAVY HAUL LOCOMOTIVES INTO TWENTY-FIRST CENTURY, by V. Sergeant, T. Nelson and W. Muir
A NEW GENERATION OF HEAVY HAUL DIESEL ELECTRIC LOCOMOTIVES, by C. Swenson and R. Wagner

ASYNCHRONOUS MOTOR TRACTION TECHNOLOGY TRAINING SYSTEM USING SCALE MODEL, by W. Oghanna, F. Flinders, R. Mathew, S. Pang, B. Stephen, B. Bock, W. Adamson

OVER POWERING OF HEAVY FREIGHT TRAINS A WAY TO DOUBLE THROUGHPUT, by D.K. Bansai

VEHICLE TRACK INTERACTION 1

PRINCIPLES OF TRANSITION CURVE CALCULATIONS, by Megyeri J.

CURVING PERFORMANCE OF FREIGHT CARS ON NARROW GAUGE TRACK, by M.A. Howard, G.M. Cassim and R.D. Frohling

EFFECTIVE DRIVER TRAINING UTILISES TRAIN DYNAMICS RESEARCH, by D.E. Roach and P.J. Wilson
UNDERSTANDING COAL TRAIN DYNAMICS REDUCES MAINTENANCE COSTS, by D. Roach and E. McLeod

SUE3STRUCTURE: GENERAL

STIFFNESS TRANSITIONSUBJECTED TO INSTANTANEOUS MOVING LOAD PASSAGES, by A.S.J. Suikerand and C. Esveld

THE INFLUENCE OF BALLAST FOULING ON THE RESILIENT BEHAVIOUR OF THE BALLAST PAVEMENT LAYER, by P.B.D. Arangie

EFFECTS OF FOULING ON BALLAST SETTLEMENT, by Xiangdong Han and Ernest T. Selia

STRATEGIC OPTIONS FOR INDIAN RAILWAYS TO ACHIEVE HIGHER SPEEDS AND AXLE LOADS ON MIXED TRAFFIC ROUTES, by Rakesh Chopra and Ankush Krish

TRACK CONDITION MEASUREMENT
MEASUREMENT OF LATERAL TRACK STRENGTH USING AAR’S TRACK LOADING VEHICLE, by D. Li, W. Shust and S. Kalay

TRACK DEGRADATION MONITORING USING SIGNAL MATCHING TECHNIQUES, by Gary A. Carr and H. James Rome

DEVELOPMENT OF INSPECTION CAR FOR MEASURING RAILWAY TRACK ELASTICITY, by Wu Wangqing, Zhang Geming, Zhu Kaiming and Luo Lin

RECTIFICATION OF DISTORTED TRACK IRREGULARITY RECORD OBTAINED BY INERTIA METHOD, by Toshio Otake, Yasukuni Naganuma and Yoshihiko Sato

**RAIL: GENERAL**

LATERAL BUCKLING OF CONTINUOUS WELDED RAIL TRACK DUE TO THERMAL AND VERTICALLOADING, by M.A. Van

RAIL NEUTRAL TEMPERATURE MEASUREMENT, by F. Mau
DEVELOPMENT OF HYPEREUTECTOID STEEL RAILS FOR HEAVY HAUL RAILWAYS, by Masaharu Ueda, Kouichi Uchino, Hideaki Kageyama, Ken Kutaragi and Kouji Babazono

GAS PRESSURE WELDING OF RAIL IN JAPAN, by R. Yamamoto, K. Ueyama, H. Oishibashi and M. Tatsumi

RAIL PROFILE 1

ROLLING CONTACT FATIGUE OF RAILS: CHARACTERISTICS, CAUSES AND TREATMENTS, by Stuart L. Grassie and Joseph Kalousek

CASE STUDY: THE COAL LINE WHEEL AND RAIL INTERACTION STRATEGY, by A. Durham

AN OVERVIEW OF THE MULTIDISCIPLINARY RAIL/WHEEL INTERACTION PLAN DEVELOPED FOR THE SISHEN-SALDANHA LINE, by A. S. Kretzmann

PARTNERSHIPS IN RAIL GRINDING, by P.S. Sroba and U. Maass
SPECIFYING RAIL GRINDING REQUIREMENTS, by Jim Cooper

VEHICLE TRACK INTERACTION 2


VEHICLE/TRACK DYNAMICS UNDER HIGH AXLE LOAD OPERATIONS AT BHP IRON ORE, by K. Epp, S. Marich, R. Bowey, A. Cowin and M. Moynan

REDUCTION OF RAIL SIDE WEAR ON HEAW HAUL RAILWAYS IN CHINA, by Daoxing Chen

EFFECT OF TRACK GEOMETRY AND VEHICLE DYNAMICS ON THE ACCURACY OF THE IN-MOTION WEIGHING SYSTEM, by J Dudek, C. Green and M. Moynan
FIELD MEASUREMENT AND ANALYSIS OF TRAFFIC-INDUCED VIBRATION BY SHINKANSEN TRAINS, by Hitoshi Kanda and Hiroshi Nagato

RAIL PROFILE 2

PROGRESS IN WHEEL AND RAIL MEASUREMENT, by Coenraad Esveld and Leif Gronskov

RAIL WEAR INSPECTION TECHNOLOGY FOR RAIL REPLACEMENT FORECASTING AND RAIL MAINTENANCE PLANNING FOR HEAVY HAUL RAILWAYS, by Daniel L. Magnus

REQUIREMENTS FOR TRANSVERSE RAILHEAD PROFILE AND RAILHEAD ROUGHNESS FOLLOWING GRINDING, by Stuart L. Grassie

EXPERIMENTAL STUDY ON THE EFFECT OF PREVENTIVE GRINDING FOR SHINKANSEN RAILS, by M. Ishida and N. Abe

TRACK DESIGN
OPTIMUM TRACK STRUCTURE CONSIDERING TRACK DETERIORATION IN BALLASTED TRACK, by Yoshihiko Sato

TRACK PERFORMANCE AS MEASURED AT FAST UNDER 39-TON AXLE LOADS AND CONVENTIONAL THREE-PIECE TRUCKS, by Dave Read and S. Kalay


THE EFFECT OF THE AXLE LOAD CAUSED BY THE DIFFERENCE OF POINT LOCKING METHODS, by Tonu Hayakawa and Masaaki Ogawa

MAINTENANCE MANAGEMENT 1

RESTRUCTURING TRACK MAINTENANCE OF ESTRADA DE FERRO CARAJAS, by Marcelo Mendes de Oliveira

MAINTENANCE ENGINEERING STRATEGY AND LOGISTIC SUPPORTS, by K. Konhbor
APPLICATION OF THEORY OF SENSITIVITY IN EXAMINING RAILWAY TRACK MAINTENANCE, by Jerzy Kisilowski and Bogdan Sowinski

PROGRESS THROUGH PARTNERSHIP, by B.C. Alberts

ROLLING STOCK

ADVANCED DEVELOPMENTS IN ROLLING STOCK MAINTENANCE, by P. Blain and A. Cowin

VALIDATION SIMPLIFICATION AND APPLICATION OF A COMPUTER MODEL OF LOAD SENSITIVE DAMPING IN THREE-PIECE BOGIES, by M.A. Howard, R.D. Fröhling and C.R. Kayser

REVIEW OF THE USE OF STAINLESS STEEL FOR COAL WAGON BODIES, by Peet Benadé and Don Maxwell

APPLICATION OF DAMAGE TOLERANCE PRINCIPLES TO STUB SILL TANK CAR CRACKING, by Daniel H. Stone and Joseph W. Cardinal
FASTENERS AND TIES (SLEEPERS)

RECENT DEVELOPMENTS IN RAIL FASTENING INSULATORS FOR HEAVY HAUL APPLICATIONS, by David Rhodes

TRACK FASTENING TESTING MAKING THE LINK BETWEEN TRACK CONDITIONS AND LABORATORY TESTS, by S.J. Cox, J.T. Barker and A. Wang

ASSESSMENT OF SLEEPER SPACINGS AT BHP IRON ORE, by S.S.S. Ravitharan, S. Marich, C. Minness and G. Offereins

LADDER SLEEPER AND NEW RAILWAY TRACKS, by H. Wakui, N. Matsumoto, H. Inoue and H. Okada

MAINTENANCE MANAGEMENT 2

TRACK MAINTENANCE MANAGEMENT PHILOSOPHY, by Willem Ebersöhn
SUBSTRUCTURE MAINTENANCE MANAGEMENT, by Emest T. Selig

SUBGRADE AND BALLAST MAINTENANCE WITH ADVANCED TECHNOLOGY, by Darrell D Cantrell

TECHNICAL SPECIFICATION, by K. Kouhbor

DETERMINATION OF TRACK WORKS WITH USE OF TOSMA, by Kunihiro Kondo, Yoshiyuki Kawasaki, Yoshihiko Sato and Eiichi Aoki

WHEELS AND BRAKES

DEVELOPMENT OF HIGH FRICTION COMPOSITION TYPE BRAKE SHOES AT CARAJÁS RAILWAY, by Ricardo Schmitt Martins

ELECTRO-PNEUMATIC BRAKING OF JAPANESE FREIGHT TRAINS, by H.E. Boysen, S. Nishi and S. Nishimura
WHAT WHEEL TEMPERATURES REVEAL ABOUT THE BRAKE SYSTEM, by A. Nieuwoudt and J. Beukes

MARTENSITE FORMATION AND DAMAGE AROUND RAILWAY WHEEL FLATS, by J. Jergeus

BEARING DESIGN AND MAINTENANCE TO MAXIMIZE OPERATING RELIABILITY, by Samuel R. Williams

MAINTENANCE INPUT

THE TRACK SYSTEM AND ITS MAINTENANCE, by B.W. Lichtberger

CHARACTERISTICS OF BALLAST SHOULDER CLEANING AND DITCHING, by Ernest T. Selig

USE OF A DYNAMIC TRACK STABILISER TO IMPROVE TRACK MAINTENANCE AND OPTIMISATION OF TRACK TAMPING J.S. Maree and P.J. Grabe
STONEBLOWING: DEVELOPMENT OF A NEW TECHNOLOGY, by B.W. Bradshaw

BRIDGES

ASSESSMENT OF THE POTENTIAL USE OF NON BALLASTED TRACK FOR HEAVY HAUL RAILWAYS, by M.I. Baxter

GETTING BRIDGES READY FOR HEAVY HAUL - THE PROCESS, by George Oommen and John A. Reoch

FATIGUE LIFE EVALUATION OF OLD SHORT AND MEDIUM SPAN CONCRETE BRIDGE UNDER HEAVY HAUL TRAINS, by Sun Guoan and Li Zhirong

STUDY ON FATIGUE DAMAGE OF STEEL RAILWAY BRIDGES MEMBERS UNDER HEAVY HAUL TRAINS, by Zeng Zhibin and Li Zhirong

GENERAL
FULL-SCALE TRACK COMPREHENSIVE TESTING SYSTEM FOR TRACK DYNAMICS LABORATORY OF CHINA RAILWAY, by Luo Lin and Li Jialin

RESEARCH AND EDUCATION

FROM THEORY TO PRACTICE: 20th CENTURY CUTTING EDGE TECHNOLOGIES FOR 21st CENTURY HEAVY HAUL OPERATIONS, by James R. Lundgren

INDUSTRIAL ENGINEERING RESEARCH AND TECHNICAL TRAINING AND DEVELOPMENT OF MIDDLE MANAGEMENT FOR COMPETITIVENESS, by N.D. du Preez and K. van Leipzig

KNOWLEDGE TRANSFER: UTILIZING NEW TECHNOLOGIES, by D.R. Holfeld and A.M. Zarembski

RAILWAY ENGINEERING EDUCATION, by Archie Rohde and Willem Ebersöhn

DISCLAIMER
The Papers printed in these Volumes of Proceedings are the work of the individual authors and have not been amended in any way by the Organizing Committee.

The Organizing Committee of the International Heavy Haul Association, will bear no responsibility for the technical correctness of any information included in these Volumes of Proceedings, and no correspondence will be entered into.

Session 1.2

HEAVY HAUL STRATEGIC

RESTRUCTURING THE RAIL INDUSTRY: THE U.S. EXPERIENCE

J.W McClellan

Norfolk Southern Corporation,

Three Commercial Place, Norfolk, Virginia 23510-2191
INTRODUCTION:

Good morning. It is a pleasure to be here in your lovely country. Today, railways and their management are under siege. In most countries, market share continues to decline. Government policies often promote other transportation modes. And governments seem determined to reduce or eliminate the deficits of publicly operated railways.

Against this backdrop, a variety of solutions have emerged. Some are more creative than they are realistic.

Even many of you in the heavy haul business traditionally the most profitable and efficient segment of the railway, will be impacted by the outcome.

INDUSTRIAL AGE MEETS INFORMATION AGE:

HEAVYHAUL AS SURVIVAL STRATEGY FOR FREIGHT RAILWAYS

R.D. van der Meulen
Spoornet
PO Box 173 East London, 5200, South Africa
Abstract

Global competition dismisses tolerance for non-competitive transport modes. Information technology fragments value chains and disintermediates ineffective players, thereby destabilizing or destroying traditional business models. In that milieu, railways typically adapt to strategic challenges by deregulation and competition. It has forced railways to re-examine their core competencies and to add value to their traditional offerings. Within a strategic consistency paradigm, the writer examines freight railways vis-a-vis road-haulier competitors. From the premise that freight railways require impregnable competitive advantage to survive, he formulates the hypothesis that they can only survive in the information age where they can leverage heavy-haul technology to advantage. At present this appears viable only in high-volume, dedicated, bulk-commodity traffic and double-stack intermodal traffic.

IMPLEMENTATION OF THE TOTAL QUALITY MANAGEMENT AT THE CARAJAS RAILWAY

Lauro J. V. Fassarella

J Giovanni A Albarelli

Cia Vale do Rio Doce, Caixa Postal 676, CEP 65085-580 - Sac Luis, Ma. - Brasil
Abstract

This paper reports on the planning developed to implement Total Quality Management at a company rendering freight and passenger railroad transportation services which is the Carajas Railway Superintendency (EFC). The objective was to present implementation stages for this management model to companies which may want to engage in similar programs. The considerable productivity improvement at the Carajas Railway over the years, which are shown herein, corroborates our commitment to Quality.

RAILWAY PRIVATIZATION - THE CN EXPERIENCE

John A. Reoch
Vice President, North American Sales & Services
Canac international Inc.

Abstract

The 1995 privatization of the Canadian National Railway Company has been termed "the most successful initial public offering in Canadian history".
CN was formed in 1922 as a result of the failure of several private railway companies which had been created during the frenzied railway-building period of the late 19th and early 20th centuries. The companies were assembled into Canada's largest, and presently North America's only transcontinental railway, which continued to be operated as a government-owned Crown Corporation until 1995. This paper will describe the process that led to CN becoming a fully privatized and sustainably profitable railway company in the highly competitive North American Freight transportation market.

On the international scene, CN's consulting and railway services subsidiary, CANAC INTERNATIONAL INC., has been involved in the privatization of state-owned railways in several countries including Argentina, Togo, Mexico and restructuring of several other railways throughout the World.

This paper will also describe the principles of successful privatization in those circumstances.

STRATEGIC OBJECTIVES OF CHINA'S RAILWAY HEAVY HAUL TRANSPORTATION BEYOND 2000

Qian Lixin

China Academy of Railway Sciences, senior research fellow

Xi Zhi Men Wai, Beijing, People's Republic of China 100081
Abstract

The paper recalls the three phases experienced by the Chinese railways in heavy haul development since 1980 and the three modes it so employed and analyzes the great technical progress made in heavy haul operation in the respect of locomotives and cars, track technology incorporated, signal control facilities, and power supply systems for electrified lines, which paves the way technically for the development of heavy haul. It points out at the same time that the Chinese freight flow conditions have also provided sufficient external conditions for heavy haul operation. The paper focuses on the railway network program of heavy haul operation in China around the year 2000 and its consequence analysis. In the end it points out that the study on the incorporated technologies for 25t axle load heavy haul operation is a technological development target for the Chinese railways entering the next century.

Session 1.3a

SUBSTRUCTURE: SUBGRADE

REHABILITATION DESIGN OF HIGH EMBANKMENTS AND A COAL LINE TRACK FORMATION

J.P. Lourens
Abstract

The paper describes the unexpected failure of high embankments which had given trouble-free service of some ten years. It is shown that the progressive collapse settlement and subsequent failure of the low density fills due to rainwater ingress over the years can be successfully analysed by means of a sophisticated finite element model, resulting in novel and cost-effective rehabilitation by means of reinforcing with steel strips as well as soil nails. The track formation is shown to be equally sensitive to moisture, coupled with an unbalanced structural design, ultimately results in distress being transposed to the rail track. Dynamic analyses in 3D and in situ testing is being utilised to cost-effectively upgrade and maintain the track formation.
Abstract

This paper reports on recent investigations undertaken by Queensland Rail into rehabilitation of railway subgrades to assist the Coal & Minerals Infrastructure Division to reduce its operating expenditure on track geometry maintenance works. Geotechnical engineering evaluations of chemical and mechanical stabilization techniques and economic analysis determine the feasibility of subgrade stabilization methodologies as a maintenance practice which will contribute to minimal interference to train operations and improve cost effectiveness. From the preliminary data it has been found that the overall effectiveness of the three formation stabilization techniques trialled will largely be dependent on the operational restrictions and further capitalization costs.

LIME STABILIZATION OF RAILWAY TRACK SUBGRADE

Theodore R. Sussmann
Ernest T. Selig
University of Massachusetts
Department of Civil and Environmental Engineering
28 Marston Hall Amherst, MA 01003-5205 USA

Abstract
This paper reviews the methods of soil stabilization using lime with emphasis on application to railway track subgrade. Prior to any subgrade stabilization project, a field investigation to identify the cause of the track functional condition deterioration and to establish track stratigraphy and soil properties is required as described. The methods for stabilizing soil with lime are admixture, pressure injection, lime columns, and quicklime piles. The various mechanisms involved in the stabilization process are presented as are the advantages and limitations of each method. Admixture stabilization, lime columns, and quicklime piles are the most reliable subgrade improvement techniques. Pressure injection is most suited to on-track construction operations and is the most widely used technique, but soil improvement is uncertain.

CONE PENETROMETER TESTING FOR TRACK SUBSTRUCTURE DESIGN AND ASSESSMENT

S. M. Chrismer
D. Li
Association of American Railroads,
Transportation Technology Center
P. O. Box 11130, Pueblo, Colorado, 81001, USA

Abstract

As part of a program to determine the nature of track substructure problems and to recommend the best remedial action, the Association of American Railroads (AAR) has developed an on-track vehicle that houses a rapid, nondestructive subgrade test apparatus known as a cone penetrometer. The cone penetrometer test (CPT) vehicle has been used to investigate the cause of excessive maintenance requirements on five
AAR member railroads. It also has been used to help select the most effective and economical remedial actions.