THOMAS

U.S. Department
of Transportation

**Federal Railroad
Administration**

Bibliography of FRA Office of Research and Development Technical Reports

**Office of Research
and Development**

1974-1980

RAILROAD RESEARCH INFORMATION SERVICE
TRANSPORTATION RESEARCH BOARD

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15. Supplementary Notes

16. Abstract

This publication contains 478 abstracts of technical publications of the Office of Research and Development of the Federal Railroad Administration covering the period from 1974 through 1980. The abstracts are compiled from the magnetic tape file of the Railroad Research Information Service; because not all FRA/ORD reports had been submitted to RRIS by the time of compilation, not all the organization's reports for the period are included. The material is arranged in the following 22 of the 26 RRIS categories: Right of Way; Track and Structures; Train-Track Dynamics; Rail Vehicles and Components; Propulsion Systems; Braking Systems; Signals, Control and Communications; Human Factors; Rail-Highway Grade Crossings; Materials Science; Environmental Protection; Advanced Systems; Safety; Electrification; Energy; Information Systems; Economics; Freight Operations; Passenger Operations; Industry Structure and Company Management; Government Policy, Planning and Regulation; Bibliography and Documentation.

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Contents

Preface

This bibliography of abstracts of technical reports of the Office of Research and Development of the Federal Railroad Administration contains only citations that were stored in the data base of the Railroad Research Information Service in February 1981. This means that a number of FRA/ORD reports for 1980 and, in some cases, reports from prior years that early in 1981 had not been issued by FRA or had not been received by RRIS are not included. Additional references for the 1974-1980 period are added to the magnetic tape file of RRIS as they become available and may be retrieved upon request to complete a user's references.

RRIS was developed within the National Research Council under contract to the Federal Railroad Administration, U.S. Department of Transportation. The RRIS computerized data system incorporates information on planning, building, maintaining, operating, managing, and regulating rail transportation systems. RRIS citations are from a wide spectrum of domestic and foreign sources, covering also heavy and light rail transit systems and various advanced guided ground transport systems. The concepts and procedures of RRIS are similar to those of other transportation research information services within the National Research Council—the Highway Research Information Service (HRIS) and the Maritime Research Information Service (MRIS).

In addition to acquisition and selection, RRIS tasks include classification, indexing, storage, retrieval, and dissemination of abstracts. Although none are included in this publication, summaries of ongoing rail-related research projects in the United States and Canada, including those of FRA's Office of Research and Development, are also acquired and processed by RRIS and appear regularly in its semiannual *Railroad Research Bulletin.* Each bulletin contains abstracts added to the RRIS file during the preceding six months, as well as the latest updating of the ongoing project summaries. The *Bulletin* is available by subscription from RRIS.

This publication is arranged in two sections—Abstracts and Index. The material in the Abstracts section is arranged by RRIS subject areas; because of the nature of reports included, some of the 26 categories into which RRIS citations may be divided are not represented. The subject area number and subject area designation are listed in the Contents and appear at the top of each page of the Abstracts section.

This Index is divided into two sections—Author/Investigator Index and Subject Term Index. The regular *Railroad Research Bulletin* has an additional index that is not included here because of the nature of the material. Both authors and subject terms are listed alphabetically, followed then by the document record number, which consists of the two-digit subject-area number and the six-digit TRIS accession number that then identifies the individual document under that subject area. Though the Subject Term Index in this publication does give a general idea of the scope of the RRIS classification system, there are many other index terms that do not appear in this publication.

The RRIS file, maintained on magnetic tape, is available for computer-generated literature searches in response to specific inquiries. The key to searching is RRIS categories and appropriate subject terms, although other data fields such as author, country of origin of the document, and date of publication may also be included as search parameters. Output of such searches may include abstracts of articles and reports, descriptions of computer programs, and summaries of ongoing research. The output is a computer-printed listing similar in format to citations that appear in this publication.

The fee schedule for RRIS file searches reflects the primary support from the Federal Railroad Administration and the nonprofit nature of all Transportation Research Board information services.

Additional information may be obtained from RRIS.

Example of a Research Report Abstract

Abstracts are classified according to an eight-digit document record number: The first two digits indicate the RRIS subject area and the last six digits indicate the TRIS accession number, a unique number assigned to each document. The subject area number and the subject area designation appear at the tops of the pages. The document record number appears at the top of each abstract. Abstracts within each subject area are listed in ascending order of accession numbers, although these generally will not be consecutive.

Document record number

TRIS accession number

Subject area number → **01 192246**

Title → **AN EVALUATION OF PERFORMANCE REQUIREMENTS FOR CROSS TIES AND FASTENERS**

Report abstract → This report was prepared as part of the Improved Track Structures Research Program managed by the Transportation Systems Center. This program is sponsored by the Office of Rail Safety Research, Improved Track Structures Research Division, of the Federal Railroad Administration. The report evaluates the technical basis for current tie and fastener specifications. Particular emphasis was placed on correlating track load data and service failure modes with tie/fastener strength requirements. This required a detailed review of the failure history and laboratory tests for the early, intermediate and new concrete tie designs used in several North American test installations. Limitations of current specifications are identified and specific modifications are recommended. A brief review of the development and performance of reconstituted timber ties and steel ties is also included.

Supplementary notes → Prepared in cooperation with Bechtel, Inc., San Francisco, CA. See also PB-279 316.

Authors → Prause, RH Kennedy, JC Arnlund, RC

Performing, sponsoring organizations → Battelle Columbus Laboratories, Bechtel Corporation, Transportation Systems Center, Federal Railroad Administration

FRA report number, data → Intrm Rpt. FRA-/ORD-78/37, Dec. 1978, 125 p.

Activity data → Contract DOT-TSC-1044

Source of abstract → ACKNOWLEDGMENT: NTIS

Availability → ORDER FROM: NTIS

NTIS accession and order number → PB-294431/2ST, DOTL, NTIS

Washington, DC, availability →

Abbreviations

DOT	U.S. Department of Transportation
DOTL	U.S. Department of Transportation Library
DOTL/NTIS	Collection of NTIS reports at DOT Library
DOTL/RP	Repository of RRIS documents at DOT Library
Fig.	Figure
FRA	Federal Railroad Administration
FRA/ORD	Office of Research and Development Federal Railroad Administration 400 7th Street S.W., Washington, DC 20590
FY	Fiscal Year
NTIS	National Technical Information Service Springfield, VA 22161
p.	Page
pp.	Pages
PB	Prefix letters for NTIS accession number; to be included when ordering NTIS documents
Phot	Photograph(s)
Ref	Reference(s)
Repr PC	Reproduced paper copy of original document
Rpt	Report(s)
Tab	Table(s)
TSC	Transportation Systems Center U.S. Department of Transportation Cambridge, MA 02142

Abstracts of Reports

00 071760
RESEARCH TO IMPROVE TUNNEL SUPPORT SYSTEMS
Studies are described that were directed toward improving the design of certain types of tunnel support systems. Studies to predict the interaction of a circular liner with the medium performed with a linear finite element computer program and a closed form solution are described. Two construction techniques that give different interaction solutions and thus different liner loadings were simulated. Results are presented in the form of dimensionless plots from which moment, thrust, shear and deformation can be predicted. Steel-fiber-reinforced regulated-set-cement concrete has been proposed for use in a slipformed tunnel liner system. Mix design, pumping characteristics and mechanical properties of this material are described. Also, test results for two specimens which represent a portion of the slipformed liner are presented. Behavior of the liner and resisting mechanism was found to be highly nonlinear and to have a great deal of reserve strength beyond the linear range. Eleven large-scale tests which simulate steel horseshoe sets in rock tunnels are described and the effects of connection characteristics, blocking stiffness, load distribution and load inclination on the set behavior are discussed. Both the concrete liners and the steel sets that were tested, were simulated by a linear (STRUDL) and a nonlinear analysis (NASTRAN) and the results compared with those obtained from the tests.

This study was sponsored by and prepared for the Federal Railroad Administration, DOT.

Paul, SL Gaylord, EH Hendron, AJ Kesler, CE Mohraz, B Peck, RB
Illinois University, Urbana, (UILU-ENG-74-2016) Final Rpt. FRA-ORD/D-74-51, June 1974, 235 pp, Figs., Tabs., 1 App.

Contract DOT-FR-30022

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-235762, DOTL NTIS

00 071935
THE EFFECT OF TIME-DEPENDENT PROPERTIES OF ALTERED ROCK ON TUNNEL SUPPORT REQUIREMENTS
Squeezing ground conditions in hard-rock tunneling are associated with fault zones containing brecciated rock and gouge. The time-dependent nature of the deformation and support loads in squeezing ground conditions suggest that the creep behavior of fault gouge is the significant engineering property controlling the in situ behavior. An experimental and analytical study is presented that deals with soil creep and its application to the prediction of tunnel support requirements in squeezing ground. Support requirements given by the theoretical analysis are compared to numerous case histories obtained from the published literature. Finally, specific consideration is given to squeezing conditions at Straight Creek and Pacheco tunnels. The analysis provides a method for estimating steel support requirements for tunnels at different depths and in various squeezing ground conditions. (Modified author abstract)

Semple, RM Hendron, AJ Mesri, G
Illinois University, Urbana, (UILU-ENG-73-2023) Final Rpt. FRA-ORD/D-74-30, Dec. 1973, 226 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-230207/1, DOTL NTIS

00 071938
TESTING AND EVALUATING OF PROTOTYPE TUNNEL SUPPORT SYSTEMS
The report presents the results of engineering studies related to the development of new and improved tunnel support systems. Steel fiber reinforced regulated-set concrete has been proposed for use as a slipformed concrete lining which can be placed immediately behind a tunnel boring machine. Mix design studies and field pumping tests for this new concrete are described. The results of a cooperative research effort carried out with the U.S. Bureau of Reclamation on precast polymer concrete segmented tunnel support systems include an evaluation of the structural aspects of the system, an analysis of potential heat and fire hazards, and an evaluation of the cost of the promising new support system. (Modified author abstract)

Parker, HW Deere, DU Peck, RB Birkemoe, PC Semple, RM
Illinois University, Urbana, (UILU-ENG-73-20 13) Final Rpt. FRA-ORD/D-74-11, Aug. 1973, 338 pp

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-231912/7, DOTL NTIS

00 080782
CONCRETE FOR TUNNEL LINERS: EVALUATION OF FIBER REINFORCED QUICK SETTING CONCRETE
This study was undertaken to determine the behavior of steel fiber reinforced, quick setting cement concretes and provide information on this material needed for its application in tunnel liners. Strength-time and creep behavior are evaluated for specific mix designs. The creep behavior does not appear to be substantially different than for plain concrete. Interaction diagrams are presented for concretes made with Duracal cement and fiber contents of 0.9, 1.2 and 1.5 percent by volume. Various failure modes were obtained depending on the initial relative eccentricity of load. Tensile stress-strain relationships are analytically obtained from flexural test data. These relationships make possible a post-crack analysis of a fiber reinforced concrete structure. Fiber content, fiber orientation, and type of cement have little effect on Poisson's ratio but do influence the modulus of elasticity and the strength. Durability of these concretes is examined through study of permeability, leaching, volume stability, disturbance of young concrete, effects of high temperature environments and sulfate resistance. Pumping of fibrous concrete is investigated through laboratory testing. The presence of fibrous reinforcement significantly increases the volume of voids making the aggregate gradation and cement paste content critical parameters in designing pumpable mixes.

This document was prepared for the Federal Railroad Administration, DOT.

Halvorsen, GT Herring, KS Keske, WG Ounanian, DW Spalding, AV Kesler, CE
Illinois University, Urbana, (UILU-ENG-74-2024) Final Rpt. FRA-ORDD-75-3, Aug. 1974, 104 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-236995, DOTL NTIS

00 082900
CONCRETE FOR TUNNEL LINERS: BEHAVIOR OF STEEL FIBER REINFORCED CONCRETE UNDER COMBINED LOADS
This study was undertaken to determine the behavior of a steel fiber reinforced concrete member subjected to combined compressive and flexural

loads. In addition, information was obtained on the tensile stress-strain relationship, the modulus of elasticity in compression, and Poisson's ratio. Interaction diagrams are presented for concretes made with two quick setting cements and fiber contents of 0.9, 1.2 and 1.5 percent by volume. Compressive failures, tensile failure, and simultaneous compressive-tensile failures were obtained depending on the moment to axial load ratio. A method is presented for determining the tensile stress- strain relationship for a length of beam immediately surrounding a crack. This tensile stress-strain relationship makes possible a computerized post-crack analysis of fiber reinforced concrete structures. Fiber content, fiber orientation, and type of cement appear to have little affect on Poisson's ratio but do influence the modulus of elasticity and the strength.

Herring, KS Laws, JW Kesler, CE Paul, SL Robinson, AR
Illinois University, Urbana, (UILU-ENG-74-2025) Final Rpt. FRA-ORDD 75-7, Aug. 1974, 80 pp, 23 Fig., 9 Tab., 10 Ref.

Contract DOT-FR-30022

ORDER FROM: NTIS, Repr. PC, Microfiche
PB-236276, DOTL NTIS

00 094036
SHOTCRETE PRACTICE IN UNDERGROUND CONSTRUCTION
This report describes the use and procedures for placement of wet-and dry-mix shotcrete in underground rock excavations. Its purpose is to serve as a guide for designers and contractors in selecting, preparing and applying shotcrete of acceptable quality in the variety of ground conditions encountered in underground work. The contents of this report include design considerations, engineering properties, shotcrete equipment, application techniques and quality control. Specifications for shotcrete are treated as well. The appendices provide supplemental information dealing with the use and engineering properties of fiber and regulated-set cement shotcrete, capabilities and specifications of shotcrete machines and some recommended guidelines for placing shotcrete underground.

Mahar, JW Parker, HW Wuellner, WW
Illinois University, Urbana, Federal Railroad Administration Final Rpt. UILU-ENG-75-2018, FRA/ORD-75/90, Aug. 1975, 501 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248765/0ST, DOTL NTIS

00 095710
TUNNEL DESIGN CONSIDERATIONS: ANALYSIS OF MEDIUM-SUPPORT INTERACTION
Practical aspects of the application of analytical techniques to geotechnical problems are reviewed with emphasis on medium-support interaction problems in underground structures. It is recognized that the analysis should be carried out in several stages, reflecting the initial state of stress in the medium, the construction process and the period of operation. A finite element program called GEOSYS that is capable of performing this type of analysis is described. The capabilities and the limitations of this and other current analytical techniques in regard to the multi-stage analysis are discussed. The results from a series of two-dimensional, plane-strain, finite element analyses of medium-liner interaction for a circular tunnel are presented. Three types of medium properties are considered, namely, linearly elastic, elasto-plastic and time-dependent. Also considered in these analyses is a simple sequence of excavation and liner placement. A comparative study of the effect of the material properties on the liner forces is made.

Ghaboussi, J Ranken, RE
Illinois University, Urbana, (UILU-ENG 74-2032) Final Rpt. FRA-ORD&D 75-24, Nov. 1974, 84 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-240216/2SL, DOTL NTIS

00 098072
INFLUENCE OF TESTING CONDITIONS ON CREEP BEHAVIOR OF CLAY
The excavation of an underground opening produces changes in the state of stress which cause deformations composed of both time-dependent and time-independent components. In some soils and rocks the time-dependent component of deformation is large. Internal structural supports are provided to limit the creep displacements, resulting in an increase in the radial stresses acting on the supports. The increase depends on the creep propensity of the soil or rock. A creep testing system (CTS) is developed to simultaneously perform four consolidated-undrained triaxial creep tests on cylindrical specimens. The CTS consists of: triaxial cells; lever-arm loading mechanisms; cell pressure-control panel board; temperature-control water baths; load, pore pressure and deformation measuring devices; and data logger system. The testing program consists of a series of twenty five step-type creep tests which were performed on samples of kaolinite and slaked Cucaracha clay-shale. The influence of testing conditions, such as loading procedure, magnitude of consolidation pressure, overconsolidation and secondary compression, on the creep behavior of clays was investigated.

This was sponsored by Federal Railroad Administration, DOT.

Febres-Cordero, E Mesri, G
Illinois University, Urbana, Federal Railroad Administration, (UILU-ENG-74-2031) Final Rpt. FRA-ORD&D-75-29, Nov. 1974, 232 pp, Figs., Refs., 3 App.

Contract DOT-FR-30022

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-243067/6ST, DOTL NTIS

00 127843
CONCRETE FOR TUNNEL LINERS: BEHAVIOR OF FIBER REINFORCED QUICK SETTING CEMENT CONCRETE
This study was undertaken to determine the behavior of steel fiber reinforced, quick-setting cement concrete and provide information on these materials for application in tunnel liners. The use of expansive cement, special fiber geometries, fiber orientation by vibration and postcracking behavior in compression as related to tunnels are briefly discussed. A Catalog of Standard Mixes for tunnel liner concretes in introduced. Strength, handling time and elastic properties are reported for pumpable mix designs with 3/8-in. (10-mm) maximum-sized aggregate with regulated-set cement and 0.9, 1.2 and 1.5 volume percent steel fiber reinforcement. Durability studies show that low void volume, pumpable mix designs are less permeable than mix designs proportioned by conventional methods. Sulfate resistance studies indicate that the quick-setting cement concrete studied to date deteriorates sooner than type 1 cement concrete in a particular sulfate environment. Regulated-set cement concrete heated to 660 F (350 C) retain 30 to 40 percent of their original strength after cooling. Available research on corrosion of fiber reinforced concrete is reported and a research program is suggested.

This study was sponsored by FRA.

Halvorsen, GT Keske, WG Stout, JA Kesler, CE
Illinois University, Urbana, Federal Railroad Administration, (UILU-ENG-75-0008) FRA OR&D 75-87, Aug. 1975, 93 pp, Figs., Tabs., Refs.

Contract DOT FR 30022

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248837/7ST, DOTL NTIS

00 127848
CONCRETE FOR TUNNEL LINERS: MIX DESIGN RECOMMENDATIONS FOR PROTOTYPE EXTRUDED LINER SYSTEM
Fiber reinforced, quick-setting cement concrete mix designs are suggested for use in the development of a prototype liner system. These mix designs can meet the structural and durability requirements of the tunnel liner and can be placed in a slipform by pumping. The mix designs are governed mainly by the fact that the mix must be pumpable. Aggregate shape and gradation are critical. A mix with a high likelihood of pumpability can be formulated by adherence to a procedure based on prevention of segregation failure, the most common pumping failure mode of fiber reinforced concrete. Fiber reinforced concrete mixes proportioned for pumping are of high strength, by normal standards, because of the paste content necessary for workability. Conventional pumping equipment is believed adequate for placing properly designed fiber reinforced concrete mixes if components are selected to minimize line head losses and minimize remolding of the concrete. Mixes for a specific field application should be tested for set times, pumpability and strength, using field procedures for batching, mixing, and placing, prior to actual field use.

This project was sponsored by FRA.
Halvorsen, GT Kesler, CE Paul, SL
Illinois University, Urbana, Federal Railroad Administration, (UILU-ENG-75-2010) Final Rpt. FRA OR&D 75-89, Aug. 1975, 29 pp, Figs., Tabs., Refs.

Contract DOT FR 30022

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248637/1ST, DOTL NTIS

00 128496
CONCRETE FOR TUNNEL LINERS: PUMPABLE FIBER REINFORCED CONCRETE
This study was undertaken to develop a procedure for designing fiber reinforced concrete mixes that may be delivered by pumping and to provide information on this method for applications in tunnel liners. The presence of fibrous reinforcement in the concrete increases the harshness of the mix and, therefore increases the complexity of pumping problems. However, by selecting combinations of fine aggregates, coarse aggregates and fibers which result in a minimum volume of voids and providing a paste content slightly in excess of the voids, fiber reinforced concretes can be pumped. Mixes with four different maximum sizes of aggregate were found to be pumpable when evaluated in the laboratory.

Ounanian, DW Halvorsen, GT Kesler, CE
Illinois University, Urbana, (UILU-ENG-75-2009) Final Rpt. FRA OR&D 75-88, Aug. 1975, 45 pp, Figs., Tabs., 13 Ref.

Contract DOT-FR-30022

ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248636/3ST, DOTL NTIS

00 132974
EFFECT OF HEAVY AXLE LOADS ON BRIDGES
It is estimated there are 3500 miles of bridges on American railroads; replacement cost is estimated at $10 billion. The problem is not the spectacular, long-span steel bridges, but the many structures built many years ago for much lighter loading. As reconstruction is deferred, more speed and weight restrictions will have to be imposed; modern equipment may have to be prohibited from many lines. With scarce capital it will be many years before the frail steel spans of 1880-1900 are replaced. The Cooper E-60 rating permitted by the AAR Mechanical Division does not produce cars capable of unrestricted operation over the rail network. Timber trestles are particularly vulnerable to closely spaced axles.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Noyszewski, M (Illinois Central Gulf Railroad)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 133-138, 9 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

00 132976
HEAVY AXLE LOADS IN NATIONAL RAILWAYS OF MEXICO AND NEED FOR STRENGTHENING OF BRIDGES
National Railways of Mexico has been confronted with many low-capacity bridges on lines where heavy cars are being, or will be handled. While the new bridge standard is Cooper E72 rating, those built prior to 1970 range downward from E60 to E35 on some former narrow-gauge routes. NdeM has raised the ratings on some bridges since diesel locomotives have replaced steam with resultant reduced impact loadings. Slow orders are imposed on certain structures to handle concentrated program of strengthening bridges where it is reduce impact on bridges and use of neoprene pads under the rail base for the same reason have been widely applied. A concentrated program of strengthening bridges where it is economical has been undertaken. Bridges of low capacity or in bad condition are replaced.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Diaz, GR (National Railways of Mexico)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 148-154, 29 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

00 133298
PROCEEDINGS OF ROADBED STABILIZATION LIME INJECTION CONFERENCE HELD AT LITTLE ROCK, ARKANSAS, ON AUGUST 21-22, 1975
Proceedings of Roadbed Stabilization Lime Injection Conference includes twelve technical papers that were presented at the conference on August 21 and 22, 1975 in Little Rock, Arkansas. The papers document the state of knowledge and related subjects on lime pressure injection stabilization of problem railroad subsoils. The related papers are on electro-chemical stabilization, finite element analysis of roadbeds and nondestructive testing of roadbed soils. These proceedings are the first to be published on the subject of lime pressure injection soil stabilization.

Blacklock, JR
Arkansas University, Little Rock, Federal Railroad Administration FRA/ORD-76-137, Nov. 1975, 267p

Contract DOT-OS-40107

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-251681/3ST, DOTL NTIS

00 136894
SHOTCRETE: STRUCTURAL TESTING OF THIN LINERS
This report presents the results of engineering studies related to the development of new and improved tunnel support systems. Thin shotcrete layers were studied to assess their capacity and behavior as temporary tunnel supports. The design, construction, and operation of a large-scale test facility simulating a planar tunnel roof with a punching block 2 ft x 2 ft (60.8 cm x 60.8 cm) are described. Preliminary tests were conducted using thin mortar layers to assess the performance of the test device and the principal variables controlling the capacity of the thin liner. Results obtained from these tests were used in the planning and evaluating of the shotcrete test program. This report describes the development of the test-device, the equipment, and its arrangement and the shotcrete used in the model. The capacity of shotcrete layers for different thickness and strength of shotcrete and shotcrete-rock bond was determined.

Fernandez-Delgado, G Mahar, J Cording, E
Illinois University, Urbana, Federal Railroad Administration Final Rpt. UILU-ENG-75-2015, FRA/ORD-75/91, Aug. 1975, 220 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-252669/7ST, DOTL NTIS

00 136899
CONCRETE TUNNEL LINERS: STRUCTURAL TESTING OF SEGMENTED LINERS
Tests of three circular segmented steel-fiber-reinforced concrete tunnel liners are described. They were 10 ft outside diameter and loaded with hydraulic rams in a manner that approximates a ground loading. There were six segments and a key in each ring and the segments were ribbed to allow bolting them together. Two tests were on single rings of segments and the third was on 3 rings bolted together. A series of beams that were designed to fail in shear and made of steel-fiber-reinforced concrete were tested. The results are used to develop a means for predicting shear strength of liner segments subjected to moment and thrust as well as shear. Segment joints similar to those used in the liner tests were subjected to eccentrically applied thrust in a testing machine so that thrust and moment were present in varying combinations at the joint. These joints were also cast of steel-fiber-reinforced concrete, and methods are presented to calculate their strength. These methods are then compared with the test results.
See also PB-252 935.

Paul, SL Sinnamon, GK
Illinois University, Urbana, Federal Railroad Administration Final Rpt. UILU-ENG-75-2013, FRA/ORD-75-93, Aug. 1975, 173 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-252934/5ST, DOTL NTIS

00 136906
INVESTIGATION OF STEEL TUNNEL SUPPORTS
A series of 18 steel ribs with 10 ft-radius arches and 7-ft straight legs were tested to investigate the effect of loading geometry, eccentricity of load, and various section shapes used for making the ribs. It was found that symmetrical loading about the rib center line gives higher rib capacity and that closed section shapes resist eccentrically applied loads much more effectively. Square structural-tube ribs filled with concrete and one square structural tube rib with sleeve connections were tested. The practicality of using ribs made of closed-section telescoping segments is discussed. It is found that the greatest problem with ribs of this type is the tolerances required in the manufacture of sections that must slide within one another. Sleeve connections are evaluated and it is found that tolerances in section sizes are also a problem in making this type of connector practical. A study of steel rib behavior with variation of blocking stiffness and connection stiffness is described, using a computer analysis. These parameters were constant in the test series described above. Finally, results of the tests on ribs are compared with the analysis commonly used for design and is found to predict their behavior with reasonable consistency.

Gaylord, EH Paul, SL Sinnamon, GK
Illinois University, Urbana, Federal Railroad Administration Final Rpt. UILU-ENG-75-2012, FRA/ORD-75/92, Aug. 1975, 170 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-253005/3ST, DOTL NTIS

00 145614
TUNNEL DESIGN CONSIDERATIONS: ANALYSIS OF STRESSES AND DEFORMATIONS AROUND ADVANCING TUNNELS
A truly comprehensive analysis of any ground-tunnel liner interaction problem requires that the three-dimensional nature (geometry, stress and displacement fields) of the problem be considered. This report describes an investigation undertaken to study the complex distribution of stresses and displacements mobilized around and along unlined, partially lined, and completely lined tunnels being advanced through soils of various stress-strain behaviors. Circular tunnels with a depth to diameter ratio of five were considered. The unlined and lined tunnel analyses were divided into three subgroups on the basis of the simulated stress-strain behavior of the soil. One series of analyses considered linear-elastic behavior and involved the consideration of two different elastic modulus values and three different Poisson's ratio values. The soil in a second subgroup was assumed to exhibit elasto-plastic behavior corresponding to a shear strength independent of the mean stress and the angle of shearing resistance. An additional series of elasto-plastic analyses considered soil behavior to be a function of both cohesion and the angle of shearing resistance. The finite element program GEOSYS was used in this investigation. The excavation and construction options of this computer program made it possible to simulate, with a minimum of effort, a tunnel being advanced through an initially stressed ground mass.
See also PB-240216.

Ranken, RE Ghaboussi, J
Illinois University, Urbana, Federal Railroad Administration Final Rpt. UILU-ENG-75-2016, FRA/ORD-75-84, Aug. 1975, 164 pp

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
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PB-258587/5ST, DOTL NTIS

00 151855
EMBANKMENT SUPPORT FOR KANSAS TEST TRACK. ANALYSIS OF EMBANKMENT INSTRUMENT DATA
Static and dynamic data collected from the embankment instrumentation at the Kansas Test Track are summarized in this report. The static data included permanent horizontal and vertical deformation measurements, moisture contents, and temperatures taken at intervals between the end of embankment construction in Fall 1971 to the opening of the track for traffic in October 1974. Data were also collected through April 1975 after the track was opened to traffic. Dynamic instrument response was measured at three periods between October 1974 and April 1975. The dynamic data include horizontal and vertical deformations and embankment pressure under traffic loads. The static and dynamic response and performance of each test section are analyzed, and the results are summarized.

Dietrich, RJ Salley, JR
Shannon and Wilson, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-76/258, Dec. 1976, 126 pp

Contract DOT-FR-54168

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-264403/7ST, DOTL NTIS

00 158940
STRUCTURAL TESTS OF CAST-IN-PLACE TUNNEL LINERS
Two tests of circular 10-ft. diameter models of cast-in-place tunnel liners are described. One test specimen was unreinforced and the other was conventionally reinforced with 0.44 percent circumferential deformed bars in the inner and the outer faces. Loading simulated vertical active ground loads and lateral passive resistance as the liner deformed. All external forces were distributed over an 8-in. (203 mm) circumferential distance at 30 deg. intervals. The purpose of the tests was to study the structural response, including nonlinear moment redistribution and failure, of a liner with loading and restraint conditions similar to those encountered in the ground. Results of these two tests are compared with results of similar tests on steel-fiber-reinforced specimens. Comparison of the results provide an indication of the influence of reinforcement and passive force stiffness on behavior and strength. Linear analyses are used to study the influence of more realistic distribution of external forces and shear stress between the liner and medium.

Paul, SL Sinnamon, GK Ferrera-Boza, R
Illinois University, Urbana, Office of the Secretary of Transportation Final Rpt. DOT/TST/76T-18, UILU-ENG-76-2027, Aug. 1976, 115 pp, 14 Ref. FRA-ORD-75-94

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-267302/8ST, DOTL NTIS

00 163228
HANDBOOK FOR RAILROAD TRACK STABILIZATION USING LIME SLURRY PRESSURE INJECTION
This handbook includes chapters dealing with the technology of line injection, surface and subsurface soil exploration and laboratory testing, environmental considerations and safety precautions. In addition, there are appendices which provides state-of-the-art specifications for lime slurry injection and laboratory soil testing procedures. A lime slurry section gives a complete description of the present state-of-the-art of Lime Slurry Pressure Injection (LSPI). This handbook hopefully will provide the railroad industry with existing information and guidance in the selection and use of the LSPI method of roadbed stabilization.

Prepared in cooperation with the Federal Railroad Administration, and the Transportation Systems Center and with the aid of the Railroad Industry.

Blacklock, JR Lawson, CH
Graduate Institute of Technology, Federal Railroad Administration Handbook FRA/ORD-77-30, June 1977, 92 pp

Contract DOT-OS-40107

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-272721/AS, DOTL NTIS

00 179119
EVALUATION OF RAILROAD LIME SLURRY STABILIZATION
This report describes a multifacted investigation into the application of lime slurry pressure injection (LSPI) to stabilize and improve railroad roadbeds. Areas discussed include (1) the current state of lime-injection technology, (2) soil exploration and testing related to the use of LSPI, (3) costs of roadbed stabilization by the LSPI method, (4) Environmental aspects of the

track-roadbed structure. In addition, summaries to two types of ancillary reports are included: (1) those resulting from case studies of several specific lime-injection projects and (2) those describing independent research work involving either the lime-soil combination or finite element analysis of the track-roadbed structure.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development. Washington, D.C. Prepared in cooperation with the Federal Railroad Administration and the Transportation Systems Center with the aid of the Railroad industry.

Blacklock, JR
Graduate Institute of Technology Final Rpt. FRA/ORD-78/09, June 1978, 178 pp, Figs., Tabs., Refs.

Contract DOT-OS-40107

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-282998/AS, DOTL NTIS, DOTL RP

00 179120
SUMMARY REPORT-BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM

This report constitutes a summary of the results of the various phases of the Ballast and Foundation Materials Research Program. Data and information obtained from the technical literature and that developed in the project are summarized. Implications of the research data and findings are discussed and recommendations for further studies are presented. Topics considered in the program were a) resilient and permanent deformation behavior of ballast and subgrade materials, b) track support system temperature regime, c) lateral stability of ballast, d) structural behaviour of the track support system (including the development of the Illi-TRACK structural model), and 3) an economic study of ballast and ballasting practices.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Thompson, MR Hay, WW Tayabji, SD
Illinois University, Urbana Final Rpt. FRA/ORD-78/10, June 1978, 84 pp, Figs., Tabs., 22 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: FRA
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PB-282348/AS, DOTL NTIS, DOTL RP

00 186243
FEASIBILITY STUDY FOR RAILROAD EMBANKMENT EVALUATION WITH RADAR MEASUREMENTS

A study was conducted to determine the feasibility of using radar measurements to define railroad embankment subsurface layer thickness and properties. A computer model was used to calculate radar reflectances as could be measured over the frequency range of 0.5 to 2.0 GHz at the surface of five different railroad embankments for which data were available. These reflectance curves were converted to realistic depth displays as could be obtained from a realtime analysis of swept-frequency radar data or from a more conventional narrow-pulse radar system. Comparisons were then made of the results of the radar system measurements with the physical conditions of the embankments.

Lundien, JR
Waterways Experiment Station Final Rpt. WES-MP-S-78-10, Aug. 1978, 47 p. FRA/ORD-79/08.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

AD-A058387/2ST

00 303667
GROUND STABILIZATION: REVIEW OF GROUTING AND FREEZING TECHNIQUES FOR UNDERGROUND OPENINGS

The ground stabilization techniques of grouting and artificial freezing are reviewed. General grouting considerations are discussed including selection of grouts and techniques of injection. Materials for both particulate and chemical grouts are described along with their influence on ground properties and advantages and disadvantages. Artificial ground freezing is discussed in terms of techniques of freezing, strength-deformation and thermal considerations, and advantages and disadvantages. Selected case histories which illustrate the application of grouting and freezing to tunnel and shaft construction are briefly summarized.

Lenzini, PA Bruss, B
Illinois University, Urbana, Federal Railroad Administration Final Rpt. FRA/ORD-75-95, UILU-ENG-75-2017, Aug. 1975, 87 p.

Contract DOT-FR-30022

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-253142/4SL, DOTL NTIS

00 303669
FABRICATION AND TESTING OF A WATER CANNON FOR ROCK TUNNELING EXPERIMENTS

A water cannon was fabricated and tested to evaluate its effectiveness in disintegrating rock for potential application in hard rock tunneling. Experiments were conducted in the laboratory and in field tests in a dolomitic limestone mine and in a granitic gneiss quarry. As jet stagnation pressures were increased in the range from below 100,000 to 650,000 psi (700 to 4500 Mn/sq m), the specific energy for disintegrating rock generally decreased, except for some evidence of a minimum specific energy for barre granite at a jet pressure near 400,000 psi (2800 Mn/sq m). The water cannon tests obtained specific energy values which are competitive with the best rolling cutter tunneling machines. Results to date indicate that practical application of water cannons has high potential in rock tunneling.

Cooley, WC
Terraspace, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD/D-74-38, TR-406-1, Feb. 1974, 92 p.

Contract DOT-FR-20042

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-233006/6, DOTL NTIS

00 308274
POSTMORTEM INVESTIGATION OF THE KANSAS TEST TRACK, VOLUME II

The Kansas Test Track (KTT) was comprised of nine different track systems, which were founded on a designed embankment. The KTT subgrade experienced premature failure in service, and KTT operations were terminated in June 1975 after approximately six months of traffic. A postmortem investigation of the KTT was carried out in 1975 and 1976. Results of this investigation are presented in two volumes. Summary data, analyses, conclusions, and recommendations are presented in Volume I. Volume II is comprised of five appendixes which document the equipment and procedure used, and data obtained in KTT structures, vibroseismic, penetrometer, trenching, and instrumentation testing.

Cooper, SS Greer, HC, III Carlson, MM Bush, AJ, III Vispi, MA
Waterways Experiment Station, Federal Railroad Administration Final Rpt. FRA/ORD-79/09.II, Feb. 1979, 238 p., Figs., Tabs., 5 App.
Contract DOT-AR-30025

ORDER FROM: NTIS

PB80-138324, DOTL NTIS, DOTL RP

01 083026
TRACK GEOMETRY MEASUREMENTS AND DATA PROCESSING DEVELOPMENTS IN THE RAIL RESEARCH PROGRAM

This report summarizes the FRA-sponsored Rail Research Program, and outlines many of the problems presently encountered by the railroad industry in providing safe, high-speed transportation; and illustrates the vital role of cost-effective maintenance planning. This report was originally presented at the IEEE/ASME Joint Railroad Conference in St. Louis, Missouri, in April 1973. The FRA Test Cars are described, with emphasis placed on the ability of the cars to measure all parameters of track geometry at high speed. Examples are included of the various types of computer-generated reports which are designed specifically for personnel who are responsible for maintenance planning and operations. The information in this report is intended for use by a general audience who desires a comprehensive nontechnical summary of the operation and application of the FRA Test Cars, related instrumentation and data processing operations.

This project is sponsored by the Federal Railroad Administration, Department of Transportation.

From, L
ENSCO, Incorporated, (DOT-FR-74-2Z) Tech. Sum. FRA-ORD&D-75-14, Oct. 1974, 29 pp, 20 Fig.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-239463/AS, DOTL NTIS

01 083027
DEVELOPMENT OF AN INERTIAL PROFILOMETER

The information in this report covers the design, fabrication and testing of an inertial profilometer system, developed for use on the FRA Test Cars. The profilometer is used to measure rail profile at high speeds, relative to an inertial reference. Design details and analysis of the profilometer are covered, and comparisons are made between profilometer measurements, mid-chord measurements, and manual measurements made with stringline and roll-ordinator devices, to show the relative accuracy of the profilometer measurements. The inertial profilometer offers several advantages over the currently-used mid-chord syystem. Accuracy of the profilometer has proven to be quite good. Operation of the profilometer is not degraded by inclement weather, and system components are not subject to damage by protruding objects in close proximity to the rail being measured.

Brandenburg, EL Rudd, TJ
ENSCO, Incorporated, (DOT-FR-74-06) FRA-ORD&D-75-15, Nov. 1974, 45 pp, 23 Fig.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-239464/AS, DOTL NTIS

01 091294
ACQUISITION AND USE OF TRACK GEOMETRY DATA IN MAINTENANCE-OF-WAY PLANNING

The report describes data acquisition by the FRA Measurement Cars and subsequent use of the collected track geometry data by the Bessemer and Lake Erie (B and LE) and the Denver and Rio Grande Western (D and RGW) Railroads. These two railroads, in conjunction with ENSCO, Inc., have prepared the report for the Federal Railroad Administration. The major emphasis of the report is placed on use of the track geometry data by B and LE and D and RGW for immediate maintenance and maintenance planning. Also provided are descriptions of data processing reports, system and measurement repeatability data, and the Track Geometry Measurement System onboard the FRA Measurement Cars.

The information herein is intended for use by maintenance- of-way personnel who are concerned with the utilization of track geometry data collected by track measurement cars and by management personnel who are involved in maintenance planning. This report was sponsored by the Federal Railroad Administration.

Bradley, K Price, B Woll, T Burnes, R Gerber, R
ENSCO, Incorporated, Federal Railroad Administration, Bessemer and Lake Erie Railroad, Denver and Rio Grande Western Railroad, (DOT-FR-75-1) Tech Rpt. FRA-ORD&D-75-27, Mar. 1975, 130 pp

Contract DOT-FR-20032

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241196/AS, DOTL NTIS

01 095720
TRACK GEOMETRY SURVEY DEVICE FOR LIM RESEARCH VEHICLE TEST TRACK

A track survey device was designed, built and operated to measure the geometry of the FRA Linear Induction Motor Test Track at Pueblo, Colorado. A laser beam is used for the measurement of profile and alignment; an electronic level for the measurement of superelevation and mechanical sensors for both support rail and reaction rail gages. The measurement is stored in magnetic tape for processing.

Sponsored by the Federal Railroad Administration.

Medecki, H Panunzio, S
General Applied Science Laboratories, Incorporated, (GASL TR-776) Final Rpt. FRA-ORD & D-74-36, Oct. 1973, 110 pp, Figs., Tabs., Phots.

Contract DOT-FR-10016

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241313/AS, DOT NTIS

01 096657
DOT TEST TRAIN PROGRAM SYSTEM INSTRUMENTATION MANUAL-FIFTH EDITION

This manual describes track measurement instrumentation which has been developed during the reporting period, and covers all instrumentation currently installed aboard the FRA Test Cars. The major emphasis of this report deals with the operation and calibration of the Track Geometry Measurement System installed aboard Test Car T-3. Ancillary systems, and equipment aboard Test Cars T-1, T-2 and T-4 is also summarized. The information herein is intended for use by technical personnel who are involved in the operation of FRA Test Car instrumentation, and by engineering and research personnel involved in the application of track geometry measurement techniques.

This was sponsored by Federal Railroad Administration, US DOT.

Anderson, L MacIntyre, S Kolcyzynski, N
ENSCO, Incorporated, (DOT-FR-74-13) Ann. Rpt. FRA-ORD&D-7504, Dec. 1973, 140 pp, Figs., Tabs.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA, Monthly Catalog of US Government Publications, GPO (TD 3.15:75-04)
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241888, DOTL NTIS

01 098073
FRA TRACK GEOMETRY MEASUREMENT SYSTEM VALIDATION REPORT

This report covers an extensive testing program which was conducted to validate the track geometry measurement system installed aboard the Department of Transportation Rail Test Cars. The tests were conducted to establish the accuracy and repeatability of measurements made with the high-speed electronic measurement system installed aboard the DOT Test Cars. The validation procedure involved both laboratory and field tests of the electronic measurement system. Comparisons were made between manual and high-speed electronic measurements of rail gage, crosslevel, profile and alignment. Results of these comparisons under various dynamic conditions, speeds, types of rail and rail loads are included in this report. The information contained in this report includes considerable detail which is intended for use by engineering and research personnel who are involved in the design, development, and validation of rail measuring devices.

This program sponsored by the Federal Railroad Administration, Office of Research and Development, US DOT.

Yang, TL
ENSCO, Incorporated, Federal Railroad Administration, (DOT-FR-73-08) Engr. Rpt. FRA-ORD&D-75-05, June 1974, 156 pp, Figs., Tabs., 3 App.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-243677/AS, DOTL NTIS

01 128640
TEST TRAIN PROGRAM SIXTH PROGRESS REPORT
This report describes the progress of the Rail Research Program involving operation of the FRA test cars and the performance of other rail research efforts during the period 1 July 1973 to 30 June 1974. Highlights of the work reported include operation of the FRA test cars to perform track surveys and other rail research activities; test car upgrading; expansion of the Rail Research Program; and data management and data analysis tasks which have been undertaken to benefit railroad technology. The Rail Research Program primarily involves the operation and instrumentation of the FRA test cars. This research program is designed to provide high-speed measurement of railroad track characteristics, development of comprehensive track measurement techniques, development of special testing instrumentation, and data evaluation through analysis and electronic processing.
See also PB-241419.

Peterson, C Kaufman, WM Yang, TL Corbin, JC
ENSCO, Incorporated, (DOT-FR-74-19) Prog Rpt. FRA-ORD&D-75-25, June 1974, 124 pp, 36 Fig.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247084/AS, DOTL NTIS

01 129200
A REVIEW OF MEASUREMENT TECHNIQUES, REQUIREMENTS, AND AVAILABLE DATA ON THE DYNAMIC COMPLIANCE OF RAILROAD TRACK
The need for increasing train speeds and operating safety while, reducing track maintenance is responsible for much of the current research on track structues, vehicle dynamics, and vehicle/track interaction. This report covers Phase I of a 3-phase program to design and fabricate equipment for measuring track dynamic characteristics. It is generally recognized that the available data and measurement techniques for obtaining this type of data for U.S. track and inadequate. This Phase I report includes a review of previous measurement techniques, a compilation of available data on track dynamic characteristics, an evaluation of data requirements, and the development of concepts for measuring track dynamic compolance.
This project was sponsored by the Federal Railroad Administration, DOT.

Kaiser, WD Nessler, GL Meacham, HC Prause, RH
Battelle Columbus Laboratories Intrm Rpt. FRA-OR&D-76-70, May 1975, 59 pp, 18 Fig., 4 Tab., 28 Ref., 2 App.

Contract DOT-FR-30051

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250547/AS, DOTL NTIS

01 129852
DOT TEST TRAIN PROGRAM SYSTEM INSTRUMENTATION MANUAL-SIXTH EDITION
This manual describes track measuring instrumentation which has been developed during the report period and covers all instrumentation currently installed aboard the FRA test cars. The major emphasis of this report deals with the operation and calibration of the track geometry measurement system installed aboard test car T-3. Ancillary systems as well as equipment aboard test cars T-1, T-2, and T-4 are also summarized. New track measurement subsystems such as the alignometer, compensated accelerometer, grade, and magnetic gage systems are described briefly in this report. These systems are scheduled for prototype testing on the FRA test cars during the coming year, and will be fully documented in subsequent reports.
Sponsorship was from Federal Railroad Administration, U.S. DOT.

ENSCO, Incorporated, (DOT-FR-74-23) Ann. Rpt. FRA-ORD&D-75-26, Dec. 1974, 126 pp, 70 Fig.

Contract DOT-FR-20032

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250776/AS, DOTL NTIS

01 131530
TEST TRAIN PROGRAM. SEVENTH PROGRESS REPORT
This report describes the progress of the Rail Engineering and Test Support Program during the period July 1, 1974 to June 30, 1975. Primary emphasis of the program was placed on the establishment of a viable operational track measurement capability. This emphasis resulted from efforts to meet the requirements of the National Track Inspection Program under implementation by the FRA's Office of Safety. Also covered in this report are special tests performed by the FRA test cars; operational improvements to the test car track measurement instrumentation; improvements in data-processing techniques that permit an analysis of track conditions in a more timely and more efficient manner; and highlights of other efforts performed under the Rail Engineering and Test Support Program.

Gunn, W
ENSCO, Incorporated, Federal Railroad Administration, (DOT-FR-75-13) Prog. Rpt. FRA-ORD&D-76-140, June 1975, 140 pp, 28 Fig., Tab., 2 App.

Contract DOT-FR-54174

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-261186/AS, DOTL NTIS

01 132960
TESTING CONCRETE TIES
After commenting on the resons for increased interest in concrete ties in the U.S., the author describes the feasibility study undertaken by Chessie System to investigate the technical and economic aspects of such substitution. Experience elsewhere and the economics of such substitution were first examined. Laboratory tests were then made of selected ties. Finally three field tests were made. There was evidence of higher lateral resistance for the concrete-tie track. The reduced resistance to buckling after tamping is discussed, and the advantage of ballast compactors must be studied.
Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Reiner, IA (Chessie System)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 17-26, 23 Fig., 8 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

01 132961
TRACK STRUCTURES FOR HEAVY WHEEL LOADS
The load bearing capability of track depends on the combined characteristics of foundation, superstructure and loads to be carried. Evidence is that loads imposed by 100-ton cars exceed the load-bearing capacity of much of the track over which they operate. Track deterioration under heavy loads appears in the form of loss of surface and line; in conversion of subgrade and ballast sections into plastic masses that pump mud and water, in wide gauge, plate cutting, tie splitting and spike-killed ties; in rapid wear, battered rail ends and in formation of corrugated and shelly rail. After discussing facets of track design and track deflection, the problems of ballast and subgrade are examined and the effects of wheel loads are detailed. Ten recommendations for combatting effects of high wheel loads and two other lines of action for limiting or accounting in advance for track deterioration are suggested.
Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Hay, WW (Illinois University, Urbana)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 27-36, 10 Fig., 13 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

01 132963
EFFECT OF HEAVY AXLE LOADS ON RAIL AND TIES
The Quebec North Shore and Labrador Railway was built in 1953 to handle iron ore from mines 350 miles north of the St. Lawrence River. Trains of up to 280 cars with five locomotive units are operated. This presentation reports the maintenance experience on track which carries up to 50 million net tons annually, and has handled almost 700 million gross tons since opening. Among the findings: line, surface and gauge must be maintained even on

tangent track; corrugated rail develops quickly on grades and curves and must be countered promptly; joint bars must be kept tight and rail ends restored; oilers are all-important on curves.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Monaghan, BM (Iron Ore Company of Canada)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 45-48, 9 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

01 132964
WELDING CONTINUOUS RAIL IN-TRACK
Continuous welded rail has usually been fabricated using the electric flash butt welding process to join 39-foot rails into 1440-foot lengths. These are then transported for installation in the field. This entails a major materials handling problem which could be reduced by making field welds. Such welds have not met the criteria of quality or cost. A solution developed in the USSR is a highly portable electric flash butt welder. It adds a new option for rail welding and is suitable not only for field work but also for in-plant welding.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Hunziker, RA (Holland Company)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 49-53, 7 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

01 133229
TECHNICAL DATA BASES REPORT. BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM
Literature and other information sources pertaining to properties of granular materials, ballast and sub-ballast materials, fine-grained soils, and structural behavior models were reviewed. Presented in this report is a summary of the current technology relative to the following: (1) procedures for evaluating ballast and subgrade material properties; (2) factors which influence ballast and soil material properties; (3) relations between ballast and soil material properties and track system behavior and performance; (4) applicability of structural analysis models to predicting behavior of track system; (5) transfer functions relating track behavior to performance. Based on the review, it is concluded that ballast and subgrade materials receive inadequate considerations in analysis and design, more realistic models are available for structural analysis of track systems, transfer functions relating track behavior to performance are not available and climatic factors exert a significant influence on behavior and performance and must be given appropriate consideration in analysis and design of the track system.

Robnett, QL Thompson, MR Hay, WW Tayabji, SD Knutson, RM
Illinois University, Urbana, Federal Railroad Administration Summ. Rpt. FRA/ORD-76/138, July 1975, 179 pp

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
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PB-251771/AS, DOTL NTIS

01 133411
LONGITUDINAL FORCES IN RAILROAD TRACK
The work is devoted to the theory of design computations for track subjected to thermal and creep forces. The theory of longitudinal forces and displacements arising in continuous welded rail (CWR) track due to temperature changes is mathematically developed. A description of results of experimental investigations of the operation of CWR track is given, with the subsequent determination of parameters and functions which characterize the behavior of the track under the influence of temperature changes. Results of investigations of longitudinal forces in CWR track resulting from moving trains are presented. The work contains an investigation of railroad track stability. The problem is solved in a nonlinear formulation, under assumption that the rail is subjected to passive loads without any restrictions on the dependence of these quantities on the corresponding displacements.

Trans. of mono. Centralny Nauchno-Isslodovatelski Institut Inzhenerov Zheleznodorozhogo Transporta, n.p. 1967, by M. Yanowitch.

Kogan, AY
Federal Railroad Administration FRA/ORD-76-11, 1967, 218 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-251657-T/ST, DOTL NTIS

01 133413
EXPERIMENTAL RESEARCH ON FLEXURE DISTORTION AND STRESS IN RAILROAD SUPERSTRUCTURE
Experimental research on flexure, distortion and stress in railroad track structures is described herein. Report undertaken with object of comparing the effect on track of several types of high-speed locomotives for passenger trains. The improved photographic method used to record movements of selected points in different parts of the superstructure makes it possible to measure both flexure distortion and stress at these points with great precision, while avoiding certain shortcomings found in other familiar methods. The data presented in this report was developed prior to 1936 and is offered in a historical context only. Portions of this document are not fully legible.

Trans. of mono. Annals of the Academy of Technical Sciences, Warsaw, v4 1937.

Wasiutynski, A
Federal Railroad Administration FRA/ORD-76-10, 1937, 221 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-251686-T/ST, DOTL NTIS

01 136798
DEVELOPMENTAL TESTS OF CONCRETE TIE AND TIE FASTENING SYSTEMS
This report covers a series of laboratory investigations into improved techniques for fastening rails to concrete railroad cross ties. Past experience with several fastening designs in North America had pointed out certain areas of deficiency. Several concepts were developed which were intended to improve this performance. The laboratory experiments were a first step in testing these concepts. Some of the designs and concepts tested were found to be ready for field testing while others demanded further development efforts. The tests included measurements of vertical, longitudinal and lateral rail restraint, electrical characteristics and stress determinations. The results are given in tabular and graphical form.

Prepared in cooperation with Baltimore and Ohio Railroad Co., Baltimore, Md.

Way, GHJ
Chessie System, Federal Railroad Administration, Baltimore and Ohio Railroad Final Rpt. RS-73-106-Phase 1, FRA-ORD/D-76-13, May 1973, 145 pp

Contract DOT-FR-20015

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-252181/AS, DOTL NTIS

01 136799
RAILROAD TRACK TECHNOLOGY IN THE USSR: THE STATE OF THE ART
Report contains limited assessment of the present state of the art of railroad track research, construction and maintenance technology in the U.S.S.R. It synthesizes the observations and opinions of a six-man team of U.S. railroaders which visited the Soviet Union during a 12-day period in the summer of 1974, for the purpose of evaluating Soviet railroad track technology. The major evaluation priority was to isolate aspects of Soviet technology that would be of value to the U.S. scheme and as identified, the steps necessary to introduce the concepts or procedures to the U.S. maintenance of way community.

Guins, SG
Federal Railroad Administration Final Rpt. FRA/ORD-76/12, Oct. 1974, 136 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-252199/5ST, DOTL NTIS

01 145603
DOT TEST TRAIN PROGRAM SYSTEM INSTRUMENTATION MANUAL. SEVENTH EDITION
The manual describes track measurement instrumentation which has been developed during the report period and covers all instrumentation currently installed aboard the FRA track survey cars. The major emphasis of this report deals with the operation and calibration of the track geometry measurement system installed aboard track survey car T-3. Ancillary systems as well as equipment aboard track survey car T-1 are also summarized. The information is intended for use by technical personnel concerned with the utilization of FRA track survey car instrumentation, and by engineering and research personnel involved in the application of track geometry measurement techniques.

See also PB-250776.

Gunn, WW
ENSCO, Incorporated, Federal Railroad Administration Ann. Rpt. DOT-FR-76-01, FRA-OR&D-76-254, June 1976, 149 pp

Contract DOT-FR-20032

ACKNOWLEDGMENT: NTIS, FRA
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PB-258497/7ST, DOTL NTIS, DOTL RP

01 147574
THE EFFECT OF IMPERFECTIONS ON THE VERTICAL BUCKLING OF RAILROAD TRACKS
This report deals with an analytical prediction of the effect of geometric imperfections on the post-buckling characteristics of railroad tracks. The analysis is restricted to the case of vertical track buckling due to constrained thermal expansion in which the track is assumed to lift itself up over a finite span. The imperfections are categorized into two cases. Case (A) in which the region of imperfection is larger than the span of lift-off and Case (B) in which the imperfection region is smaller than the span of lift-off. It is shown that while a perfectly straight track does not exhibit bifurcation points from the undeformed state, the imperfect track does and that the bifurcation temperature in Case (A) is lower than in Case (B) for the same ratio of imperfection amplitudes reduces the bifurcation temperatures significantly. It is found that the bifurcation temperature as well as the safe temperature increase are higher for heavier tracks.

Research sponsored by the Federal Railway Administration, Office of Research and Development, under contract to the Transportation Systems Center, Cambridge, Massachusetts.

El-Aini, YM
Princeton University, (DOT-TSC-FRA-75-17) Intrm Rpt. FRA-OR&D-76-09, June 1976, 42 pp, 10 Fig., 1 Tab., 9 Ref., 1 App.

Contract DOT-TSC-900

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-259389/5ST, DOTL NTIS

01 148272
DEVELOPMENT OF A STRUCTURAL MODEL AND MATERIALS EVALUATION PROCEDURES-BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM
An adequate engineering analysis of conventional railway track support system (CRTSS) requires the consideration of all the major components of the track support system. Past efforts in this area have not been satisfactory because of lack of proper material characterization and very simplified modelling of the CRTSS. An attempt has been made to model the CRTSS using the finite element method that would allow a determination of the transient response of the CRTSS by incorporating proper material characterization. Because of the complex three-dimensional geometry, the analytical modelling was divided into two stages; namely, a longitudinal analysis stage and a transverse analysis stage. Stress dependent material properties of the ballast, the subballast, and the subgrade can be used with the finite element method. The finite element model has been validated using the measured response at Section 9 of the Kansas Test Track. Good agreement was obtained between the measured response and that calculated using the finite element model. The report also describes ballast and subgrade materials evaluation procedures. The repeated load triaxial testing procedure that has been selected for evaluating the resilient and permanent deformation characteristics of ballast and subgrade soil materials is described in detail.

Research sponsored by the Federal Railroad Administration, DOT, and the Association of American Railroads.

Robnett, QL Thompson, MR Knutson, RM Tayabji, SD
Illinois University, Urbana Final Rpt. FRA-OR&D-76-255, Nov. 1975, 97 pp, 35 Fig., 6 Tab., 57 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-262987/1ST, DOTL NTIS, DOTL RP

01 148273
TRACK SUPPORT SYSTEMS PARAMETER STUDY-BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM
A finite element structural analysis model for conventional railway track support systems (CRTSS) has previously been developed. This study includes parameter studies and sensitivity analyses conducted using the structural model to establish the effects of various parameters on the "instantaneous-elastic" response of CRTSS. The parameters studied are ballast (type and depth), subballast (type and depth), subgrade support conditions, rail size, ties (spacing and width), wheel loading, missing ties and tie type. The parameter study indicates that ballast type and rail size do not significantly effect "instantaneous-elastic" response of CRTSS, while subballast (stabilized), subgrade support condition and wheel loading are some of the major parameters that affect the "instantaneous-elastic" response of the CRTSS.

Research sponsored by the Federal Railroad Administration, DOT, and the Association of American Railroads.

Tayabji, SD Thompson, MR
Illinois University, Urbana Final Rpt. FRA-OR&D-76-256, Mar. 1976, 71 pp, 18 Fig., 14 Tab., 6 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-263370/9ST, DOTL NTIS, DOTL RP

01 148274
PROGRAM ILLI-TRACK: A FINITE ELEMENT ANALYSIS OF CONVENTIONAL RAILWAY SUPPORT SYSTEM. USER'S MANUAL AND PROGRAM LISTING
A computer program for the finite element analysis of conventional railway track support systems has been developed. This report details a User's Manual and a Program Listing of the computer program.

Research sponsored by the Federal Railroad Administration, DOT, and the Association of American Railroads.

Tayabji, SD Thompson, MR
Illinois University, Urbana Final Rpt. FRA-OR&D-76-257, Mar. 1976, 101 pp, 7 Fig., 3 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-262988/9ST, DOTL NTIS, DOTL RP

01 151837
BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM. PHASE IV. MATERIALS EVALUATION STUDY
This report presents the results of Phase 4-Materials Evaluation Study, of the Ballast and Foundation Materials Research Program. Emphasis is on characterizing the response of the structural support elements (subgrade, subballast, and ballast) with respect to in service loading conditions. Properties of the subgrade, the subballast, and the ballast that significantly influence track structure behavior and performance have been identified. Part A of the report includes the evaluation of the resilient (elastic) response and permanent strain response of 7 ballast and subballast materials. Part B contains plastic strain and degradation results of ballast materials subject to long term (1 million repetitions) loading. Part C includes the evaluation of resilient response and permanent strain response of ten subgrade soils. Thermal regime characterization, including freeze-thaw analysis is presented in Part D. A comprehensive summary and conclusions are given in Part E.

Knutson, RM Thompson, MR Mullin, T Tayabji, SD
Illinois University, Urbana, Association of American Railroads Technical Center, Federal Railroad Administration Tech Rpt. FRA-ORD-77/02, Jan. 1977, 324 pp

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-264215/5ST, DOTL NTIS

01 153367
U.S.-U.S.S.R. TRACK AND RAIL METALLURGY INFORMATION EXCHANGE
The report covers track research and development activities, rail metallurgy and the technology of laying welded rail, assembly and disassembly of track panels and wood tie reclamation. It draws upon the experiences, observations and discussions of a seven-man team of engineers, researchers, and metallurgists who visited the Soviet Union during an 11-day period in 1976. The basic goals were to expand upon the knowledge obtained by previous delegations and to learn as much as possible for application or modification to US research and development activities and track maintenance procedures.

The exchange was coordinated by the U.S. DOT's Office of Policy, Plans and International Affairs and the Soviet State Committee for Science and Technology. This report was sponsored by the FRA's Office of Research and Development and the USSR Ministry of Railways.

Beck, RF
Elgin, Joliet and Eastern Railway Company Final Rpt. FRA/ORD-77/19, Mar. 1977, 140 pp, 63 Fig., 2 Tab., 3 App.

Contract P.O. No. 74276

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-266368/AS, DOTL NTIS, DOTL RP

01 153369
THE EFFECTS OF ACCELERATED BALLAST CONSOLIDATION
The effects of accelerated ballast consolidation were tested on main-line tracks of the Boston and Maine, the Chessie, the Missouri Pacific, the Penn Central and the Saint Louis and Southwestern, and at three sites on the Southern. Tests were made before and after traffic, after surfacing and related track work had been completed, both with and without machine consolidation of the ballast in the cribs and shoulders. The resistance of individual ties and panels of track to lateral forces, track settlement under traffic, and other indicators of track stability were measured. The average lateral resistance before traffic in sections of track with consolidated ballast was found to be equivalent to that reached after more than 400,000 tons (360,000 metric tons) of traffic on track with unconsolidated ballast. Settlement was found to be less in consolidated ballast, especially at joints. The differences diminished under traffic but were still evident after many thousands of tons of traffic. Some of the test results were not conclusive because of wide variations in local conditions and other factors. However, the results indicate that accelerated consolidation of ballast will be a valuable addition to track surfacing work in areas where continuous welded rail has a high probability of buckling under temperature stress after the ballast has been disturbed.

Sponsored by the FRA's Office of Research and Development, U.S. DOT. Other railroads participating in this work were the Boston and Maine Corporation, Penn Central Transportation Company, St. Louis and Southwestern Railway Company, and the Missouri Pacific Railroad Company.

Cunney, EG May, JT Jones, HN
ENSCO, Incorporated, Southern Railway Company, Chessie System, (DOT-FR-76-02) Final Rpt. FRA-OR&D-76-274, Mar. 1977, 184 pp, Figs., Tabs., 12 Ref., 5 App.

Contract DOT-FR-54174

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-266447/AS, DOTL NTIS, DOTL RP

01 156868
MEASUREMENT PLAN FOR THE CHARACTERIZATION OF THE LOAD ENVIRONMENT FOR CROSS TIES AND FASTENERS
This report was prepared as a part of the Improved Track Structures Research Program sponsored by the Office of Rail Safety Research of the Federal Railroad Administration. The report is a planning document for a track measurement program to obtain data on the service loads and reactions of cross ties and rail fasteners. These data will be used to validate analytical models for predicting track response and to provide a statistical description of track loading for design and testing improved cross ties and fastener assemblies. The report includes criteria for site selection, an evaluation of measurement parameters, instrumentation and data analysis techniques, and the development of statistical criteria for planning the measurement program.

Funded by the FRA/U.S. DOT through the Transportation Systems Center; the Bechtel Corporation served as subcontractor.

Prause, RH Harrison, HD Arnlund, RC
Battelle Columbus Laboratories, Bechtel Corporation, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA-/ORD-77/03, DOT-TSC-FRA-77-9, Apr. 1977, 88 pp, Figs., Tabs., 8 Ref., 1 App.

Contract DOT-TSC-1044

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-271393, DOTL NTIS, DOTL RP

01 157217
TEST TRAIN PROGRAM. EIGHTH PROGRESS REPORT
This report describes the progress of the Rail Engineering and Test Support Program during the period July 1, 1975 to June 30, 1976. Primary emphasis of the program was to perform track inspection of heavily traveled mainline track for the FRA Office of Safety. Also described in this report are special tests performed for the FRA: improvements to the track measurement car and instrumentation; improvements and development of off-line data-processing techniques; development of analysis software for special FRA tests; and highlights of studies performed in support of the Rail Engineering and Test Support Program. This report is intended for use by management and technical personnel who are concerned with accomplishments of the Rail Engineering and Test Support Program.

Sponsored by the FRA/U.S. DOT, Office of Research and Development.

Peterson, C Gunn, W
ENSCO, Incorporated, (DOT-FR-76-03) Prog Rpt. FRA-OR&D-77-25, June 1976, 109 pp

Contract DOT-FR-54174/64113

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-269938, DOTL NTIS, DOTL RP

01 157596
AN ANALYSIS OF THERMAL TRACK BUCKLING IN THE LATERAL PLANE
The post-buckling equilibrium states are determined analytically. To obtain a consistent formulation of the problem, use is made of the principle of virtual displacements and the variational calculus for variable matching points. The obtained formulations are nonlinear, but can be solved exactly. Solutions are presented for four buckled configurations. The results are presented graphically for a typical railroad track now in use on main lines. The obtained results are compared with the corresponding results of other investigators.

Sponsored by the FRA/U.S. DOT, Office of Research and Development; DOT's Transportation Systems Center acted as support agency.

Kerr, AD
Princeton University, Federal Railroad Administration, Transportation Systems Center, (DOT-TSC-FRA-76-77) Intrm Rpt. FRA-ORD-76-285, Sept. 1976, 70 pp, 12 Fig., 5 Tab., 12 Ref.

Contract DOT-TSC-900

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-267938/9ST, DOTL NTIS, DOTL RP

01 157702
A BIBLIOGRAPHY ON RAIL TECHNOLOGY
This rail technology review provides assistance to a number of rail technology programs initiated by the Transportation Systems Center (TSC) for the Federal Railroad Administration (FRA). The results of a search and review in four specific areas in the field of rail technology are presented in the form of a bibliography with descriptive abstracts, source acknowledgments, and availabilities. The geographic scope of the review was worldwide with particular emphasis on the literature of the United States, Canada, the United Kingdom, Western Europe, the Soviet Union, and Japan. The technical scope of investigations for which abstracts are presented include such important topics as the nondestructive examination of rails, the determination of rail stresses and strains and factors affecting them, rail failure behavior and the analysis of rails-in-service, and the metallurgical aspects of rail steel and its production. The time period covered by the review is 1965 through 1975, with particular emphasis on the past five years. Types of literature covered include: journal articles, conference papers, reports, textbooks, handbooks, and unpublished papers. Indices for the identification of the abstracts are provided.

Sponsored by the FRA/U.S. DOT, Office of Research and Development, through the DOT Transportation Systems Center, under Interagency agreement with the Defense Supply Agency, Dayton, Ohio 45444.

Chapin, WE King, RD Pestel, HC Breslin, RH
Battelle Columbus Laboratories, Transportation Systems Center, (DOT-TSC-FRA-76-28) Final Rpt. FRA/ORD-77/15, May 1977, 538 pp, 1526 Ref.

IA RA-75-19

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-275046/1ST

01 158198
NONDESTRUCTIVE MEASUREMENT OF LONGITUDINAL RAIL STRESSES
A study of the effect of applied stress on the wave velocity (acoustoelasticity) of railroad rail steel has shown that a potentially useful technique exists for the nondestructive measurement of longitudinal stresses. The detection of extreme stress levels would contribute toward increased rail safety by decreasing accidents due to track buckling and weld pull aparts in continuously welded rail. Velocity variations between various new rails and between new and used rails were found to be significant. The overall effect of this is expected to be minimized by either establishing a base line velocity profile for rail or by comparing the velocity change of two waves, each experiencing a different change with applied stress.

Egle, DM Bray, DE
Oklahoma University Intrm Rpt. FRA/OR&D-76-270, June 1975, 127 pp, Figs., Tabs., 36 Ref., 4 App.

Contract DOT-OS-40091

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272061/AS, DOTL NTIS

01 163791
THE REAL WORLD OF TRACK AS RELATED TO SAFETY
The attitude and training of inspectors and track supervisors, along with the track conditions which they must detect and correct are discussed. The experience of the author's railroad is described.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Peterson, LA Gatton, CL (Louisville and Nashville Railroad Company)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 47-51, 16 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

01 163792
THE PRESENT AND FUTURE IN RAIL FLAW DETECTION
Automation of the process of detecting rail flaws so this may be done more rapidly and accurately has progressed to the stage of preliminary design. In automating rail inspection, signal processing and data processing hardware, along with the system's hardware technology, are already available, offering the greatest promise for accomodating the high data rates of the multiple sensor system.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Kaske, AD Phipps, PL (Sperry Univac Defense Systems)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 52-59, 6 Fig., 10 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

01 163793
TRACK INSPECTION APPROACHES FOR SAFETY AND MAINTENACE PLANNING
For several years the Bessemer & Lake Erie has taken part in a study of track geometry and track degradation. The objectives are development of quantitative ratings of track quality and utilization of such data for long-range track maintenance planning. A special car has been instrumented for the railroad's own regular use in measuring wheel-rail forces and the FRA's track geometry measurement car is used periodically for added data collection. The railroad is working toward a system which may be used as a full-time maintenance planning tool.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Price, BH (Bessemer and Lake Erie Railroad)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 60-69, 26 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

01 167111
ANALYSIS OF KANSAS TEST TRACK BEAM RESPONSE
In the fall of 1975 post-mortem static and dynamic tests were conducted on a reinforced twin concrete beam section of the Kansas Test Track (KTT) near El Dorado, Kansas. These tests were part of an extensive program undertaken by the Federal Railroad Administration to gain insight into the mechanisms of the rapid deterioration of that test facility. The data from the static and dynamic tests were used to validate a dynamic track structure model of the KTT beam sections. This report presents a summary of the validation process and the subsequent use of the model as an analytical tool for parameter studies. These studies assist in the investigation of the nature of the KTT beam performance, give insight into the behavior of beam and slab track structures, and provide the technical background for evaluation of future non-conventional track structure designs.

Anderes, JR
Mitre Corporation, Federal Railroad Administration Final Rpt. MTR-7502, FRA/ORD-77/31, June 1977, 85 pp

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-271412/9ST, DOTL NTIS

01 167341
U.S.-U.S.S.R. RAIL INSPECTION INFORMATION EXCHANGE
This trip report describes the results and conclusions of the U.S. delegation resulting from the U.S.-U.S.S.R. Rail Inspection Information exchange tour of the Soviet Union, August 24 through September 1, 1975. This information exchange was conducted under protocol agreements developed in 1974 between the Ministry of Railroads of the U.S.S.R. and the Federal Railroad

Administration of the U.S. Department of Transportation. The objective of this information exchange was to achieve a technical description of Soviet rail inspection technology and practice and to learn of recent R&D efforts for nondestructive inspection (NDI) of rail. The pertinent areas included: contemporary rail NDI systems, planning and scheduling of rail inspection, inspection of track components other than rail, methods for measurement of rail stresses, and recent R&D efforts in rail NDI. This report is divided into five sections: itinerary, description of devices and techniques, applicability of Soviet technology to U.S. rail NDI, effectiveness of the information exchange, and recommendations for future exchanges.

Becker, FL
Battelle Memorial Institute/Pacific Northwest Labs, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-77-6, FRA/ORD/77-35, June 1977, 90 pp

Contract DOT-TSC-979

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-272612/3ST

01 167377
RAIL INSPECTION SYSTEMS ANALYSIS AND TECHNOLOGY SURVEY
The study was undertaken to identify existing rail inspection system capabilities and methods which might be used to improve these capabilities. Task I was a study to quantify existing inspection parameters and Task II was a cost effectiveness study to utilize the results of Task I in defining the total costs incurred in inspecting and replacing rail and in defining the most cost effective inspection system. Some of the major findings from these studies were that the practices of stopping for hand check and to mark flaws and of manually processing all data were the major factors presently limiting inspection speeds. It was concluded that use of automatic data processing and elimination of the stops would allow speeds to be increased to about 25 mph (40 kmph) and inspection costs would be reduced by about a factor of 2. It was also concluded that with extensive transducer and carriage development, speeds up to 50 mph (80 kmph) were feasible and would further reduce inspection costs from 0 up to a maximum of about 30 percent depending upon usage. A recommendation was made to develop an inspection vehicle with an ultimate speed capability of 50 mph (80 kmph) or higher.

Kaiser, WD Byers, RH Ensminger, D Meacham, HC Flora, JH
Battelle Columbus Laboratories, Federal Railroad Administration, Transportation Systems Center Final Rpt. DOT-TSC-FRA-77-13, FRA/ORD-77/39, Sept. 1977, 229 pp

Contract DOT-TSC-979

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-272931/7ST

01 170072
A STUDY OF RAILROAD BALLAST ECONOMICS
This report presents the results of Phase V--Economic Evaluation of the Ballast and Foundation Materials Research Program. The present "State of the Art" in the ballast costing area is discussed. The individual ballast costs are quantified to the extent possible using the data base compiled from the literature review and from replies to a survey received from 70 U. S. and Canadian Railroads. A discussion of the differences in ballast performance is presented. An equation to compute the additional cost justified to place a ballast of superior stability is formulated. It has been possible to quantify many of the costs associated with ballasting procedures; however, due to the wide diversity in operating conditions, procedures, gang organization, financial conditions and climatic factors, these costs vary greatly from railroad to railroad since many railroads do not take into account all costs in their costing exercises. The cost derived in this study can be used as an input to a general model for ballast selection.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. by Illinois Univ. at Urbana-Champaign, Department of Civil Engineering. Report on Ballast and Foundation Materials Research Program.

Hay, WW Baugher, R Reinschmidt, AJ
Illinois University, Urbana, Association of American Railroads Technical Center, Federal Railroad Administration Techn Rpt. FRA/ORD-77/64, Sept. 1977, 100 pp, Figs., Tabs., 13 Ref., 1 App.

Contract DOT-FR-30038
ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-275102/AS, DOTL NTIS

01 170421
NONDESTRUCTIVE MEASUREMENT OF LONGITUDINAL RAIL STRESSES: APPLICATION OF THE ACOUSTOELASTIC EFFECT TO RAIL STRESS MEASUREMENT
An ultrasonic probe has been designed, evaluated and shown capable of measuring longitudinal stress changes in railroad rails. The probe utilizes the effect of applied stress on wave velocity (acoustoelastic effect) to determine the stress change. Both laboratory and field evaluation has shown that the probe is capable of measuring stress changes with an accuracy of plus or minus 6.9 MN sq m (plus or minus 1 ksi).

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Egle, DM Bray, DE
Oklahoma University Final Rpt. FRA/ORD-77/34.1, Jan. 1978, 113 pp, 47 Fig., 7 Tab., 27 Ref., 2 App.

Contract DOT-OS-40091

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-281164/4ST, DOTL NTIS

01 175999
PARAMETRIC STUDY OF TRACK RESPONSE
This report was prepared as part of the Improved Track Structures Research Program managed by the Transportation Systems Center. The report presents results from a parametric study of track response using a comprehensive track analysis model. Track response parameters include rail and tie bending moments, rail displacement, tie rail seat load, and the distribution of stresses in the ballast and subgrade. The effects of variations in tie size, tie spacing, ballast depth and rail fastener stiffness are presented in graphs suitable for track design trade-off studies. Alternative wood and concrete tie track configurations are evaluated using equivalent maintenance criteria. Maintenance criteria for track surface deterioration were reviewed to select ballast and subgrade stress parameters which can be related to track settlement rate for service loads. Formats for cumulative settlement criteria are evaluated using available laboratory data for the behavior of ballast and subgrade materials under repeated loads. Track lateral strength requirements for wood and concrete tie track are also discussed.

Prause, RH Kennedy, JC
Battelle Columbus Laboratories, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. DOT-TSC-FRA-77-75, FRA-ORD-77-75, Dec. 1977, 118 pp, Figs., Tabs., Refs., 1 App.

Contract DOT-TSC-FRA-1044-1

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-279316/4ST, DOTL NTIS, DOTL RP

01 176001
AN ANALYTICAL AND EXPERIMENTAL EVALUATION OF CONCRETE CROSS TIE AND FASTENER LOADS
This report has been prepared as part of the Improved Track Structures Research Program sponsored by the Office of Rail Safety Research of the Federal Railroad Administration. The report covers a review and evaluation of track analysis models for predicting tie and fastener loads. The principal track analysis model selected includes the effects of tie bending, ballast depth, and ballast and subgrade elastic properties in a unified manner. The report also includes a statistical description of track loads measured for revenue traffic operating on three sections of concrete tie track on the Florida East Coast Railway. Measured tie loads are compared to maximum design loads used in current specifications for concrete ties and fasteners.

Prepared in cooperation with Bechtel, Inc., Gaithersburg, Md. See also report dated Apr 77, PB-271393.

Prause, RH Harrison, HD Kennedy, JC Arnlund, RC
Battelle Columbus Laboratories, Bechtel, Incorporated, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA-/ORD-77/71, Dec. 1977, 356 pp, Figs., Tabs., Refs., 9 App.

Contract DOT-TSC-1044

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-279368/5ST, DOTL NTIS, DOTL RP

01 179118
TRACK STRUCTURE DESIGN USING MATHEMATICAL MODELS

The objective of the report is to demonstrate the use of mathematical track structure models in the development of design charts. The models have been developed in Task 1, Mathematical Modelling, of the Track Structures Research Program, Contract DOT-FR-30038. The charts should enable the optimal selection of track components and to evaluate the structural performance of existing track components in a given loading environment. The criterion for acceptable track design is that the strength of the track structure on a fatigue basis not be exceeded and the Minor's rule is used. The charts are based on arbitrarily chosen wheel-rail load magnitudes. For vertical wheel-rail loading, the loading configuration consists of eight wheel loads and corresponds to that of two adjacent trucks of two coupled 100 ton (90,720 kg) cars. For lateral wheel-rail loading, a single lateral load applied to the base of one rail is used.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

So, W
Association of American Railroads Technical Center Final Rpt. FRA-/ORD-78/08, June 1978, 64 pp, Figs., 4 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-282357/AS, DOTL NTIS, DOTL RP

01 179262
REFURBISHMENT OF RAILROAD CROSSTIES. A TECHNICAL AND ECONOMIC ANALYSIS

An analysis of the principal modes of failure for wooden railroad crossties was conducted and an evaluation of the technical and economic feasibility of refurbishing these ties was conducted. Among the principal modes of structural deterioration, only spike-killed tie repair was identified as practically feasible for in-situ treatment. However, once ties were removed from track, the feasibility of an in-plant repair of selected ties was found to be technically feasible for plate-cut and spike-killed ties. Such a repair operation could result in cost savings of 19-50% over the cost of new tie insertion, depending on the nature of the process selected and the assumed salvage value of a "spent" tie. Candidate process plant flow descriptions have been developed and the initial (capital) costs and annual operating costs evaluated. Recommendations for process evaluation are included as a starting point for continued investigations of crosstie reuse.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Loomis, AV Anyos, T
Stanford Research Institute Final Rpt. DOT-TSC-FRA-77-29, FRA-/ORD-77/76, Dec. 1977, 132 pp, Figs., Tabs., 5 App.

Contract RA 75-29

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-283447/AS, DOTL NTIS, DOTL RP

01 182085
AN EXPERIMENTAL EVALUATION OF TECHNIQUES FOR MEASURING THE DYNAMIC COMPLIANCE OF RAILROAD TRACK. PHASE I

This report covers the initial track measurement task of a 3-phase program to design and fabricate equipment for measuring track dynamic characteristics. The objective of this task was to evaluate techniques for measuring the dynamic compliance and to identify general trends in the behavior of the track structure. Some of the results obtained were a high degree of nonlinearity of vertical track stiffness with vertical preload and a settling phenomenon of the track structure due to the constant preload and dynamic excitation. This settling yields a stiffer track structure for a constantly applied preload as compared to a cyclic preload. The information in this report is intended for use by research personnel who have an interest in railroad track performance as related to vehicle/track interaction and track maintenance, and in the measurement of track deflections and dynamic characteristics for developing track analysis models and evaluating track structure condition.

See also report for June-December 73, PB-250547.

Nessler, GL Prause, RH Kaiser, WD
Battelle Columbus Laboratories, Federal Railroad Administration Final Rpt. FRA/ORD-78/25, July 1978, 141 p.

Contract DOT-FR-30051

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-285559/1ST, DOTL NTIS

01 188676
DESIGN AND ANALYSIS OF A TRACK COMPLIANCE MEASUREMENT SYSTEM. PHASE II

This report covers the design of a vehicle for measuring the static and dynamic compliance of railroad track. The static compliance system uses the rail deflections due to different axle loads to calculate the track compliance. The static compliance measurements are taken continuously as the vehicle travels a section of track. The dynamic compliance system utilizes an electrohydraulic excitation system capable of cyclically applying in-service wheel loads simulating a passing train and superimposing either pulse, random, or sinusoidal dynamic excitation on the wheel load to dynamically excite the track structure. The excitation and resulting response of the system are analyzed using a digital Fast Fourier Transform program. From these data, the dynamic characteristics of the track structure can be determined. The information in this report is intended for use by research personnel who have an interest in railroad track performance as related to vehicle/track interaction and track maintenance, and in the measurement of track deflections and dynamic characteristics for developing track analysis models and evaluating track structure condition.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Kaiser, WD Meacham, HC Tuten, JM
Battelle Columbus Laboratories Final Rpt. FRA/ORD-78/57, Nov. 1978, 85 p., 12 Fig., 5 Tab., 3 Ref., 3 App.

Contract DOT-FR-30051

ACKNOWLEDGMENT: FRA
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PB-297055/AS, DOTL NTIS, DOTL RP

01 188679
THERMAL BUCKLING OF STRAIGHT TRACKS: FUNDAMENTALS, ANALYSES, AND PREVENTIVE MEASURES

This report, written mainly for the practicing railroad engineer, explains the phenomenon of thermal buckling of straight tracks, shows how to analyze it, and describes measures for preventing it. Following an introductory discussion of track buckling problems caused by a temperature increase in the rails, the report describes the distribution of axial forces in the track rails caused by temperature changes. It reviews briefly track buckling test results obtained by a number of railroads. The method of analysis for the determination of a "safe temperature increase", recently developed by the author, is then discussed. To simplify the use of this analysis, the results are presented graphically for a wide range of track parameters, and the use of the presented graphs is demonstrated with examples. It is shown how the graphs may also be used for the determination of the rail installation temperature. The paper concludes with a description of track tests for obtaining the needed parameters, and a discussion of measures adopted by various railroads to prevent thermal track buckling.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Kerr, AD
Princeton University, (77-TR-6) Intrm Rpt. FRA/ORD-78/49, DOT-TSC-FRA-78-14, Sept. 1978, 58 p., 23 Fig., 2 Tab., 28 Ref., 2 App.

Contract DOT-TSC-1149

ACKNOWLEDGMENT: FRA
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PB-291929/8ST, DOTL NTIS, DOTL RP

01 188681
EFFECT OF TORSIONAL FASTENER RESISTANCE ON THE LATERAL RESPONSE OF A RAIL-TIE STRUCTURE

The use of the classical beam bending equations for the analysis of the track response in the lateral plane is of questionable validity, when the used fasteners exhibit a noticeable torsional resistance. To remedy this situation, recently a variety of other track equations were proposed and used. The purpose of the present study is to establish the effect of fastener resistance on the lateral response of the rail-tie structure and also to determine whether a fourth order differential equation, which includes a rotational resistance term, is sufficiently accurate for describing its lateral response. To achieve this aim deflection tests were conducted on a rail-tie structure with adjustable fastener rigidities, then this test-structure was analyzed using a fourth order equation with and without a rotational resistance term, and subsequently the analytical and test results were compared. The test results revealed that with an increasing rotational resistance of the fasteners, the deviation of the test curves, from the case of zero fastener resistance, also increases; thus, the beam bending equation is not suitable, in general, for the analysis of the lateral track response. The comparison of the analytical and test result showed that the measured deflection shapes of the test structure, for a variety of fastener rigidities, agree closely with the deflection shapes obtained using a fourth order differential equation which includes a rotational resistance term, provided the coefficient of this additional term contains the effect of the fastener rigidity and the bending rigidity of the cross-ties.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Kerr, AD
Princeton University, (77-TR-8) Intrm Rpt. FRA/ORD-78/35, DOT-TSC-FRA-77, Sept. 1978, 28 p., 10 Fig., 10 Ref., 1 App.

Contract DOT-TSC-1149

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-290734/AS, DOTL NTIS, DOTL RP

01 188688
ECONOMICS OF CONCRETE-AND WOOD-TIE TRACK STRUCTURES

This report presents results from an evaluation of the economic benefits of concrete-versus wood-tie track. The analysis includes the life-cycle capital, maintenance, and renewal costs for concrete-and wood-tie track for four specific test cases and traffic ranges from 15 to 40 annual million gross tons (MGT). The sensitivity of the justifiable first cost of concrete ties as a function of parametric changes in service and maintenance variables has also been determined.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

White, DW Arnlund, RC Prause, RH
Battelle Columbus Laboratories, Bechtel, Incorporated, Transportation Systems Center, (TSC-744) Intrm Rpt. FRA/ORD-78/30, DOT-TSC-FRA-78-2, Aug. 1978, 76 p., 3 Fig., 18 Tab., Refs., 4 App.

Contract DOT-TSC-1044

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-291613/8ST, DOTL NTIS, DOTL RP

01 188689
EVALUATION OF IMPROVED TRACK STRUCTURAL COMPONENTS UNDER SUB-ARCTIC CONDITIONS

One area of concern to railroads in the northern third of the United States is the effect of frost heave and subsidence on track geometry. The purpose of this study was to evaluate two methods of improving track geometry and reducing maintenance in sub-arctic environments. Test track sections were installed in frost heave areas of the Alaska Railroad. One installation was designed to evaluate concrete ties with adjustable fasteners. The other installation was designed to evaluate the effect of including an elastic polymer stabilizer in the ballast. The concrete tie adjustable fastener section performed satisfactorily. Ties withstood bending stresses induced by the unfavourable frost heaving support conditions. The fasteners provided an acceptable means of adjusting track during frost heave. Stabilized ballast effectively reduced track subsidence due to weak foundation support. However, other problems such as hardening of the binding material and migration of the unstabilized ballast layer, made the particular system used unacceptable at this time.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Weber, JW
Portland Cement Association, Alaska Railroad Final Rpt. FRA-/ORD-79/01, Jan. 1979, 100 p., Figs., Tabs., 7 App.

Contract DOT-69-25-0003-4144

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-291376/2ST, DOTL NTIS, DOTL RP

01 188691
FLAW DETECTION IN RAILS

The Physical principles and techniques of magnetic and ultrasonic flaw detection in rails are given. The intended use, working principles and layout of various rail flaw detector systems and the procedure for working with them are described. The methodology of rail inspection, both in the field and at railwelding facilities is also described. The repair of flaw detection equipment on the railroads is examined. The book has been approved by the Chief Administration of Educational Institutions of the MPS (Ministry of Railroads) as a textbook for rail transportation technical schools and by the Academic Council of the State Committee of the USSR Council of Ministers responsible for professional-technological education as a manual for individual-team instruction production workers. It will be helpful to track facility workers involved in the inspection of rails.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. Third Edition (1971), revised and expanded, translated from the Russian by Robert J. Karriker.

Gurvich, AK
Oklahoma University FRA/ORD-77/10, Dec. 1978, 578 p., 246 Fig., 19 Tab., 1 App.

Contract DOT-OS-40091

ACKNOWLEDGMENT: FRA
ORDER FROM: FRA/ORD

DOTL RP

01 192246
AN EVALUATION OF PERFORMANCE REQUIREMENTS FOR CROSS TIES AND FASTENERS

This report was prepared as part of the Improved Track Structures Research Program managed by the Transportation Systems Center. This program is sponsored by the Office of Rail Safety Research, Improved Track Structures Research Division, of the Federal Railroad Administration. The report evaluates the technical basis for current tie and fastener specifications. Particular emphasis was placed on correlating track load data and service failure modes with tie/fastener strength requirements. This required a detailed review of the failure history and laboratory tests for the early, intermediate and new concrete tie designs used in several North American test installations. Limitations of current specifications are identified and specific modifications are recommended. A brief review of the development and performance of reconstituted timber ties and steel ties is also included.

Prepared in cooperation with Bechtel, Inc., San Francisco, CA. See also PB-279 316.

Prause, RH Kennedy, JC Arnlund, RC
Battelle Columbus Laboratories, Bechtel Corporation, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA-/ORD-78/37, Dec. 1978, 125 p.

Contract DOT-TSC-1044

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-294431/2ST, DOTL NTIS

01 194637
MODERN CONCRETE CROSSTIE PRACTICE IN FRANCE AND MEXICO

(1) Considered briefly is the history of concrete crosstie development in France. Failure of some crossties in 1973 led to a determination of the failure modes and a rigorous analysis of the service load limits to be taken into account. New crosstie designs evolved from this investigation. Technical

specifications and acceptance tests for crossties fabricated according to the new design criteria are described. New-concept crossties under current assessment are also described. (2) The reasons for the adoption of the concrete crosstie by Ferrocarriles Nationales de Mexico (National Railways of Mexico) are presented. Details of manufacture and testing of these crossties are described. Specifications for concrete crossties are presented. Consideration is given to the performance of crossties and fasteners under service conditions. Some causes of crosstie failure are identified.

Original reports extracted from La Revue Generale des Chemins de Fer, February 1976 issue and translated by W.B. O'Sullivan and J.L. Harmsen.

Prud'homme, A Erieau, J Tena Bernal, M Tellez Gutierrez, R
Federal Railroad Administration FRA/ORD-79/02, Mar. 1979, 82 p., Figs., Tabs.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-295715/AS, DOTL NTIS, DOTL RP

01 304666
TRACK RENEWAL SYSTEMS: A SURVEY REPORT
This report presents a survey of track renewal machines and track renewal systems in Europe and North America. Topics covered include a brief history of track renewal, traditional North American selective track maintenance, and each of the major track renewal machine types currently in use. Emphasis is given to the Canron P-811-based system: P-811 operations are described in detail, including direct observations of the machines operating in Italy and on the Northeast Corridor. Also included are reviews of three recent studies of the economics of track renewal systems for U.S. railroads. The studies used different scenarios and therefore produced different results. However, each study did forecast a positive rate of return on the investment required for track renewal systems to replace selective maintenance methods. The report concludes with a brief account of each of the seven major issues that affect the economics of track renewal but that have yet to be studied in detail.

Cataldi, GR Elkaim, DN Larsen, KW
Unified Industries, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/43, July 1979, 27 p.

Contract DOT-FR-8046

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-300866/1ST, DOTL NTIS

01 304805
WOOD TIE REUSE: A SURVEY REPORT
This report presents a survey of wood tie reuse associated with track renewal in North America and Europe. Topics covered include the causes of tie deterioration, the technology of tie repair, and a survey of wood tie reuse practices in France, Italy, West Germany, Great Britain, the U.S.S.R., and the United States. Also included is a discussion of the economics of wood tie reuse, consisting principally of reviews of the wood tie reuse aspects of two recent U.S. studies. One study focused on the potential of track renewal as an alternative to selective maintenance and the other study examined the technical and economic feasibility of using repaired ties in lieu of new ties when replacing defective ties. Although these studies are neither wholly comparable nor comprehensive, they do provide perspective on the potential costs and benefits of wood tie reuse. All in all, based on these studies and other information, it appears that the economics of tie reuse is promising and that used ties have a potential role to play in track maintenance in North America.

Cataldi, GR Elkaim, DN Larsen, KW Elliott, P
Unified Industries, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/44, UII-92104-2, Aug. 1979, 25 p.

Contract DOT-FR-8046

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-114044, DOTL NTIS

01 308270
THE KANSAS TEST TRACK PART I--ANALYSIS OF TEST DATA
This report presents the results of an experimental project to compare the performance of different track support systems. Data obtained during the project are summarized, presented, and analyzed. Based on these data, conclusions are made regarding the performance of the different track support systems. Details of instruments used for data measurement, their location in track, test procedures, and test data are presented in Part II of the report.

Ball, CG Hanson, NW Weber, JW
Portland Cement Association, Federal Railroad Administration Final Rpt. FRA/ORD-79/22.I, Nov. 1979, 132 p., 49 Fig., 35 Tab., 10 Ref.

Contract DOT-FR-90043

ORDER FROM: NTIS

PB80-128390, DOTL NTIS, DOTL RP

01 308271
THE KANSAS TEST TRACK PART II--APPENDICES
This report presents data obtained from an experimental project to compare the performance of different track support systems. Also, it describes instruments used for data measurement, their location in track, and test procedures. Analysis and evaluation of test data are presented in Part I of the report.

Ball, CG Hanson, NW Weber, JW
Portland Cement Association, Federal Railroad Administration Final Rpt. FRA/ORD-79/22.II, Nov. 1979, 159 p., Figs., Tabs., 6 App.

Contract DOT-FR-90043

ORDER FROM: NTIS

PB80-134562, DOTL NTIS, DOTL RP

01 308272
MECHANICAL IMPEDANCE EVALUATIONS OF THE KANSAS TEST TRACK: PRETRAFFIC AND POSTTRAFFIC TESTS
The Kansas Test Track (KTT) was comprised of nine different track systems whose dynamic response was measured in two series of impedance tests. Pretraffic impedance testing was done in 1973, before the KTT was opened to traffic, and a second (Posttraffic) test series was carried out in 1975 after the KTT had experienced premature failure in service. Results of these tests, presented in the form of impedance and velocity transfer ratio plots, have been used to characterize the various KTT track systems according to their initial dynamic stiffness and component behavior. Known limitations of the test apparatus precluded a detailed analysis; however, a linear idealization was developed to grossly model track system response. These results illustrate the feasibility of an impedance approach to the structure-ballast-interaction processes which govern track system performance.

Cooper, SS
Waterways Experiment Station, Federal Railroad Administration Final Rpt. FRA/ORD-79/10, Nov. 1979, 167 p., 116 Fig., 5 Tab., 12 Ref.

Contract DOT-AR-30025

ORDER FROM: NTIS

PB80-138043, DOTL NTIS, DOTL RP

01 308273
POSTMORTEM INVESTIGATION OF THE KANSAS TEST TRACK, VOLUME I
The Kansas Test Track (KTT) was comprised of nine different track systems, which were built on a designed embankment. The KTT subgrade experienced premature failure in service, and KTT operations were terminated in June 1975 after six months of operation. A postmortem investigation of KTT was carried out in 1975 and 1976. Volumes I and II document the structure, ballast, and embankment studies carried out by the U. S. Army Engineer Waterways Experiment Station in the postmortem investigation. Results presented in Volume I provide needed insight into track system behavior and are particularly descriptive of ballast and embankment performance. A rationale is presented to explain the mechanism of failure in the subgrade, and attention is drawn to the structure-ballast-subgrade interaction processes which govern track system performance. Inadequate drainage of the top of the KTT embankment led to moisture content increases in the top of subgrade from 1971 to 1974, when traffic commenced. The embankment clay was moderately to highly plastic, and moisture-induced loss of strength in the top few inches of subgrade was the principal cause of failure.

Cooper, SS Bush, AJ, III Greer, HC, III Vispi, MA Carlson, MM
Waterways Experiment Station, Federal Railroad Administration Final Rpt. FRA/ORD-79/09.I, Nov. 1979, 130 p., 75 Fig., 13 Tab., 18 Ref.

Contract DOT-AR-30025
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PB80-138316, DOTL NTIS, DOTL RP

01 308275
TRACK COMPONENT--PROPERTY TESTS VOLUME I--RAIL, TIE AND FASTENERS
This report describes the test procedures and the results of tests on the physical properties of rail, tie and fastener. The properties obtained are the bending rigidity of the tie, bending rigidity of the rail in both the vertical and lateral planes, and the fastener resistance to rotation about the vertical axis. The component tests were run on two rail sections, 115 lb RE and 136 lb RE, on 7"x9"x81/2" gum ties and on three fastener configurations on the two different rail sections. The tests were conducted at the Association of American Railroads (AAR) Track Structures Dynamic Test Facility in Chicago, Illinois.

Zarembski, AM Choros, J Gitlin, I
Association of American Railroads Technical Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-79/32, Nov. 1979, 54 p., 24 Fig., 10 Tab., 5 Ref., 2 App.

Contract DOT-FR-30038

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PB80-142367, DOTL NTIS, DOTL RP

01 309878
CORRELATION OF STATISTICAL REPRESENTATIONS OF TRACK GEOMETRY WITH PHYSICAL APPEARANCE
Railway track has previously been represented as a random process with certain parameters that relate to the quality of the track. This report helps to make these parameters more meaningful by correlating the random process and its parameters with more familiar descriptions of the track. The correlation is done by presenting photographs and verbal descriptions of five selected types of track and then comparing this information with the statistical representations of the track. The recently developed method of statistically representing track is applied to the five track zones. Alignment and profile track geometry are processed to give space curves and mid-chord offsets for chords of 62 feet and one-half, one and two times the rail length. This information is presented for the five zones along with power spectral density representations that characterize both the stationary random density representations that characterize both the stationary random track process and the random joint amplitude process. For the three zones with bolted rails, histograms of joint amplitudes are also provided. This report is a helpful companion to more analytical reports on the same subject because it correlates these mathematical treatments with more traditional track descriptions.

Corbin, JC
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/35, June 1979, 77 p., 45 Fig., 4 Tab., 2 App.

Contract PO84371

ORDER FROM: NTIS

DOTL TF23.U68A34, PB80-126881, DOTL NTIS

01 313203
TRACK GEOMETRY MEASUREMENT BY HIGH-RAIL VEHICLES
This report examines the capabilities of a high-rail track survey vehicle to assist in improvement of the track safety inspection program; and assist in data collection for transportation planning. The project examines both technical and operational aspects of high-rail vehicle usage as an inspection service and as a data collection tool. This research project found that measurements of track geometry collected by a high-rail vehicle could be modeled to match measurements collected by a train type vehicle. This finding opens the door to wide utilization of the less costly, highly mobile, easily scheduled, high-rail survey vehicle. This report is a document which outlines the crew requirements, costs, scheduling procedures, reliability and accuracy levels that are associated with the operation of a high-rail track survey vehicle. This report is intended for use by railroad management, state railroad planners and federal railroad planners who may be interested in the operation of a high-rail track survey program.

Sherfy, MA
Iowa Department of Transportation, Federal Railroad Administration Final Rpt. FRA/ORD-78/55, Nov. 1979, 204p

Contract DOT-FR-64243
ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-145857, DOTL NTIS

01 313625
TRACK REHABILITATION AND MAINTENANCE RESEARCH REQUIREMENTS
The Federal Railroad Administration has established a research and development program aimed at improving railroad track safety and performance. As part of the support of that earlier effort, two planning studies were performed which identified track system rehabilitation and maintenance problems, suggested candidate subprograms for solving the problems, and evaluated the subprograms. Subsequently, the two sets of evaluation results were combined to yield a single list of subprograms rank-ordered according to a multi-criterion measure of desirability. This report summarizes the two studies, it describes in summary fashion how two sets of evaluation results were combined, and it presents the combined rank-ordered list of recommended candidate subprograms. These recommended candidate subprograms will be considered by the Federal Railroad Administration, Office of Research and Development as part of the process of establishing track research projects. The selected projects may support a variety of research requirements, in addition to those detailed herein, and therefore may not be implemented precisely as described. Also, the sequence of progression of the projects may not exactly match the recommended rankings due to other considerations which could not be reflected in this report.

Zobrak, MJ
Mitre Corporation, Federal Railroad Administration Final Rpt. FRA-/ORD-80/09, Jan. 1980, 69 p.

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-161169, DOTL NTIS

01 313652
TRACK STIFFNESS: MEASUREMENT SYSTEM EVALUATION PROGRAM
This report describes a three-phase program to develop and evaluate an on-board, track stiffness measurement system. High correlation has been established between observed variations in track stiffness signatures and the actual conditions of track structures and subgrade. Track stiffness and track geometry were found to be independent and complementary measurements. A detailed study of long-and short-span bridge stiffness signatures was conducted. An analytical study of the relationship of the mid-chord-offset difference to absolute stiffness for bridge structures and continuous roadbed was made. Theoretical stiffness models were matched to actual short-span bridge stiffness signatures.

Hayes, G Joshi, P Sullivan, JH
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/30, ENSCO/DOT/FR-79-30, Dec. 1979, 165 p.

Contract DOT-FR-64113

ACKNOWLEDGMENT: NTIS
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PB80-165293, DOTL NTIS

01 313955
VERTICAL TRACK MODULUS: TEST RESULTS AND COMPARISON OF ANALYSIS TECHNIQUES
A vertical track response test was conducted at the AAR Track Structures Dynamic Test Facility. This test was intended to characterize the behavior of the track structure under increasing vertical loads. It was also intended to evaluate the different techniques available for the calculation of the vertical track modulus. The response of the track was obtained by monitoring track deflection under increasing vertical loads. This load and deflection data was then used to calculate vertical track modulus, track stiffness and track compliance. Three widely used techniques were used to calculate the vertical modulus.

Choros, J Zarembski, AM Gitlin, I
Association of American Railroads Technical Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-79-34, Nov. 1979, 47 p.

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
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PB80-165624, DOTL NTIS

01 314087
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL
No abstract available.
Set includes PB80-182181, PB80-182199, and PB80-182207 as RRIS 01 314088 thru RRIS 01 314090, Volume I thru Volume III respectively.

Boeing Commercial Airplane Company, Transportation Systems Center, Federal Railroad Administration FRA/ORD-80/5, Feb. 1980, 212 p.

ACKNOWLEDGMENT: NTIS
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PB80-182173

01 314088
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL. VOLUME I- DESCRIPTION AND PLANNING
The most predominant failure mode of rails with bolt joints is a web crack initiating at the rail bolt hole. This failure mode is of a classical fatigue nature induced by web stress concentration around the bolt hole. This program was conducted to apply a metal-working process to the rail bolt hole to reduce the effect of such stress concentration and to demonstrate the effectiveness of the technique. Using a process known as cold hole expansion, common to the aircraft industry, where the bolt hole is expanded to the point of plastic deformation, a residual compressive stress of both radial and tangential components is formed around the bolt hole. The compressive stress developed effectively reduces the failure-initiating stress concentration at the bolt hole. The effectiveness of the cold-expansion process as applied to rail was demonstrated by comparison fatigue testing of both cold-expanded (CE) and non-cold-expanded (NCE) specimens. Laboratory tests indicated that life improvement for CE specimens was such that web or head failures would be the predominant failure mode, rather than CE bolt holes. The test results were statistically analyzed, indicating a factor of 10 or greater improvement in rail life due to reduction in bolt-hole failure could be anticipated. Experimental equipment was adapted to apply cold hole expansion to an 8.5 mile test section of track in commercial service. Evaluation of this field test is continuing.
See also RRIS 01 314087. Also available in set of 3 reports PC E09, PB80-182173.

Lindh, DV Taylor, RQ Rose, DM
Boeing Commercial Airplane Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/5.I, DOT-TSC-FRA-80-5-I, Feb. 1980, 76 p.

Contract DOT-TSC-1048-1

ACKNOWLEDGMENT: NTIS
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PB-80182181, DOTL NTIS

01 314089
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL. VOLUME II- PROCESS PARAMETERS AND PROCEDURES
The bolt-hole cold-expansion process has been applied to railroad rail in laboratory tests and has demonstrated a potential for the reduction of rail-bolt-hole-failure incidence. Limited field tests also have been conducted and are currently under long-term evaluation. Because the process is not common to the rail industry, this procedures manual has been prepared to assist in process implementation. The procedures manual describes the process, and provides instruction and recommendations for field application, and establishes the requirements for bolt-hole and tool-size relationships.
See also RRIS 01 314087. Also available in set of 3 reports PC E09, PB80-182173.

Lindh, DV Taylor, RQ
Boeing Commercial Airplane Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/5.II, DOT-TSC-FRA-80-5-II, Feb. 1980, 25 p.

Contract DOT-TSC-1048-2

ACKNOWLEDGMENT: NTIS
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PB-80-182199, DOTL NTIS

01 314090
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL. VOLUME III -FIELD EXPERIMENT RESULTS
The bolt-hole cold-expansion process has been demonstrated by laboratory tests to significantly affect the initiation and propagation of fatigue cracks from rail bolt holes such that a reduction of the incidence of rail-bolt-hole failure in cold-expanded rail would be expected. A field-verification experiment was implemented in 1977 and reported in Volume I of this report. This volume contains the results of the field experiment, and examination of the effect of fatigue ratio (R) on the observed laboratory fatigue-life improvement of cold-expanded bolt holes, an investigation of crack growth of rails in a vacuum environment, and a comparison of the fatigue performance of cold-expanded bolt holes with rail flashwelds.
See also RRIS 01 314087. Also available in set of 3 reports PC E09, PB80-182173.

Lindh, DV Taylor, RQ Rose, DM
Boeing Commercial Airplane Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/5.III, DOT-TSC-FRA-80-5-III, Feb. 1980, 111 p.

Contract DOT-TSC-1048-3

ACKNOWLEDGMENT: NTIS
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PB80-182207, DOTL NTIS

01 319049
STATISTICAL REPRESENTATIONS OF TRACK GEOMETRY. VOLUME I--MAIN TEXT
Mathematical representations of railroad track geometry variations are derived from time series analyses of track measurements. Since the majority of track is free of anomalies (turnouts, crossings, bridges, etc.), representation of anomaly-free track is first considered. Anomalies are then represented by using a combination of processes used to describe joints or welds in the anomaly-free track. In practice, anomaly-free track is constructed by joining many rails of the same length together so that periodic behavior is expected. Results indicate that the geometry of such track structures is completely represented by a periodically modulated random process whose first, second, and higher order statistics are a function of position along the rail relative to a joint or weld. This process is the synthesis of two simpler processes. The first is a stationary random process completely described by its power spectral density (PSD), which is modeled as a smooth function described by a roughness parameter and a set of corner frequencies (wavelengths). This process gives a complete representation of a homogeneous track structure free of joints or welds. The second process, which represents the joints or welds, involves a shape function, a decay rate away from the peak, and a correlation between joint amplitudes. The sequence of shape amplitudes is also a stationary random process having a non-zero mean. The mean amplitude and the decay rate of the shape function can be estimated from track geometry PSD's. Roughness parameters, corner frequencies, mean shape amplitudes and decay rates of the processes are related to track classes as defined by FRA Track Safety Standards, and to the measurements prescribed by those standards.

Corbin, JC
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/22.1, DOT-TSC-FRA-80-4.I, Mar. 1980, 208 p., 78 Fig., 19 Tab., 23 Ref., 10 App.

Contract DOT-TSC-1211-1

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PB81-179020, DOTL NTIS, DOTL RP

01 319050
STATISTICAL REPRESENTATIONS OF TRACK GEOMETRY. VOLUME II-APPENDIXES
This volume contains some of the more detailed data and analyses to support the results and conclusions reached in Volume I of this report. It is divided into appendixes lettered A through J. Appendix A defines a procedure for evaluating the statistical parameters from field-collected track-geometry data. Appendixes B and C contain track-geometry data traces and descriptive text used to support various results and conclusions as they apply to rail joints and track anomalies respectively. Appendix D contains the curve fits obtained for processed PSD data. Appendixes E and F describe the analyses used to determine instrument and quantization noise, respectively. Appendix G is a history of research preceding the effort described in

this report. Appendix H describes formal mathematical procedures needed for complete characterization of a periodically modulated random process. Appendix I contains data on railhead wear. Appendix J reports on new technology.

Corbin, JC
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/22.2, DOT-TSC-FRA-80-4.II, Mar. 1980, 202 p., Figs., Tabs., 10 App.

Contract DOT-TSC-1211-2

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PB81-179038, DOTL NTIS, DOTL RP

01 319055
USE OF AUTOMATICALLY ACQUIRED TRACK GEOMETRY DATA FOR MAINTENANCE-OF-WAY PLANNING
This report covers a joint FRA/Rail Industry Program to develop maintenance planning techniques based on regularly-scheduled automated track-geometry-measurements and maintenance-of-way reports. The study was conducted from 1971 through 1978 with the cooperation of the Bessemer and Lake Erie, and the Denver and Rio Grande Western Railroads. As a result of the program, maintenance-of-way reports generated from track-geometry-measurement data have been used by the participating railroads in their maintenance planning and in the improvement of their overall track safety.

Hayes, G Bradley, K Price, B Sawyer, D Dominguez, A
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/44, DOT-FR-79-20, June 1980, 131 p., Figs., 3 App.

Contract DOT-FR-64113

ORDER FROM: NTIS

PB80-198609, DOTL NTIS, DOTL RP

01 319063
MEASUREMENT AND CORRELATION ANALYSIS PLAN FOR CONCRETE TIE AND FASTENER PERFORMANCE EVALUATION
This report was prepared as part of the Improved Track Structures Research Program sponsored by the Office of Rail Safety Research of the Federal Railroad Administration. The report presents an experiment plan and a correlation methodology through which the long-term performance of concrete tie track will be evaluated. The experiment plan defines test segments, instrumentation and measurement procedures for a comprehensive evaluation, over a two-year period, of three concrete tie test sections and one wood tie control section, all of which are installed on revenue service track. This evaluation is to be correlated with similar track performance data from the Facility for Accelerated Service Testing (FAST). Formats for FAST data to be requested from the Transportation Test Center are summarized. Finally, the methods of direct comparison, regression and analytical simulation, by which track performance at FAST and on the revenue service will be compared, are defined.

Dean, FE Harrison, HD Prause, RH Selig, ET McMahon, D
Battelle Columbus Laboratories, Massachusetts University, Amherst, Federal Railroad Administration Intrm Rpt. FRA/ORD-79/51, Nov. 1979, 120 p., Figs., Tabs., Refs., 7 App.

Contract DOT-FR-8164

ORDER FROM: NTIS

PB80-183882, DOTL NTIS, DOTL RP

01 319066
TRACK REHABILITATION RESEARCH AND DEVELOPMENT: A BASIS FOR PROGRAM PLANNING
The Federal Railroad Administration has established a Track Rehabilitation Research and Development program to better meet its obligations under the Railroad Revitalization and Regulatory Reform Act of 1976. In support of that effort, this report identifies and rank-orders track system problems, suggests a number of subprograms aimed at solving the more important problems, and evaluates and rank-orders the subprograms. This report contains detail of the subprograms as identified in part in a previously published summary report "Track Rehabilitation and Maintenance Research Requirements", FRA/OR&D-80/09. These recommended candidate subprograms will be considered by the Federal Railroad Administration, Office of Research and Development as part of the process of establishing track research projects. The selected projects may support a variety of research requirements, in addition to those detailed herein, and therefore may not be implemented precisely as described. Also, the sequence of progression of the projects may not exactly match the recommended rankings due to other considerations which could not be reflected in this report.

Martin, RE Anderes, JR Zobrak, MJ Wuerdemann, H
Mitre Corporation, Federal Railroad Administration Final Rpt. FRA-/ORD-80/10, Mar. 1980, 323 p., Figs., Tabs., 6 Ref., 6 App.

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-210495, DOTL NTIS, DOTL RP

01 319067
TRACK AND BRIDGE MAINTENANCE RESEARCH REQUIREMENTS
This report includes the design of seven research plans in the area of track and bridge maintenance. The railroad industry was surveyed to ascertain the maintenance problems of their greatest concern which lend themselves to resolution by research. The problems uncovered in the survey were ranked based upon the opinion of the industry and the following seven of the top ranked problem categories were selected for the development of research plans: I--Bridge Inspection, Rating and Evaluation of Remaining Life; II--Subgrade Stabilization and Improvement; III--Timber Cross Tie Rehabilitation and Disposal; IV--Special Trackwork Maintenance; V--Bolted Joints; VI--Ballast Fouling From External Sources; and VII--Switch Point Wear Limits.

Wegenroth, RH Clapp, HP
Parsons, Brinckerhoff, Quade and Douglas, Inc, Federal Railroad Administration FRA/ORD-80/11, Mar. 1980, 140 p., Figs., Tabs., 2 App.

Contract DOT-FR-8071

ACKNOWLEDGMENT: NTIS
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PB80-207855, DOTL NTIS, DOTL RP

01 325716
DEVELOPMENT OF A PROTOTYPE EMAT SYSTEM FOR INSPECTION OF RAILS
This is the Final Report of the First Phase of an investigation of the application of Electromagnetic Acoustic Transducers (EMAT's) to detect flaws in railroad rails. EMAT's generate ultrasonic beams in rails and receive return signals without surface contact and without liquid couplant. This work used samples of flawed rails and laboratory EMAT equipment to verify that EMAT technology can detect critical rail flaws. Sperry Rail Service assisted in defining operating requirements for an operational inspection system. A preliminary determination of EMAT operating parameters for optimum flaw detection was made. This work demonstrated that virtually all of the critical rail flaws can be detected in the laboratory by EMAT's with a sensitivity comparable to that obtained with conventional piezoelectric transducers.

Alers, G McLauchlan, D Maiseri, H Lee, R
Rockwell International, Federal Railroad Administration Final Rpt. FRA/ORD-80/45, Sept. 1980, 77p, 46 Fig., 5 Tab., 2 Ref., 1 App.

Contract DOT-FR-9143

ORDER FROM: NTIS

PB81-109514, DOTL NTIS, DOTL RP

01 325717
A PROTOTYPE MAINTENANCE-OF-WAY PLANNING SYSTEM VOLUME I. FINAL REPORT (INCLUDING APPENDICES A THROUGH E)
The results of this study substantiate the concept of using automatic track inspection vehicles as a tool in Maintenance -of-Way planning. This study is based on data collected over a period of one year on 288 miles of CONRAIL mainline track. Track geometry was measured using an FRA Track Geometry Measurement Vehicle. The concept of a figure of merit, based on track geometry (gage, profile, alignment, crosslevel and warp) and used as a means of quantifying track condition is developed. It is shown through correlation with Federal Track Safety Standards, standard Ride Quality Indices, and derailments that these figures of merit, referred to as

Track Quality Indices (TQI's), are an objective measure of track condition. An initial set of 14 candidate TQI's is reduced to a set of five which best quantify the track's ability to meet its functional requirements. Next, eleven selected physical parameters, which affect the rate of track deterioration, are investigated. These are categorized as traffic, track structure and maintenance parameters. It is found that a subset of these is capable of accounting for at least 80 percent of the change in track condition as measured by a TQI. Predictive equations for each of the five TQI's are given for six levels and/or types of maintenance. These equations are significant above the 0.999 level. Illustrative degradation curves are derived from the predictive equations and specific observations are made for the test zone.

Hamid, A Sawyer, D Kenworthy, MA Rasmussen, K
ENSCO, Incorporated, Federal Railroad Administration Tech Rpt. FRA/ORD-80/47.I, DOT-FR-80-17, Nov. 1980, 117p, Figs., Tabs., 5 App.

Contract DOT-FR-64113

ORDER FROM: NTIS

PB81-147159, DOTL NTIS, DOTL RP

01 325733
TRACK RENEWAL SYSTEM AND WOOD TIE REUSE ANALYSIS

This report presents the results of an analytical study of technical and economic feasibility of applying the track renewal method of railroad track maintenance in the United States. Track renewal, or out-of-face renewal, has long been the prevailing form of track maintenance used in Europe and has recently spread to Asia, Australia, and North America. Current North American activity is very limited, but the carriers and other elements of the railroad community are becoming increasingly interested in the potential advantages of track renewal as an alternative to selective maintenance. The core of the report consists of a detailed framework for conducting a comparative economic analysis of the track renewal method versus the traditional selective maintenance method. The framework includes detailed descriptions of both methods, unit costs for each major operation under each method, and the comparative present worth long-term costs associated with each method. The framework methodology is presented in detail so that the reader can examine and if necessary modify the built-in assumptions and thereby tailor the framework for application to a specific situation. A sample economic analysis is presented wherein the framework is used to compare the estimated long-term and first-year costs when they are applied to fourteen specific track maintenance scenarios, each of which represents a particular set of assumptions and conditions. The results of the sample analysis include the following: (1) track renewal offers the prospect of large long-term cost savings over selective maintenance, although only under certain circumstances; (2) wood tie reuse is a critical factor in optimizing the long-term savings; (3) with wood tie reuse, track renewal is likely to be $15,000 to $27,000 cheaper per track mile than selective maintenance over time; (4) the internal rate of return for track renewal is likely to be 25--35 percent; (5) the break-even point for first-year costs is about 32 percent tie replacement for installing wood ties and 75 percent for replacing wood with concrete ties; (6) ballast cleaning costs are reduced by about 28 percent with track renewal; and (7) track occupancy time for maintenance is reduced 60--79 percent with track renewal. The report also presents a worldwide survey of present and future track renewal machine technology to enable the reader to consider alternatives to the type of machine assumed in the framework and analysis. Also included is a discussion of the use of track renewal machines for abandoning existing track, building new track, and for other nonmaintenance applications. In addition, there is a brief section on two alternatives to track renewal machine ownership and operation by the railroads: (1) railroad leasing and operation, and (2) railroad purchase of services from contractor owner-operator. The report concludes with the identification of several areas for additional study, principally with respect to the further development and refinement of the framework as a research tool. It also states that the framework should be tested by one or more railroads; the results should be used to strengthen the framework and should also be shared with the railroad community.

Cataldi, GR Elkaim, DN
Unified Industries, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/63, Oct. 1980, 98p, 29 Fig., 83 Tab.

Contract DOT-FR-9044

ORDER FROM: NTIS

PB81-125510, DOTL NTIS, DOTL RP

01 326046
TRACK COMPONENT PROPERTY TESTS. VOLUME II-RAIL, TIES, JOINT-BARS AND FASTENERS

This report describes the test procedures and the results of the tests on the physical properties of rail, concrete ties, jointbars and fasteners. The properties obtained are the torsional rigidity of rail, bending rigidity of concrete ties, bending stiffness of jointbars and fastener resistance to rotation about the vertical, lateral and longitudinal axis. The components tests were run on two rail sections, 115 RE and 136 RE, on five different concrete ties, on 136 RE rail joint bars, and on five fasteners configurations on the two different rails on wood ties and two configurations on the 115 RE rail on concrete ties.

See also Volume 1, PB80-142367.

Choros, J Gitlin, I
Association of American Railroads Technical Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-80/25, June 1980, 55p

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-218977, DOTL NTIS

01 326057
LABORATORY INVESTIGATION OF LATERAL TRACK SHIFT

This report describes test procedures and results of the AAR lateral track shift tests. The tests included static and dynamic lateral track loadings under various vertical loads, relative effects of single and double axle loading, panel shift tests and single tie tests. These tests, which were conducted at the AAR's Track Laboratory, were designed to quantify and determine the lateral strength of the track using various methods. The test results are limited to an unconsolidated track condition. The results indicate that a lateral stiffness of the track can be determined from each of the three methods used. These results, obtained from each of the methods tested, are compared in this report.

Choros, J Zarembski, AM Gitlin, I
Association of American Railroads Technical Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-80/27, Aug. 1980, 83p

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
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PB80-223928, DOTL NTIS

02 097306
A REVIEW OF RAIL-WHEEL CONTACT STRESS PROBLEMS
From its earliest days, railroad technology has been limited by an inadequate understanding of the mechanics of load transfer between wheel and rail. It is the purpose of this paper to indicate the major problems in this area, and to review the progress made to date in the solution thereof. Attention is focussed upon investigations of the stresses (normal pressure and tangential shear) on the contact patch, rather than upon studies of bending stresses in the rail. The physical basis of Hertz's widely used analysis is outlined, and the assumptions and limitations of that analysis are indicated. The need is shown for the development of solutions to important non-Hertzian problems such as: coformal contact (e.g. between worn wheels and track), contact of rough bodies, rolling friction, adhesion, and creep. The literature on these problems, as well as work in progress, is reviewed. A detailed mathematical treatment is avoided, but the principal results of much of the theory are illustrated through geometrical and physical descriptions. Recent works on the effects of surface waviness, plastic deformation, and residual stresses in rail, are reviewed.

This paper was presented at the Railroad Track Mechanics Symposium, Princeton University, 22 April, 1975.

Paul, B
Pennsylvania University, Philadelphia MEAM 75-1, FRA/ORD-76/141 Apr. 1975, 52 pp., Figs., Refs.

Contract DOT-OS-40093

ACKNOWLEDGMENT: Pennsylvania University, Philadelphia
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PB-251238, DOTL RP

02 098076
THE AERODYNAMIC ANALYSIS OF SINGLE AND MULTIPLE VEHICLES ENTERING AND TRAVELING IN OPEN TUNNELS
The analyses required to calculate the aerodynamic effects of tunnel entry, tunnel venting and multiple vehicle motions in open ended tunnels are presented. Results for several cases of open ended tunnel travel and various entry configurations are presented and described. The effects of an earlier vehicle's motion on the pressure peak associated with a second vehicle entering a tunnel are presented and discussed.

Strom, CR
Mitre Corporation, Federal Railroad Administration, (MTR-6755) Tech. Rpt. FRA-ORD&D-75-16, Jan. 1975, 43 pp, Figs., 3 Ref.

Contract DOT-FR-54090

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244068/3ST, DOTL NTIS

02 099842
ANALYSIS OF RAILROAD CAR TRUCK AND WHEEL FATIGUE. PART I-SERVICE LOAD DATA AND PROCEDURES FOR THE DEVELOPMENT OF FATIGUE PERFORMANCE CRITERIA
The development of fatigue performance standards for freight car truck components and wheels requires a knowledge of the fluctuation service load environment, and a basis for stating the conservatism of the design with respect to the environment. On this program special emphasis was given to determining the load environment by analyzing data from 53 test runs conducted on the Erie Branch test track of the Bessemer and Lake Erie Railroad. A number of test parameters were varied, such as speed, type of truck, modifications to the suspension system, etc., to determine those parameters having the greatest influence on the severity of the load. Vertical loads were measured at the side-frame-pedestal/roller-bearing-adapter interface and lateral loads were determined at the wheel/rail interface. The cyclic load data are summarized in a series of load spectra. Factors which must be considered in the development of fatigue performance standards from these spectra include reliability goals, the statistical spread of both load and fatigue strength data, and the philosophy followed in the design of the truck itself.

Sponsored by Federal Railroad Administration and under contract from Transportation Systems Center.

Johnson, MR
IIT Research Institute, Federal Railroad Administration, Transportation Systems Center, (DOT-TSC-FRA-75-11) Intrm Rpt. FRA-OR&D-75-68, May 1975, 146 pp, Figs., Tabs., Phots., 20 Ref., 4 App. Contract DOT-TSC-727

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC

PB-244090/AS, DOTL NTIS

02 125885
INSTRUMENTATION FOR MEASUREMENT OF FORCES ON WHEELS OF RAIL VEHICLES
The information in this report covers the procurement, development and testing of instrumentation designed to measure the dynamic forces and temperatures which are created in the wheels of a load rail vehicle truck. The information contained herein is intended for use by scientific, research and engineering personnel who are involved in the measurement of dynamic loads of rail vehicle wheels.

Sponsored by DOT Federal Railroad Administration.

Association of American Railroads Technical Center, ENSCO, Incorporated, (LT-328) FRA-ORD&D 75-11, May 1974, 103 pp, Figs., Tabs., 13 Phot.

Contract DOT-FR-20010

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247154/AS, DOTL NTIS

02 129104
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. LITERATURE SEARCH. VOLUME I
This document serves as an introduction to the literature known to be available and relevant to rail freight car trucks, their components and performance characteristics. In connection with the Federal Railroad Administration sponsored research in Truck Design Optimization a literature search was conducted to review and assemble all relevant publications, papers, and articles. The collected documentation has been organized into five sections: (1) The History of the Freight Car Truck; (2) Truck Design; (3) Truck Compenents; (4) Track-Train Dynamics as Related to Truck Performance; and (5) Truck Performance. Each section contains; an introduction dealing with literature selected for reprinting, reprints of articles judged particularly representative or salient, and a bibliography alphabetized by author. The five sections have been organized into three-volumes. Volume I contains the sections entitled: "The History of the Freight Car Truck" and "Truck Design." Volumes II and III will complete the compilation. It is expected that supplements to the three initial volumes will be published at a later date as additional information becames available.

This interim report represents the first of a three volume set. Volume II (RRIS 02 129105) and Volume III (RRIS 02 129106) bear the same report number with B and C suffixes respectively.

Southern Pacific Transportation Company, Federal Railroad Administration, (TDOP 75-251) Intrm Rpt. FRA-OR&D 75-81A, June 1975, 124 pp, Figs., Phots., Refs.

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248350/1ST, DOTL NTIS

02 129105
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. LITERATURE SEARCH. VOLUME II
Volume II of the TDOP Literature Search contains the sections entitled: "Truck Components" and "Track-Train Dynamics As Related To Truck Performance." Each of the two sections contains: An introduction dealing with literature selected for reprinting, Reprints of articles judged particularly representative or salient, A bibliography alphabetized by author. The "Bibliography--Truck Components" is further organized into the following subsections: Brakes and Brake Rigging; Centerplates; Side Frames and Bolsters; Snubbers and Dampers; Springs; Wheels, Axles, and Roller Bearings; Miscellaneous Component Systems.

This interim report represents the Second of a three volume set. Volume I (RRIS 02 129104) and Volume III (RRIS 02 129106) bear the same report number with A and C suffixes respectively.

Southern Pacific Transportation Company, Federal Railroad Administration, (TDOP 75-252) Intrm Rpt. FRA-OR&D-75-81B, July 1975, 198 pp

Contract DOT-FR-40023
ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248351/9ST, DOTL NTIS

02 129106
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. LITERATURE SEARCH. VOLUME III
Volume III of the TDOP Literature Search contains the sections entitled: "Truck Performance" and "Literature Search Title Index." The section dealing with truck performance contains: An introduction dealing with literature selected for reprinting, Reprints of articles judged particularly representative or salient, A bibliography alphabetized by author. The "Bibliography--Truck Performance" is further organized into the following subsections: Computer Analysis of Truck Performance, Field Analysis of Truck Performance, Laboratory Analysis of Truck Performance. The index section contains a listing alphabetized by title of all publications included in the three-volume Literature Search.

This interim report represents the third of a three volume set. Volume I (RRIS 02 129104) and Volume II (RRIS 02 129105) bear the same report number with A and B suffixes respectively. Bibliographical additions will be made as more information becomes available throughout the Truck Design Optimization Project.

Southern Pacific Transportation Company, Federal Railroad Administration, (TDOP 75-253) Intrm Rpt. FRA-OR&D-75-81C, Aug. 1975, 215 pp

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248352/7ST, DOTL NTIS

02 129152
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. DETAILED TEST PLANS FOR SERIES 5 TESTS-PHASE 1
This document presents the detailed test plans for Series 5 Tests of Phase I of the Truck Design Optimization Project. It is a continuation of previous reports for the same project presenting the introduction and detailed test plans for Series 1, 2, and 3 Tests in the first volume and the detailed test plans for Series 4 Tests in the second volume. It includes a description of the trucks and cars to be used in the testing, the basis for selecting them, and a description of the tests themseleves. It lists the instrumentation to be used and the sequence of testing. The reader is referred to the previous documents for details of the instrumentation and data analysis.

The reports entitled Introduction and Detailed Test Plans For Series 1, 2, and 3 Tests, Phase I, and Detailed Test Plan for Series 4 Tests, Phase I are prereguisite to this document. Sponsorship was from FRA, DOT.

Southern Pacific Transportation Company, (TDOP 75-153) Intrm Rpt. FRA-OR&D 75-82, TDOP-75-153, Nov. 1975, 32 pp, 6 Fig., 2 Tab.

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA
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PB-248631/4ST, DOTL NTIS

02 129153
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. INTRODUCTION AND DETAILED TEST PLANS-SERIES 1, 2, AND 3 TESTS-PHASE I
This document serves as an introduction to the Freight Car Truck Design Optimization Project (TDOP) and presents the detailed test plans for Series 1, 2, and 3 Tests of a contemplated group of four series for that project. Some of the background of the project is given, the development of the test method is described, a description of the instrumentation on the test track and test car and of the facilities of Southern Pacific Transportation Co, (SPT Co.) are given, a data collection and processing plan and analytical procedures for comparing test results with predicted values are presented. A description of the Series 1, 2, and 3 Tests, the contemplated test schedule, and the management structure for the project are also given. In the appendix, the tasks required to be performed by the statement of work for Phase I are outlined.

This is a prerequisite to the forthcoming interim report covering the test plan for Test Series 4, FRA Report FRA-OR&D 75-60. This document supersedes issue of July 1975. Sponsored by FRA.

Southern Pacific Transportation Company, (TDOP-75-11) Intrm Rpt. FRA-OR&D 75-59, TDOP-75-11, Oct. 1975, 120 pp, 28 Fig., 11 Tab.

Contract DOT FR-40023

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248632/2ST, DOTL NTIS

02 129198
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. SURVEY AND APPRAISAL OF TYPE II TRUCKS
This report serves as an introduction to the family of truck designs known as Type II that will be studied in connection with the Federal Railroad Administration's Truck Design Optimization Project. An investigation was made of existing trucks and truck designs qualifying as Type II trucks and this investigation considers features which would be of interest in selecting candidates for testing and evaluation of such trucks under Phase II of the Truck Design Optimization Project. Type II special service designs embody new concepts that utilize current wheel set and journal bearing assemblies and braking arrangements compatible with current air brake systems. Car coupler height is maintained but car body support other than center plates can be employed. Ride quality and minimum maintenance cost are of major importance to Type II designs.

This project was sponsored by the Federal Railroad Administration, DOT.

Southern Pacific Transportation Company, (TDOP 75-201) Intrm. Rpt FRA-OR&D-76-05, TDOP-75-201, Dec. 1975, 133 pp, Figs.

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248633/0ST, DOTL NTIS

02 132958
12TH ANNUAL RAILROAD CONFERENCE PROCEEDINGS, "EFFECT OF HEAVY LOADS ON TRACK"
Sessions included track developments, suspension developments and track/-train interaction. Eighteen papers were presented by authors from the United States, Canada, Mexico and Europe.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23 and 24, 1975. Individual papers are RRIS Numbers 02 132959, 01 132960, 01 132961, 02 132962, 01 132963, 01 132964, 03 132965, 03 132966, 03 132967, 03 132968, 03 132969, 24 132970, 02 132971, 02 132972, 18 132973, 00 132974, 02 132975, and 00 132976.

Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, 174 pp, Figs., Refs.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-252968/AS, DOTL NTIS, DOTL RP

02 132959
DETERMINATION OF LOADS ON TRACK
In the past decade, advances in the technology of instrumentation and of computers have made possible the determination of wheel/rail loads so that proper design and maintenance procedures may be developed for vehicles and track so that the industry can live with today's axle loadings. Methods of determining such loads by measurements on the vehicle and the track are discussed. Mathematical modeling procedures may also be utilized to calculate such loads. Computer simulation which includes both vehicle and track in a dynamic interacting system permits specification of outputs in the form of vertical and lateral forces between wheel and rail. Some of the research programs in load determination are then described.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Meacham, HC
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 8-16, 28 Fig.

ACKNOWLEDGMENT: FRA
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PB-252968/AS, DOTL NTIS, DOTL RP

02 132962
OBSERVATIONS ON THE EFFECT OF HEAVY WHEEL LOADS ON RAIL LIFE
The Bessemer and Lake Erie Railroad has operated 90-ton open-top cars since 1931 and has some statistics on rail wear and rail life under the stresses imposed by such equipment. Rail life on tangent track has been around 440 million gross tons for jointed rail and beyond 650 million gross tons for continuous welded rail. Statistics are also available for Curvemaster and controlled cooled rail on curves. On newer ore carrying railways, rail life appears to be appreciably shorter. Among possible reasons are the bidirectional operation of loaded trains on B&LE, the mixing of various capacities of cars, and the predominance of traffic on solid, rather than roller-type, journal bearings.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Rougas, M (Bessemer and Lake Erie Railroad)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 41-44, 5 Fig.

ACKNOWLEDGMENT: FRA
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PB-252968/AS, DOTL NTIS, DOTL RP

02 132971
RAIL DYNAMICS SIMULATOR
The car testing facility at the Rail Dynamics Laboratory at the Transportation Test Center is described. The facility was designed and constructed to assist government and industry in evaluating and characterizing the dynamic behavior of cars equipped with two-axle trucks. The configuration of the Vertical Shaker System are described, along with its capabilities. Mathematical modeling of a piggyback car is discussed.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

De Benedet, D (Wyle Laboratories)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 118-122, 12 Fig.

ACKNOWLEDGMENT: FRA
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PB-252968/AS, DOTL NTIS, DOTL RP

02 132972
COMPARATIVE STUDY OF LOCOMOTIVE LATERAL STABILITY MODELS
In this paper a comparative study is made between present investigation of the 39 degree-of-freedom mathematical model and other simplified models. The results of the study of a typical six-axle locomotive obtained from the 39 DOF model are presented. The lateral stability is appraised, and the model includes the coupling between vertical and lateral motions. The merits and demerits of various models are discussed. A bibliography is included.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Garg, VK Mels, KD (General Motors Corporation)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 123-129, 5 Fig., 13 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

02 132975
RAIL WEAR AND CORRUGATION PROBLEMS RELATED TO UNIT TRAIN OPERATIONS: CAUSES AND REMEDIAL ACTION
This paper is a case study of rail wear problems on Canadian National's main line through the Rocky Mountains as a result of unit train operation. The problems are gauge-face wear on the high rail on curves, rail head flow on the low rail and corrugations having a wavelength varying from 8 to 30 inches on the low rail. Prior to introduction of unit trains there were almost no such problems. A study of the lateral forces is described. Remedial action requires a concentrated effort by Engineering, Equipment and Transportation groups with no quick "fix" available. Absence of any action will only cause track deterioration and if it is desired to more bulk commodities in unit trains, the problem must be attacked in an organized manner.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

King, FE (Canadian National Railways)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 139-147, 11 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

02 143041
DYNALIST II, A COMPUTER PROGRAM FOR STABILITY AND DYNAMIC RESPONSE ANALYSIS OF RAIL VEHICLE SYSTEMS. VOLUME I. TECHNICAL REPORT
A methodology and a computer program, DYNALIST II, have been developed for computing the response of rail vehicle systems to sinusoidal or stationary random rail irregularities. The computer program represents an extension of the earlier DYNALIST program. A modal synthesis procedure is used which permits the modeling of subsystems or components by partial modal representation using complex eigenvectors. Complex eigenvectors represent the amplitude and phase characteristics of rail vehicle systems which occur as a result of wheel-rail interaction, heavy damping in the suspension system and rotating machinery. Both vertical and lateral motion are handled by the program which allows up to twenty-five component and fifty system degrees of freedom.

Prepared by Wiggins (J. H.) Co., Redondo Beach, Calif.

Hasselman, TK Bronowicki, A Hart, GC
Transportation Systems Center, Wiggins (JH) Company, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-74-14.I, FRA-/ORD-75/22.I, Feb. 1975, 118 pp

Contract DOT-TSC-760-1

ACKNOWLEDGMENT: NTIS
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PB-256046/4ST, DOTL NTIS

02 143947
DYNALIST II. A COMPUTER PROGRAM FOR STABILITY AND DYNAMIC RESPONSE ANALYSIS OF RAIL VEHICLE SYSTEMS. VOLUME III. TECHNICAL REPORT ADDENDUM
Several new capabilities have been added to the DYNALIST II computer program. These include: (1) a component matrix generator that operates as a 3-D finite element modeling program where elements consist of rigid bodies, flexural bodies, wheelsets, suspension elements and point masses assembled on a nodal skeleton; (2) a periodic and transient time-history response capability; (3) a component update capability for parametric studies; (4) an orthogonality check on component and system complex eigenvectors; (5) an option for improving low-frequency convergence under modal truncation; (6) a more general sine-amplitude forcing function capability; (7) automatic phase lag generation; (8) user-controlled scaling options on all response plots; and a number of additional minor improvements. A Technical Report Addendum and a completely revised User's Manual document these changes to the previous version of DYNALIST II.

See also PB-256 046 and PB-258 194.

Bronowicki, A Hasselman, TK
Wiggins (JH) Company, Federal Railroad Administration, Transportation Systems Center Final Rpt. DOT-TSC-FRA-74-14-3, FRA/OR&D-75-22.III, July 1976, 74 pp

Contract DOT-TSC-990

ACKNOWLEDGMENT: NTIS
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PB-258193/2ST, DOTL NTIS

02 143948
DYNALIST II. A COMPUTER PROGRAM FOR STABILITY AND DYNAMIC RESPONSE ANALYSIS OF RAIL VEHICLE SYSTEMS. VOLUME IV. REVISED USER'S MANUAL

The Federal Railroad Administration (FRA) is sponsoring research, development, and demonstration programs to provide improved safety, performance, speed, reliability, and maintainability of rail transportation systems at reduced life-cycle costs. A major portion of these efforts is related to improvement of the dynamic characteristics of rail vehicles, track structures, and train consists. The Revised User's Manual reflects current modifications in output format which have been written into the Dynalist II program.

See also PB-258 193.

Bronowicki, A Hasselman, TK
Wiggins (JH) Company, Federal Railroad Administration, Transportation Systems Center Final Rpt. DOT-TSC-FRA-74/14-4, FRA/OR&D-75-22.IV, July 1976, 156 pp

Contract DOT-TSC-990

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-258194/0ST, DOTL NTIS

02 144091
COMPUTATIONAL METHODS TO PREDICT RAILCAR RESPONSE TO TRACK CROSS-LEVEL VARIATIONS

The rocking response of railroad freight cars to track cross-level variations is studied using: (1) a reduced complexity digital simulation model, and (2) a quasi-linear describing function analysis. The reduced complexity digital simulation model employs a rail truck model that neglects the high-frequency dynamics of the bolster and wheelset masses, yet includes kinematic center plate, side bearings, and wheelset nonlinear effects. This model has computation-time requirements that are less than one eighth those of more detailed computer simulation models and agrees within 15% percent for the prediction of roll angle, side bearing force, center plate force and wheel force at maximum roll angle response with the more detailed models. A study of quasi-linear describing function techniques to compute the steady-state response of freight cars to equivalent sinusoidal cross-level track variations has demonstrated the feasibility of the technique for the types of nonlinearities important in car response. This technique, which computes steady-state response from a set of nonlinear algebraic equations rather than by numerical integration, is effective for parametric studies in which a series of the responses is required as a parameter is varied incrementally since once the solution is obtained for one set of parameter values, additional responses for an incremental change in the parameter are obtained efficiently.

MIT is under contract to Transportation Systems Center, DOT.

Platin, BE Beaman, JJ Hedrick, JK Wormley, DN
Massachusetts Institute of Technology, Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-76-13) Final Rpt. FRA-OR&D-76-293, Sept. 1976, 86 pp, 34 Fig., 4 Tab., 12 Ref., 7 App.

Contract DOT-TS-11201

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-272676/AS, DOTL NTIS

02 145556
FREQUENCY DOMAIN COMPUTER PROGRAMS FOR PREDICTION AND ANALYSIS OF RAIL VEHICLE DYNAMICS. VOLUME I. TECHNICAL REPORT

Frequency domain computer programs developed or acquired by TSC for the analysis of rail vehicle dynamics are described in two volumes. Volume I defines the general analytical capabilities required for computer programs applicable to single rail vehicles and presents a detailed description of frequency domain programs developed at TSC in terms of analytical capabilities, model description, equations of motion, solution procedure, input/output parameters, and program control logic. Descriptions of programs FULL, FLEX, LATERAL, and HALF are presented. TSC programs for assessing lateral dynamic stability of single rail vehicles are also described.

(PC A06/MF A01) Also available in set of 2 reports as PB-259 286-SET, PC E99/MF E99.

Perlman, AB DiMasi, FP
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-75-16.I, FRA/ORD-76/135.I, Dec. 1975, 116 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-259287/1ST, DOTL NTIS

02 145557
FREQUENCY DOMAIN COMPUTER PROGRAMS FOR PREDICTION AND ANALYSIS OF RAIL VEHICLE DYNAMICS. VOLUME II. APPENDIXES

Frequency domain computer programs developed or acquired by TSC for the analysis of rail vehicle dynamics are described in two volumes. Volume 2 contains program listings including subroutines for the four TSC frequency domain programs described in Volume I.

(PC A06/MF A01) Also available in set of 2 reports as PB-259 286-SET, PC E99/MF E99.

Perlman, AB DiMasi, FP
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-75-16.II, FRA/ORD-76/135.II, Dec. 1975, 102 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-259288/9ST, DOTL NTIS

02 147575
LINEAR INDUCTION MOTOR RESEARCH VEHICLE WHEEL/RAIL ADHESION TEST

A principal factor in the design of effective propulsion and braking systems for new rail transportation equipment is the available adhesion vs speed characteristics of steel-wheel-on-steel-rail vehicles. Objectives of the LIMRV wheel/rail adhesion test were: (1) to obtain, over a wide speed range, empirical data that complements the considerable body of data available from previous low-to-moderate-speed investigations, and (2) to determine the extent of loss of available wheel/rail adhesion with increasing vehicle speed. The results obtained are qualitatively compatible with published data on moderate- speed tests; at high speeds, however, degradation of the attainable adhesion coefficient was not apparent. This test program indicates that wheel/rail adhesion may not limit the maximum safe speed of wheel/rail vehicles to the degree previously assumed. It is also evident that for the LIMRV, which has a higher speed capability and apparently a larger attainable wheel/rail adhesion coefficient than a conventional vheicle, the running rail surface exerts a more pronounced effect on the maximum-attainable adhesion than does vehicle speed. The measured adhesion values were greater than expected at the higher speeds, but the maximum attainable adhesion coefficient was not determined because of force limitations of the present braking system. It is therefore believed that further testing of the LIMRV could significantly add to the existing body of knowledge on wheel/rail adhesion, particularly in the area of attainable adhesion vs speed relationships.

Research was sponsored by the Federal Railroad Administration, Office of Research and Development.

Chen, RP D'Sena, GO
AiResearch Manufacturing Company of California, (75-11970, Rev. 1) Final Rpt. FRA-ORD/D-76-261, Apr. 1976, 57 pp, Figs., Tabs., 7 Ref., 2 App.

Contract DOT-FR-40016

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-261853/6ST, DOTL NTIS

02 147592
EVALUATION OF ANALYTICAL AND EXPERIMENTAL METHODOLOGIES FOR THE CHARACTERIZATION OF WHEEL/RAIL LOADS

This report has been prepared as part of the Improved Track Structures Research Program sponsored by the Office of Rail Safety Research of the Federal Railroad Administration. The major modes of track degradation have been reviewed to identify the significant wheel/rail loading mechanisms. Analytical models for vehicle/track interaction have been selected for predicting the loads in appropriate formats for each of the major modes of track degradation. This report also evaluates the data required to validate the analytical procedures, and both track and vehicle-borne instrumentation are reviewed for fulfilling these requirements. Available data on wheel/rail

loads have been used to assemble a preliminary statistical characterization for interim use.

Research was sponsored by the FRA under contract to the Transportation Systems Center, DOT, Cambridge, Massachusetts.

Ahlback, DR Harrison, HD Prause, RH (Battelle Columbus Laboratories); Johnson, MR (ITT Research Institute)
Battelle Columbus Laboratories, ITT Research Institute, (DOT-TSC-FRA-76-10) Intrm Rpt. FRA-OR&D-76-276, Nov. 1976, 261 pp, Figs., Tabs., Refs., 4 App.

Contract DOT-TSC-1051

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272063/AS, DOTL NTIS, DOTL RP

02 147712
PROGRAM MULTI: A MULTI-PURPOSE PROGRAM FOR COMPUTING AND GRAPHING ROOTS AND VALUES FOR ANY REAL FUNCTION. USERS/PROGRAMMERS MANUAL

As part of its activity under the Rail Equipment Safety Project, computer programs for track/train dynamics analysis are being developed and modified. As part of this effort, derailment behavior of trains negotiating curves under buff or draft has been investigated. To determine how critical car and train parameters affect actual stability of various train buckling modes, a generalized multi-purpose computer programs has been developed that can be used to compute and graph cross sections of any surface in space, or to compute and graph the roots of any equation and any function of these roots. It can be used for a variety of applications, including the graphing of multi-valued functions whose branches are not known beforehand. This capability is unique among graphing programs, and it greatly facilitates that analysis of any system with multiple equilibrium branches. The program is especially suited for computing the branches and investigating the stability of nonlinear finite-degree of freedom systems subjected to static loads. The program is oriented towards systems with one or two degrees of freedom, but it can also handle additional degrees of freedom and any number of parametric variables.

Research was sponsored by the FRA, Office of Research and Development.

Brantman, R
Transportation Systems Center, (DOT-TSC-FRA-76-1) Final Rpt. FRA/OR&D-76-143, May 1976, 56 pp, 2 App.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-261121/8ST, DOTL NTIS, DOTL RP

02 147713
AERODYNAMIC FORCES ON FREIGHT TRAINS. VOLUME 1: WIND TUNNEL TESTS OF CONTAINERS AND TRAILERS ON FLATCARS

The aerodynamic forces on trailers and containers on flatcars have been measured in wind tunnel tests. The forces were measured on the central car of a five-car train consisting of a locomotive, three flatcars with various loadings and a boxcar. Tests were made over a range of yaw angles and with different loadings. Standard trailers, containers and flatcars were tested as well as a variety of modifications designed to improve the aerodynamic performance. In addition to the railroad-car tests, a series of blocks simulating containers and trailer bodies were tested to determine the effect of gap spacing, corner radius, and surface roughness. The flatcars loaded with containers were found to have about forty percent less drag than when loaded with trailers. Various modifications that reduced the frontal area of the trailers or filled in the empty space between the trailer body and the car were all found to be effective in reducing the drag. Gap spacing size had little effect until it became of the order of the body width, and then the drag increased with increased spacing. Side and lift forces are chiefly caused by yaw angle and side area. The forces act near the centroid of the side area, but when the gap spacing becomes large they move farther forward. The research reported is intended to increase the knowledge base in understanding the aerodynamic drag component of trail resistance.

Research was sponsored by the FRA, Office of Research and Development, under contract to the Transportation Systems Center, Cambridge, Massachusetts.

Hammitt, AG
Hammitt (Andrew G) Associates, (DOT-TSC-FRA-76-30,1) Final Rpt. FRA/OR&D-76-295.1, Dec. 1976, 150 pp, 68 Fig., 8 Tab., 24 Ref., 1 App.

Contract DOT-TSC-1002-1
ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-264304/AS, DOTL RP

02 148271
FUNCTIONAL REQUIREMENTS FOR A FACILITY FOR ACCELERATED SERVICE TESTING (FAST)

This report describes recommendations for a proposed Facility for Accelerated Service Testing (FAST) and the rationale for the recommendations. It includes a list of proposed initial test series for railroad track research and railroad mechanical equipment research to be conducted by rapid accumulation of traffic operating continuously on proposed test track loops. The proposed FAST consists of three closed track loops, providing a curvature range up to 10 degrees and a maximum speed capability up to 80 mph. In addition, a Mechanical Loop option is described.

Research was sponsored by the Federal Railroad Administration, DOT.

Punwani, SK Lundgren, JR Martin, GC
Association of American Railroads Technical Center Final Rpt. FRA-/OR&D-76-139, Sept. 1975, 247 pp, Figs., Tabs., 20 Ref., 2 App.

Contract DOT-FR-30038

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-263605/8ST, DOTL NTIS, DOTL RP

02 148588
DESCRIBING FUNCTION TECHNIQUES FOR THE NON-LINEAR ANALYSIS OF THE DYNAMICS OF A RAIL VEHICLE WHEELSET

The describing function method of analysis is applied to investigate the influence of parametric variations on wheelset critical velocity. In addition, the relationship between the amplitude of sustained lateral oscillations and critical speed is derived. The non-linearities in the model include the difference in rolling radii as a function of lateral displacement of the wheelset from its mean position, profile conicity, and gravitational stiffness in the lateral and yaw directions. The proposed method is validated by applying it to a wheelset example cited in the literature. Comparable results are obtained using the proposed technique. The describing function method presented in the report is quite general and is applicable to dynamic models exhibiting severe non-linear characteristics in profile. Critical speed, frequency of limit cycles, gravitational force, effective conicity, gravitational stiffness and creepage, etc., can be easily computed using the proposed algorithm.

Research was sponsored by the Federal Railroad Administration, DOT.

Garg, DP
Transportation Systems Center, (DOT-TSC-FRA-75-6) Intrm Rpt. FRA-OR&D-75-83, July 1975, 102 pp

ACKNOWLEDGMENT: FRA
ORDER FROM: FRA/ORD

02 148589
DYNALIST II, A COMPUTER PROGRAM FOR STABILITY AND DYNAMIC RESPONSE ANALYSIS OF RAIL VEHICLE SYSTEMS. VOLUME 2: USER'S MANUAL

A methodology and a computer program, DYNALIST II, have been developed for computing the response of rail vehicle systems to sinusoidal or stationary random rail irregularities. The computer program represents an extension of the earlier DYNALIST program. A modal synthesis procedure is used which permits the modeling of subsystems or components by partial modal representation using complex eigenvectors. Complex eigenvectors represent the amplitude and phase characteristics of rail vehicle systems which occur as a result of wheel-rail interaction, heavy damping in the suspension system and rotating machinery. Both vertical and lateral motion are handled by the program which allows up to twenty-five component and fifty system degrees of freedom.

Research was sponsored by the Federal Railroad Administration, DOT, under contract to the Transportation Systems Center, Cambridge, Massachusetts.

Bronowicki, A Hasselman, TK
Wiggins (JH) Company FRA-OR&D-75-22.II, Feb. 1975, 100 pp, Apps.

ACKNOWLEDGMENT: FRA

ORDER FROM: NTIS

PB-257733/AS, DOTL NTIS

02 150482
PRELIMINARY ANALYSIS OF THE EFFECTS OF NON-LINEAR CREEP AND FLANGE CONTACT FORCES ON TRUCK PERFORMANCE IN CURVES

Prediction of wheel displacements and wheel-rail forces is a prerequisite to the evaluation of the curving performance of rail vehicles. This information provides part of the basis for the rational design of wheels and suspension components, for establishing criteria for maintenance of track and wheels, for use as a guideline for safety standards, and for understanding the mechanism of noise generation and wheel-climbing. The analysis presented here extends the results from linear steady-curving appropriate to flangeless guidance, and provides a foundation for the examination of the details of forces and displacements under more severe conditions necessary to the understanding, prevention, and suppression of undesirable effects.

Perlman, AB Weinstock, H
Transportation Systems Center, Federal Railroad Administration Intrm Rpt. DOT-TSC-FRA-75-5, FRA/ORD-75/56, May 1975, 42 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-262177/9ST, DOTL NTIS

02 151218
NON-DESTRUCTIVE IMPACT BETWEEN RAILROAD CARS: EXPERIMENTAL AND ANALYTICAL STUDY

A computer simulation of the dynamics of rail car impacts is compared with experimental data obtained from full scale switchyard impacts. The compared cases involve impacts between a standing light hopper car and a moving, fully loaded tank car at speeds ranging from 2 mph to 8 mph. The monitored dynamic responses include vertical car motions, draft gear travel, longitudinal coupler forces, car body accelerations, and vertical bolster loads.

Peters, DA Yin, SK
Washington University, St Louis, Federal Railroad Administration Tech. Rpt. FRA/ORD-76-247, Jan. 1977, 65 pp

Contract DOT-OS-40106-2

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-263187/7ST, DOTL NTIS

02 153977
FRICTION-CREEP AND WEAR STUDIES FOR STEEL WHEEL AND RAIL

Some basic aspects of the friction-creep phenomena in the rolling of a steel wheel on a rail are studied with a qualitative analysis of stress, strain, adhesion and creep in the contact zone and the stresses on the remaining surface of the rail and the wheel. Some pertinent literature on the subject is briefly discussed. A friction-creep test facility was modified and improved to give more accurate friction-creep data. The electrical control and drive system was changed to give accurate speed of rotation and to dynamically brake the two wheels separately. Friction-creep data was taken with braking of both the small and the large wheels. The data obtained with small wheel braking showed higher coefficients of friction than that of the large wheel braking. Some preliminary reasons for the difference are qualitatively discussed. A preliminary study of the nature and progress of wear during rolling was done with two microscopes, installed for each wheel. With the help of a microswitch and flash gun, some qualitative observations were made on one spot on the wheel. Attempts are being made to study the nature and rate of wear quantitatively.

Prepared in cooperation with Association of American Railroads, Washington, D.C., and General Motors Corp., La Grange, Ill. Electro-Motive Div.

Karamchandani, KC Kumar, S Sciammarella, CA Seth, B Nailescu, L
Illinois Institute of Technology, Association of American Railroads, General Motors Corporation, Federal Railroad Administration Intrm Rpt. IIT-TRANS-75-1, FRA/ORD-76-272, May 1975, 114 pp

Contract DOT-OS-40103

ACKNOWLEDGMENT: NTIS

ORDER FROM: NTIS

PB-264873/1ST, DOTL NTIS

02 154010
COMPARATIVE ANALYSIS OF DYNAMICS OF FREIGHT AND PASSENGER RAIL VEHICLES

Analytical studies have been conducted on several different rail vehicles typical of North American railroad operations. Mathematical models, and computer codes for the mechanization of these models, have been generated to provide a predictive methodology for determining vehicle/track dynamic interaction under a range of conditions. These models have been validated through comparison of results with test data from several of the rail vehicles. Results of a comparative analysis of nine different rail vehicles were presented in a Final Report (FRA-ORD&D-74-39) dated March 1974. In subsequent contract modifications, the analytical techniques were used to provide support to the Metroliner Ride Improvement Program (DOT-FR-20049). Both the vehicle ride comfort and truck hunting stability were investigated by means of computer simulation. Parameter variation studies were used to determine optimum suspension values for both ride comfort and hunting stability. The report provides a summary of work conducted under the original contract and five subsequent modifications. Recent modifications to the mathematical models to improve simulation accuracy are discussed. In addition, improvements in the representation of track geometry in power spectral density format based on recent measurements are discussed.

See also RRIS 02 090530.

Ahlbeck, DR Doyle, GR, Jr
Battelle Columbus Laboratories, Federal Railroad Administration Summary FRA/ORD-77/04, Nov. 1976, 73 pp

Contract DOT-FR-20077

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-265050/5ST, DOTL NTIS

02 163794
TRACKING & RIDE PERFORMANCE OF ELECTRO-MOTIVE 6-AXLE LOCOMOTIVES

The three-axle truck has been investigated to determine correlation between ride quality and derailment tendency. The tests, instrumentation and interpretation of results are described. The SDP40F was tested on marginal track, in situations where truck hunting can occur, and where it could be compared with two-axle locomotive and freight car trucks heavily loaded. It was concluded that more documentation is needed for the load levels which different North American track structures can safely accommodate in terms of short-duration and cumulative loadings.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Klinke, WR Swenson, CA (General Motors Corporation)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 106-118, 17 Fig., 10 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

02 167302
GENERAL MODELS FOR LATERAL STABILITY ANALYSES OF RAILWAY FREIGHT VEHICLES

The report presents the development of general analytical models for use in exploring the nature of freight car hunting and for finding means of controlling the hunting behavior. These models result from one aspect of the Freight Car Dynamics research project conducted by Clemson and Arizona State Universities in cooperation with the Association of American Railroads. First, a model of a wheelset with lateral, yaw, and axle torsional degrees of freedom is developed. Secondly, two such wheelsets are included in a general model of a 9 degree of freedom truck that has lateral, yaw, and warp degrees of freedom in addition to relative lateral and yaw motions of the wheelsets with respect to the truck frame. By suitable choices of primary suspension elements, this general model may be specialized to become (1) a roller-bearing freight truck, (2) a plain-bearing freight truck, (3) a roll-

er-bearing truck with primary suspension elements, (4) a passenger truck, (5) a generic model of a freight truck with interconnected wheelsets, or (6) a rigid truck. Finally, two such truck models are combined with a car body that has lateral, yaw, and roll rigid body degrees of freedom plus two degrees of freedom that serve to approximate the first lateral bending and torsional modes. For all three models, the effects of design parameters on the critical speed for hunting are examined.

Prepared in cooperation with Association of American Railroads, Chicago, Ill. Technical Center and Arizona State Univ., Tempe. Dept. of Mechanical Engineering. See also PB-252 290.

Law, EH Hadden, JA Cooperrider, NK
Clemson University, Federal Railroad Administration, Arizona State University, Tempe, Association of American Railroads Technical Center Intrm Rpt. FRA/ORD-77/36, June 1977, 229 pp, Figs., 8 Tab., 51 Ref., 3 App.

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS, FRA
ORDER FROM: NTIS

PB-272371/6ST, DOTL NTIS

02 167345
STUDY OF FRICTION AND CREEP BETWEEN STEEL WHEEL AND RAIL

A systematic experimental, parametric and similitude investigation of the friction and creep behavior of a steel wheel rolling on a steel rail is given. Laboratory investigation was performed on the 1/5th scale experimental GM-IIT Wheel Rail Simulation Testing Facility reported on earlier. Investigation of the size and area of contact between the two wheels at different stages of surface wear shows that the initially elliptical (near Hertzian) area of contact changes fast into a near rectangular shape with a several-fold increase, depending on the load and the duration of testing and wear. It was found that Kalkers Theory fits the nondimensionalized data well, when wheel surfaces are near perfectly smooth. The product of actual contact area and creep is always constant for a given normal load and friction coefficient regardless of the surface roughness and wear time. This constancy law was derived on the basis of experimental data. It has been shown here that for the elastic and smooth surfaces the Carter-Poritsky theory also predicts the product of creep and theoretical area of contact as constant for a given load and operating friction coefficient. Generalized expressions for the interrelationship of friction coefficient, creep, actual area of contact, normal load and shear modulus have been established on the basis of experimental data. Recommendations for future design improvements have been made on the basis of these relations.

Sponsored in part by General Motors Corp., La Grange, Ill. Electro-Motive Div., and Association of American Railroads, Washington, D.C.

Sciammarella, CA Press, M Kumar, S Seth, B Nailescu, S
Illinois Institute of Technology, Federal Railroad Administration, General Motors Corporation, Association of American Railroads Technical Center Final Rpt. FRA/ORD-76/271, IIT-TRANS-76-2, July 1976, 106 pp

Contract DOT-OS-40103

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-272713/9ST

02 167379
DEVELOPMENT OF A SYSTEM TO DISPLAY AND RECORD SLACK ACTION IN FREIGHT TRAINS

This report summarizes the development of a system which senses, displays and records the slack action or inter-car movement in freight trains. The system, called the Draft-Buff Indicator (DBI), was developed to serve as a train-handling aid. It provides the user (railroad training officer, accident investigator or locomotive engineer) with a real-time display of the draft-buff distribution within a moving train and also provides a record of the information for later analysis. The report discusses the development of the sensors, transmitters, receivers and display which make up the system, as well as alternative versions of the system which were considered and rejected for various reasons. The report also discusses the various applications of the system in revenue service and in accident analysis up to the time of publication.

Vrabel, JD Sussman, ED Ofsevit, D
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-77-2, FRA/ORD-77/53, Aug. 1977, 62 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-272944/0ST

02 175504
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME I. EXECUTIVE SUMMARY

The report reviews and gives conclusions of Phase I of the Truck Design Optimization Project (TDOP). It represents the first of a six volume published set. The report studies the performance of the standard three-piece truck. Railroad profitability can be increased through the objective of reduction of lading damage. A combination of longitudinal forces (humping and train action), lateral oscillations (hunting), and vertical dynamics (rock n' roll) is one cause of lading damage which can be eliminated by the railroad industry's adoption of performance guidelines which define performance values to control truck and carbody motion. Another profitability objective is to reduce the costs of wear and maintenance on rail vehicle components. Wheel flange and tread wear represent one of the major costs to operating railroads and car leasers, and can be attributed to poor truck performance and adverse wheel/rail interface dynamics. The thirty percent of car repair costs associated with wheels can be substantially reduced through improved truck performance. Both of these objectives must be backed by the development of a sound economic methodology useful in the equipment acquisition process and the attendent alternative investment decisions.

See also PB-248350. Volumes 2 through 6 in RRIS 02 175505-177509 respectively.

Fay, GR Bang, AJ
Federal Railroad Administration Final Rpt. FRA/ORD-78/12.I, Feb. 1978, 39 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-278698/6ST

02 175505
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME II. PHASE I, FINAL REPORT

Tasks assigned to Phase I of the Truck Design Optimization Project (TDOP) are concluded. This report includes lists of data tapes, reports filed through FRA with the National Technical Information Service (NTIS). Also, in the appendices of this report will be found seven additional small technical reports, as well as drawing lists, definitions and a bibliography.

See also Volume 1 and Volumes 3 through 6 in RRIS 02 175504 and 175506-175509 respectively.

Southern Pacific Transportation Company, Federal Railroad Administration FRA/ORD-78/12.II, TDOP-76-227, Feb. 1978, 285 pp

Contract DOT-FR-40023

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-278699/4ST

02 175506
FREIGHT CAR TRUCK DESIGN OPTIMIZATION PROJECT. VOLUME III. PHASE I. FREQUENCY DOMAIN MODEL

The frequency domain model computer program developed by the Truck Design Optimization Project (TDOP) simulates the operation of an idealized railroad freight car riding on standard three piece trucks. Given user specified data describing the characteristics and operating conditions of the vehicle, the program utilizes track deflection data prestored on random access disk to generate driving functions for the model. These track deflection data are broken down into frequency components before being used to activate the simulated vehicle. Similarly, the results of program execution are vehicular responses as functions of frequency. The large execution times associated with time domain models are avoided, but the price for this saving is the restriction of the simulations to those idealized conditions that are solvable by linear simultaneous complex equations.

See also Volumes 1 through 2 and 4 through 6 in RRIS 02 175504-175505 and 175507-175509 respectively.

Southern Pacific Transportation Company, Federal Railroad Administration Final Rpt. FRA/ORD-78/12.III, TDOP-76-126, Feb. 1978, 404 pp

Contract DOT-FR-40023

ACKNOWLEDGMENT: NTIS, FRA
ORDER FROM: NTIS,
PB-278700/0ST, DOTL NTIS, DOTL RP

02 175507
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME IV. CRITIQUE OF FREQUENCY DOMAIN MODEL-SOLUTION TECHNIQUES
The Truck Design Optimization Program (TDOP), Phase I, Frequency Domain Model (FDM) is reviewed. The review of this railcar structural dynamics program is divided into three areas: (1) solution method, (2) power spectral density, and (3) integrity of the excitation function.

See also Volumes 1 through 3 and 5 through 6 in RRIS 02 175504-175506 and 175508-175509 respectively.

Sussman, NE
Mitre Corporation, Federal Railroad Administration FRA/ORD-78/12.IV, WP-12656, Feb. 1978, 46 pp

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS, FRA
ORDER FROM: NTIS
PB-278701/AS, DOTL NTIS, DOTL RP

02 175508
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME V. CRITIQUE OF FREQUENCY DOMAIN MODEL-EQUATIONS OF MOTION
As part of the Truck Design Optimization Project (TDOP) a mathematical model was developed to be used for predicting truck behavior. The model, its description, the nomenclature used, and the development of the equations of motion were all oriented toward the computer program which would ultimately solve the equations. A detailed review and evaluation of the mathematical model was carried out. This review was judged necessary to provide an independent evaluation of the model which contained many assumptions and some errors whose effect was not clear.

See also Volumes 1 through 4 and 6 in RRIS 02 175504-175507 and 175509 respectively.

Muhlenberg, JD
Mitre Corporation, Federal Railroad Administration FRA/ORD-78/12.V, WP-11978, Feb. 1978, 58 pp

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS, FRA
ORDER FROM: NTIS
PB-278702/6ST, DOTL NTIS, DOTL RP

02 175509
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME VI. CRITIQUE OF PHASE I. TEST SERIES RESULTS REPORTS
The major output resulting from the Phase I effort which is of interest to railroads, suppliers, and the Phase II contractor was the series of Test Results Reports, which contained summary commentary and selected processed data from the field testing. Because of the importance of the content of these collections of data and the quantity of data involved, these reports are addressed in considerable detail in this report.

See also Volumes 1 through 5 in RRIS 02 175504-175508 respectively.

Muhlenberg, JD
Mitre Corporation, Federal Railroad Administration Tech Rpt. FRA-/ORD-78/12.VI, Feb. 1978, 30 pp

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-278703/4ST

02 176018
ANALOG AND DIGITAL COMPUTER SIMULATION OF COULOMB FRICTION
Coulomb friction, such as found in the suspension system of railway freight cars, can strongly influence dynamic behavior. The Coulomb friction nonlinearity must be accurately implemented in computer simulations of multi-degree-of-freedom dynamic models. This report proposes three computer models for friction and analyzes their performance in analog and digital computer simulations. Simulation techniques used are described in detail. Performance of each friction model is compared to analytical results. The accuracy, advantages, and disadvantages of each model are discussed. The report concludes with recommendations on the use of the proposed friction models.

Heller, R Tuten, JM Kadala, PS Law, EH
Clemson University, Federal Railroad Administration Intrm Rpt. FRA/ORD-78/07, Dec. 1977, 61 pp

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-279465/9ST, DOTL NTIS

02 176025
USERS' MANUAL FOR KALKER'S SIMPLIFIED NONLINEAR CREEP THEORY
The conversion of the computer program, 'Simplified Theory of Rolling Contact,' (used for calculation of a nonlinear creep force-creepage relationship) from the original Algol language to Fortran is considered. The Algol program was written by Professor J. J. Kalker and was derived from the paper, 'Simplified Theory of Rolling Contact,' Delft Progr. Rep., Series C: Mechanical and Aeronautical Engineering and Shipbuilding, 1 (1973), pp. 1-10. A significant number of changes was made in the program for more convenient use; however, the fundamental equations remain unchanged. The results were checked in detail to insure agreement with the original solution. The program gives an appropriate solution for the resultant tangential creep forces and spin moment acting between two bodies of equal linearly elastic material properties. The creep forces and spin moment are due to lateral, longitudinal, and spin creepages. Assumptions corresponding to the Hertz contact theory are implied and two additional simplifying assumptions are made, resulting in a significant reduction in computation time as contrasted with previous solutions. Two separate computer codes were developed, the first being the general solution with extended input and output, and the second a shortened version primarily intended for use as a subroutine. Surprisingly good agreement is found to exist between the 'Simplified Theory' and published experimental results for a wide range of contact ellipse eccentricity.

Prepared in cooperation with Arizona State Univ., Tempe. Dept. of Mechanical Engineering and Association of American Railroads, Chicago, Ill.

Goree, JG Law, EH
Clemson University, Arizona State University, Tempe, Association of American Railroads Technical Center, Federal Railroad Administration FRA/ORD-78/06, Dec. 1977, 58 pp

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-279503/7ST, DOTL NTIS

02 179115
AN INVESTIGATION OF TECHNIQUES FOR VALIDATION OF RAILCAR DYNAMIC ANALYSES
A linear model of the vertical dynamics of a railcar was validated by the application of spectral techniques to experimental data. Track input spectra were computed from test track surface measurements gathered in the TDOP test program. Acceleration measurements of a freight car were used to compute vehicle acceleration spectra in response to the test track. The corresponding response of the linear model was computed from the analytical transfer functions and experimental track input spectra. Validation of the linear model was based upon a comparison of corresponding analytical and experimental vehicle acceleration spectra. The truck suspension was isolated and analyzed from experimental measurements of corresponding truck and car body accelerations. Spectral functions were employed to evaluate the assumptions of suspension linearity.

Prepared in cooperation with Association of American Railroads Research Center, Chicago, Illinois for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development.

Fallon, WJ Cooperrider, NK Law, EH
Arizona State University, Tempe, Clemson University Intrm Rpt. DOT-FRA-ORD&D-78/19, Mar. 1978, 105 pp, Figs., 6 Tab., 17 Ref., 2 App.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-279996/AS, DOTL NTIS, DOTL RP

02 179121
USER'S MANUAL FOR ASYMMETRIC WHEEL/RAIL CONTACT CHARACTERIZATION PROGRAM

Wheel/rail geometric constraint relationships, such as the effective conicity and gravitational stiffness, strongly influence the lateral dynamics of railway vehicles. The principal curvatures of wheel and rail profiles are important parameters in the determination of creep coefficients used in rail vehicle models. In general, these geometric constraints and profile curvatures are nonlinear functions of the wheelset lateral displacement. This report is a users' manual for a computer program written in FORTRAN IV that uses iterative procedures to determine these nonlinear functions for arbitrary wheel and rail profiles. The program computes the wheel/rail contact positions, geometric constraint functions, and profile curvatures for any given wheel profile, rail profile, rail cant angle, and rail gauge for an asymmetric wheelset on asymmetric rails. Analytical methods used and program input and output are described. Results are in the form of printout, punched cards and drum plotter plots. The users' manual includes program listings, sample deck set-ups, and sample run output.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. Prepared in cooperation with Association of American Railroads Research Center, Chicago, Illinois.

Heller, R Cooperrider, NK
Clemson University, Arizona State University, Tempe Intrm Rpt. FRA/ORD-78/05, Dec. 1977, 98 pp, Figs., 4 Ref.

Contract DOT-OS-40018

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-279707/AS, DOTL NTIS, DOTL RP

02 179122
RESISTANCE OF A FREIGHT TRAIN TO FORWARD MOTION-VOLUME I, METHODOLOGY AND EVALUATION

This interim report documents the results of the initial portion of an intensive investigation of the train resistance phenomenon. The history and development of prior investigations are discussed and the formulas for train resistance developed by investigators in the U.S. and abroad are analyzed with respect to their present applicability to the phenomenon. Factors contributing to the considerable discrepancies among various formulas are discussed. A methodology suitable for a quick and accurate solution of the hitherto ignored problem of the air resistance of different arrangements of the same consist is developed and utilized in determining train resistance. Preliminary estimates of reductions in train resistance and consequent fuel and cost savings resulting from possible modifications to train and track technology are given. Recommendations are made for further investigations during the remainder of this study and possible fruitful areas for new research. Two appendices explain the rationale behind the calculation of air resistance of various consist arrangements and discuss the related computer program in detail.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. See also FRA/ORD-78/04. II, Volume II,--Implementation and Assessment.

Muhlenberg, JD
Mitre Corporation Intrm Rpt. FRA/ORD-78/04.I, MTR-7664, Apr. 1978, 149 pp, Figs., Tabs., 35 Ref., 2 App.

Contract DOT-FR-54090

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-280969/AS, DOTL NTIS, DOTL RP

02 179126
AERODYNAMIC FORCES ON FREIGHT TRAINS VOLUME II--FULL-SCALE AERODYNAMIC VALIDATION TESTS OF TRAILER-ON-A-FLAT CAR (SERIES II)

Aerodynamic forces were measured on full-scale Trailer-on-a-Flat Car (TOFC) configurations and a reliable data base was established for Validation of wind tunnel test programs. The drag, side and lift forces were determined on two trailers mounted on an instrumented flat car, each by means of a specially designed force-balance system. Two TOFC configurations (Configuration 1 with a loaded buffer car leading the instrumented flat car and Configuration 2 with an empty buffer car) were tested under different wind conditions. In addition to the aerodynamic resistance of the trailers, total tractive resistance of the TOFC was measured via instrumented couplers. The results indicate good agreement between the full-scale aerodynamic drag data and the wind tunnel data from the tests at the Calspan Corporation. The wind tunnel tests conducted at the California Institute of Technology exhibited significantly higher drag values than the full-scale measurements, especially at high wind angles. The foregoing conclusions apply to both Configurations 1 and 2. It was found that Configuration 2 experienced consistently larger drag than Configuration 1. Measurement of the total tractive resistance enabled a rough estimation of the rolling resistance of the instrumented flat car. The present tests show that at 50 mph the aerodynamic drag accounts for 50 to 60 percent of total train resistance and the rolling resistance takes the remaining share. At 90 mph, the drag force amounts to approximately 55 to 70 percent of the total resistance.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Freight Systems.

Joshi, PB
ENSCO, Incorporated Test Rpt. DOT-FR-78-19, FRA/ORD-76-295.II, Mar. 1978, 381 pp, Figs., Tabs., 14 Ref., 4 App.

Contract DOT-FR-64113

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-281823/AS, DOTL NTIS, DOTL RP

02 179290
A MATHEMATICAL-COMPUTER SIMULATION OF THE DYNAMICS OF A FREIGHT ELEMENT IN A RAILROAD FREIGHT CAR. INTERIM TECHNICAL REPORT NO. 3

This research studies the dynamic response of a freight element, inside a typical freight box car under service conditions, by a computer-model simulation technique. A 27 degree of freedom mathematical model has been developed to represent the freight car, truck and freight element, with the car body as a single rigid mass. This model has been validated against published railroad research data. This model is a more detailed one than most previously published simulations, and has additional characteristics. One is the option of modeling dry friction dampers by either Coulomb friction or equivalent viscous damping. A second improvement is the facility to express the response of the system in either time or frequency domain. The computer simulation shows that the critical roll mode speed of a representative 70-ton box car is around 17.5 mph. The maximum car body roll angle is 11.4 degrees peak to peak, the maximum wheel load is 69,000 lb/wheel, and wheel lift durations are 0.2-0.4 sec. For a specific freight element near the roof maximum lateral accelerations of 1.5 g peak to peak at 0.64 Hz were calculated. At 50 mph, this value becomes 0.2 g at 2 Hz. Vertical acceleration of 0.1 g at 1.25 Hz is computed for freight near the car body center of gravity at 50 mph. The mathematical model can be used for parametric studies on designs of the car body and truck. Cushioning requirements for freight-/package systems subjected to vibrations inside a freight car can also be established.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. Sponsored by Office of University Research, Federal Railroad Administration, Association of American Railroads, and General Motors Electro-Motive Division. Partially supported by Illinois Institute of Technology, Chicago, Illinois.

Shum, KL Willis, T
Illinois Institute of Technology Intrm Rpt. FRA/ORD-77/28, IIT-TRANS-75-2. N3, July 1977, 130 pp, Figs., 4 Tab., 17 Ref., 3 App.

Contract DOT-OS-40103

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-282308/AS, DOTL NTIS, DOTL RP

02 182004
VSS DEMONSTRATION PROGRAM. PART 1: SYSTEM PERFORMANCE EVALUATION

The Vertical Shaker System (VSS) is the initial test program to be conducted at the Rail Dynamics Laboratory. The objectives of this program are to

demonstrate the performance and capabilities of the VSS and to accumulate test data to be used in checking the validity of analytical models. The experiments are performed on three different load configurations of a trailer-on-flatcar. The test program was found to be successful. Pretest planning, to specify input levels and motion requirements, was essential to effective VSS operation. Log books, used to record program events as they occurred, were found to be invaluable in post test analyses.

Wyle Laboratories, Federal Railroad Administration Final Rpt. FRA-/ORD-78/43, July 1978, 134 p.

Contract DOT-FR-64200

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-284980/0ST, DOTL NTIS

02 182124
USER'S MANUAL FOR PROGRAM COUNTACT. (COUNTERFORMAL CONTACT STRESS PROBLEMS)

COUNTACT (Counterformal Contact of Two Elastic Bodies) is an all Fortran computer program for the solution of stress analysis between two elastic bodies in counterformal contact. It is used to find the pressure distribution between the two bodies, the boundary of contact patch, and the total load corresponding to a given depth of penetration. The program COUNTACT has two versions: COUNTACT-1 for those bodies with a contact patch having one axis of symmetry, and COUNTACT-2 for those bodies whose contact patch has two axes of symmetry. Descriptions of the program variables, input, output, and method of analysis are given. Instructions for problem modelling, preparation of input data, and solutions of sample problems, are included. The general approach to writing a user-supplied subroutine required by the program is discussed.

See also report dated December 76, PB271033.

Paul, B Hashemi, J
Pennsylvania University, Philadelphia, Department of Transportation, Federal Railroad Administration Tech Rpt. FRA/ORD-78/27, MEAM-77-2, Sept. 1977, 37 p.

Contract DOT-OS-60144

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-286097/1ST, DOTL NTIS

02 182880
DYNAMIC LOADS ON THE UNDERCARRIAGE OF FREIGHT CARS

A description is presented of the procedure and the equipment used to study the dynamic loads acting on the undercarriages of freight cars. The results are presented from testing the four axle and eight axle gondolas and tank cars on the primary routes of the railroad network as part of operating and experimental freight trains. The generalizing relations are obtained for the vertical and horizontal (lateral) forces and the derailment coefficient. The test data would be useful for further, more precise definition of the calculated norms when designing cars considering the prospective operating conditions. The book is designed for scientific and technical workers connected with the construction, operation, maintenance and repair of freight cars. [Russian]

Report appeared in Trudy TsNII Proceedings No. 572, published 1977 and is available to the Public from FRA Office of Rail Safety, RRD-32, while quantities last. The report is a translation of a current Russian Compendium on Wheel/Rail Dynamic Interaction.

Krudryautseu, NN
Transport Publishing House 243 p., Figs., Tabs. FRA/ORD-79/33

ACKNOWLEDGMENT: FRA
ORDER FROM: FRA/ORD

DOTL TF23.U68A34

02 186076
AN IMPROVED NUMERICAL METHOD FOR COUNTERFORMAL CONTACT STRESS PROBLEMS. TECHNICAL REPORT NO. 3

A numerical method is given for the solution of frictionless counterformal contact stress problems. By modifying the previously described simply-discretized method, and by introducing an automatic mesh generating procedure for the changing contact region, it has been possible to make major improvements in the generality, stability, accuracy, and efficiency of the numerical procedures. The method has been verified by comparison with known solutions for the Hertzian case. Numerical examples for non-Hertzian cases include the first known solution for non-Hertzian contact of a railroad wheel and rail. The mesh generation and boundary iteration procedure introduced is applicable to a wider class of problems with changing boundaries, such as determination of wheel-rail adhesion-slip boundary, determination of elastic-plastic interfaces for residual stress problems, etc.

Paul, B Hashemi, J
Pennsylvania University, Philadelphia, Federal Railroad Administration FRA/ORD-78/26, MEAM-77-1, July 1977, 66 p.

Contract DOT-OS-60144

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-286228/2ST, DOTL NTIS

02 186210
USERS' MANUAL FOR KALKER'S 'EXACT' NONLINEAR CREEP THEORY

The conversion of the computer program, 'A Programme for Three-Dimensional Steady State Rolling' developed by Professor J.J. Kalker, from the original Algol language to Fortran is considered. This program determines the resultant creep forces and moment for steady state rolling of two bodies of equal or unequal linearly elastic material properties. A related manual for Kalker's 'Simplified Theory of Rolling Contact' is considered in the report 'User's Manual for Kalker's Simplified Nonlinear Creep Theory,' by James G. Goree and E. Harry Law, FRA/ORD-78/06 Contract DOT-OS-40018, December, 1977. The program considered in the present report concerns the same problem except for the extension to unequal materials. It is found that, for equal materials, the 'Simplified Theory' gives approximately the same results as the exact solution in most cases and in those instances where some difference was noted, the simplified theory appears to be in better agreement with experimental results. In addition, the simplified theory reduces the computation time by a factor of approximately 50 to 100.

See also report dated December 77, PB-279503.

Goree, JG
Clemson University, Association of American Railroads Technical Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-78/50, Aug. 1978, 55 p.

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-287472/5ST, DOTL NTIS

02 186848
THE U.S. DOT/TSC TRAIN PERFORMANCE SIMULATOR

A Train Performance Simulator (TPS) is a computer program which simulates the operation of a train over a railway route. It may be used for a variety of purposes to determine the effects of some operational strategy or equipment change upon schedules and energy consumption. The general characteristics of a TPS are discussed, including requirements for route and train input data and fundamentals of the mathematical models available. The USDOT/TSC TPS is a relatively complex, but simple to use, example of a general-purpose TPS. Its features are described and the operating cycle of the program is examined. The mathematical model is discussed in detail. A wide variety of output data may be specified and many output options exist. Instructions for setting up the input data or running the TPS are not given, but samples of output are included.

Hazel, ME
Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-77/48, DOT-TSC-FRA-78-15, Sept. 1978, 48 p.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-287815/5ST

02 188675
FRATE, VOLUME I: USER'S MANUAL

FRATE (Freight Car Response Analysis and Test Evaluation) is the name of a digital computer program which numerically solves the structural dynamic equations of motion of a single railroad freight car excited by

wheel/rail interface motions. The Federal Railroad Administration (FRA) has sponsored its development for the purpose of applying it to freight car analysis and test problems. This manual has been written with the objective of providing the user with all of the detailed information needed as concisely and accessibly as possible. To this end the manual has been divided into two volumes: Volume I is a User's Manual containing basic user related information, Volume II is a Technical Manual Containing more detailed technical information. FRATE is written to allow the simulation of a broad range of freight cars by only simple input data changes. A Trailer-on-Flatcar (TOFC) configuration is simulated in this manual. FRATE solves the equations of motion in the time domain and includes the following features; (1) nonlinearities which presently include separations, bilinear springs and no small angle assumptions, (2) five degree-of-freedom coordinate coupling (longitudinal motions have been omitted), (3) normal mode structural flexibility and (4) frequency response from simulated sweep testing. Although it has not been included in this report coulomb damping has been included and used in a trial version of FRATE.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Kachadourian, G Sussman, NE Anderes, JR
Mitre Corporation Tech Rpt. FRA/ORD-78/59, MTR 7889, VI, Sept. 1978, 97 p., 14 Fig., 12 Tab.

Contract DOT-FR-54090

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-291206/1ST, DOTL NTIS, DOTL RP

02 188677
THE APPLICATION OF QUASI-LINEARIZATION TECHNIQUES TO RAIL VEHICLE DYNAMIC ANALYSES

The objective of the work reported here was to define methods for applying the describing function technique to realistic models of nonlinear rail cars. The describing function method offers a compromise between the accuracy of nonlinear digital simulation and the computational efficiency of linear methods. This work entailed the development of realistic describing function representations for nonlinearities such as the wheel/rail contact interaction and the development of algorithms for using these describing functions to predict the occurrence and stability of hunting and the forced response of rail vehicles to sinusoidal and statistical track irregularities. This report explains the describing function technique, demonstrates how it can be applied to nonlinear rail vehicle dynamics problems, describes algorithms that can be used for such problems, and presents results for typical nonlinear problems, including wheel profile and suspension nonlinearities.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Hedrick, JK Cooperrider, NK Law, EH
Massachusetts Institute of Technology, Arizona State University, Tempe, Clemson University Final Rpt. FRA/ORD-78/56, DOT-TSC-FRA-78-6, Nov. 1978, 228 p., Figs., Tabs., 51 Ref., 1 App.

Contract DOT-TSC-902

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-289849/AS, DOTL NTIS, DOTL RP

02 188680
USER'S MANUAL FOR PROGRAM CONFORM (CONFORMAL CONTACT STRESS PROBLEMS)

CONFORM (Conformal Contact of Two Elastic Bodies) is an all FORTRAN Computer program for the solution of contact stress between two elastic bodies in conformal contact. It is used to find the pressure distribution between the two bodies, the boundary of contact patch, and the total load corresponding to a given depth of penetration. This program is a generalization of a previous program (COUNTACT) which was restricted to the case of counterformal contact. This new program CONFORM will treat counterformal as well as conformal cases. Built into the program are specialized subroutines which enable the user to conveniently specify the surface profiles for railroad wheels and railheads. By reading dimensional information from conventional engineering drawings of wheels and rails the user need not do any programming. For wheel and rail profiles (e.g. worn wheels) which consist of other than straight lines and circular arcs (associated with standard new wheels and rails), the user may provide his own subroutines for describing the wheel-rail geometry. Descriptions of the program variables, input, output, and method of analysis are given. Instructions for problem modelling, preparation of input data, and solutions of sample problems, are included.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Program of University Research, Washington, D.C.

Paul, B Hashemi, J
Pennsylvania University, Philadelphia Tech Rpt. FRA/ORD-78-40, MEAM 78-1, June 1978, 81 p., 18 Fig., 1 Tab., 7 Ref., 3 App.

Contract DOT-OS-60144

ACKNOWLEDGMENT: FRA
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PB-288927/7ST, DOTL NTIS, DOTL RP

02 188682
TRUCK DESIGN OPTIMIZATION PROJECT (TDOP) PHASE II-PHASE I DATA EVALUATION AND ANALYSIS PLAN

This document describes a plan for evaluating and analyzing the TDOP Phase I test data for Type I freight car trucks. The plan proposes that the initial tasks should include cataloging the Phase I data, refining the TDOP sorting routine, and converting and validating the government-furnished Phase I post processing program to run on Wyle's Interdata 8/32 computer. Once the software is operational, the Phase I data evaluation and analysis will begin with a pilot program to establish the validity of the techniques for establishing freight car truck performance indices. The plan states that a final report will be published sixty days after completion of the evaluation and analysis of the Phase I data.

Prepared for U.S. Department of Transportation, Washington, D.C. This report is the first of a series that will be published under the major title "Truck Design Optimization Project, Phase II as the multi-year program develops. A preliminary version of this plan was distributed at the first TDOP Phase II In-Progress Review held in Chicago, Illinois on March 21, 1978.

Gibson, D
Wyle Laboratories FRA/ORD-78/34, TDOP TR-01, Sept. 1978, 27 p., 13 Fig.

Contract DOT-FR-742-4277

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-300 969/3ST, DOTL NTIS, DOTL RP

02 188692
AERODYNAMIC FORCES ON FREIGHT TRAINS--VOLUME III CORRELATION REPORT-FULL SCALE TESTS OF TRAILERS ON FLATCARS AND COMPARISON WITH WIND TUNNEL RESULTS

Full scale measurements of the aerodynamic forces of trailers on flatcars have been performed at the Transportation Test Center in Pueblo, Colorado. These measurements were performed by mounting the trailers on the flatcar through force balances. In the two configurations that were tested the flatcar in front of the test car was loaded and unloaded. The tests were quite successful and resulted in consistent reproducible results. In addition to the full scale tests, wind tunnel tests were performed at Reynolds numbers up to 20% of full scale values for the same configurations. These wind tunnel tests supplemented previous wind tunnel tests similar to those previously reported in Volume I of this series. Reasonable agreement, to about 20%, was found between the wind tunnel and full scale tests. This agreement was about as good as between the wind tunnel tests themselves. Rolling resistance was also determined from the full scale tests as the difference between total and aerodynamic resistance. The results were degraded by hysteresis in the coupler force measurement but show good agreement with the Davis relation.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Hammitt, AG
Hammitt (Andrew G) Associates Final Rpt. FRA/ORD-76-295.III, AGH 11-002-78, Sept. 1978, 94 p.

Contract DOT-FR-756-4333

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-288137/AS, DOTL NTIS, DOTL RP

02 191066
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME VII. RESULTS REPORT FOR TEST SERIES 1

The field testing in Test Series 1, Phase I, of the Truck Design Optimization Project (TDOP) was conducted for the purpose of evaluating an existing 70-ton (63.6-mt) freight car truck. The truck was tested with many different configurations based upon various combinations of conditions: 4 track types, 2 gib, and 3 side bearing clearances, speed conditions varying from 10 to 79 mph (16 km/hr to 127 km/hr), and curvatures ranging from 1 degree to 9 degrees. The data from approximately 90 tests are contained on 35 magnetic tapes, and the results are plotted on several hundred graphs. While only a portion of the graphs is included in the Series 1 Results Report, the massive amount of data collected and processed during Phase I make it mandatory that the reader become familiar with both the scope of testing in Test Series 1, and the means by which locations within the test matrix of each section may be pinpointed.

For preceding Volumes, see RRIS 02 175504.

Southern Pacific Transportation Company, Federal Railroad Administration Final Rpt. FRA/ORD-78/12. VII, TDOP-76-026, May 1978, 400 p.

Contract DOT-FR-40023

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-291904/1ST, DOTL NTIS

02 191335
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. VOLUME VIII. RESULTS REPORT FOR TEST SERIES 2 AND 5

This results report contains information reduced from the Truck Design Optimization Project (TDOP) data tapes and organized into an appropriate graphical output. These results encompass data from Test Series 2 and data from the 70-ton (63.6-mt) mechanical refrigerator car used in Test Series 5. Test Series 5 also included data from a 100-ton (90.9-mt) boxcar on cylindrical profile wheels with spring variations and snubbing supplements. These results will be reported with other 100-ton (90.9-mt) boxcar data in Test Series 3 Results Report. In this report, results from Test Series 2 and 5 are compared with the base case results described in TDOP Results Report For Series 1 Tests. Testing was expanded in Series 5 to evaluate harmonic roll characteristics on a specially prepared track, and the results from these tests are used to establish a base case for harmonic roll characteristics.

See also Volume 1, PB-278698.

Southern Pacific Transportation Company, Federal Railroad Administration Final Rpt. FRA/ORD-78/12.VIII, TDOP-76-27, May 1978, 232 p.

Contract DOT-FR-40023

ACKNOWLEDGMENT: NTIS
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PB-290663/4ST, DOTL NTIS

02 196983
USERS' MANUAL FOR PROGRAM FOR CALCULATION OF KALKER'S LINEAR CREEP COEFFICIENTS

A program written in FORTRAN IV is described that uses the Hertz theory of rolling contact between two bodies and Kalker's linearized theory of creep to determine the geometry of the contact patch between railway vehicle wheel and rail and the creep coefficients that characterize the linearized creep forces between wheel and rail. The program input, output and the subroutines used are described herein and the results are in the form of printout. The manual includes program listings, sample deck set ups and sample run outputs. Two other user's manuals for determination of creep forces and moments have been issued under this contract. These are "Users' Manual for Kalker's Simplified Nonlinear Creep Theory" by J.G. Goree and E.H. Law and "Users' Manual for Kalker's Exact Nonlinear Creep Theory" by J.G. Goree.

Haque, I Law, EH Cooperrider, NK
Clemson University, Federal Railroad Administration, Association of American Railroads Technical Center Tech Rpt. FRA/ORD-78/71, Mar. 1979, 36 p., 3 Fig., 2 Tab., 9 Ref., 3 App.

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS
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PB-297802/AS, DOTL NTIS

02 196989
TESTS OF THE AMTRAK SDP-40F TRAIN CONSIST CONDUCTED ON CHESSIE SYSTEM TRACK

This report describes tests of an SDP-40F train consist conducted on Chessie System track during June 1977. The tests consisted of the operation of two typical AMTRAK passenger consists, one powered by two SDP-40F's and the other by two E-8's, over a variety of track conditions. The objectives of the tests were to compare dynamic performance of the SDP-40F locomotive with the E-8, and to determine the sensitivity of the SDP-40F response to track geometry variations, operational parameters and truck configuration changes. Data was obtained on the lateral and vertical wheel/rail loads and carbody accelerations under a variety of speeds, track geometry and track surface conditions. Modifications of the SDP-40F trucks were also made and tested. Each locomotive was tested in a consist representative of passenger service over a variety of operational track conditions. In general, the SDP-40F lateral wheel/rail loads in selected curves showed a tendency to increase above curve balance speed at a faster rate than that of the E-8. A means was developed for accurately predicting lead axle lateral force levels in 2 degree curves as a function of speed and track geometry variations. A new strain gage configuration was developed which will greatly improve the accuracy of lateral rail loads measurements.

Tong, P Brantman, R Greif, R Mirabella, J
Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-79/19, DOT-TSC-FRA-79-14, May 1979, 260 p., Figs., Tabs., 8 App.

ORDER FROM: NTIS

PB-297711/AS, DOTL NTIS

02 196990
A MULTIPURPOSE TRAIN PERFORMANCE CALCULATOR: USER'S MANUAL

This manual documents a Train Performance Calculator (TPC) program which simulates the operation of a passenger train over a rail route. The Input for the program is the track data for the route, the characteristics of the locomotive, the type and number of cars, and the number of passengers. The output from the TPC is in the form of tables showing speed, time, and fuel used: and in the form of graphs showing speed, time, and fuel used versus distance traveled. The TPC has been in use for two years to study the energy intensity of Amtrak trains in the New York to Buffalo Corridor.

Heilman, H Kahrs, C Williams, G
Union College, Federal Railroad Administration Final Rpt. FRA-/ORD-79/17.I, Dec. 1978, 81 p., Figs.

Contract DOT-FR-8027

ORDER FROM: NTIS

PB-296392/AS, DOTL NTIS

02 196991
A MULTIPURPOSE TRAIN PERFORMANCE CALCULATOR: VOLUME II PROGRAMMERS' REFERENCE MANUAL

This manual documents a train performance calculator (TPC) program which simulates the operation of a passenger train over a rail route. The input for the program is the track data for the route, the characteristics of the locomotive, the type and number of cars, and the number of passengers. The output from the TPC is in the form of tables showing speed, time, and fuel used: and in the form of graphs showing speed, time and fuel used versus distance traveled. The TPC has been in use for two years to study the energy intensity of Amtrak trains in the New York to Buffalo Corridor.

Heilman, H Kahrs, C Williams, G
Union College, Federal Railroad Administration Final Rpt. FRA-/ORD-79/17.II, Dec. 1978, 84 p.

Contract DOT-FR-8027

ORDER FROM: NTIS

PB-296393/AS, DOTL NTIS

02 198302
TESTS OF THE AMTRAK SDP-40F TRAIN CONSIST CONDUCTED ON CHESSIE SYSTEM TRACK, EXECUTIVE BRIEF

This report describes results of tests of an SDP-40F train consist conducted on Chessie System track during June, 1977. The test consisted of the operation of two test trains intended to be typical of AMTRAK passenger

consists, one powered by two SDP-40F's and the other by two E-8's, over a variety of track conditions The objectives of the tests were to compare dynamic performance of the SDP-40F locomotive with a baseline case, the E-8, and to determine the sensitivity of the SDP-40F response to track geometry variations, operational parameters and several maintenance and configuration states of the truck/suspension system.

Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-79/18, May 1979, 24 p.

ACKNOWLEDGMENT: NTIS
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PB-297941/7ST, DOTL NTIS

02 304658
TEST TRAIN PROGRAM. TENTH ANNUAL REPORT
This report describes the progress on the Engineering and Test Support Services for Railroad Instrumentation, Data Acquisition, Processing and Evaluation Program from 1 July 1977 through 30 June 1978. The report covers operation of the FRA track-geometry-measurement, data acquisition and rail-flaw-detection fleet, as well as track survey operations and the related data processing. The report also describes special tests on Lightweight Flatcar Evaluation, Full-Scale Aerodynamic Tests of Trailer-on-a-Flatcar, Piggyback Evaluation, Maintenance-of-Way, Passenger Vehicle Studies, Dynamic Locomotive Testing, and Track Stiffness Measurement System Evaluation. Fabrication and installation of the new Wayside Detection Facility at TTC is also described herein.
See also 9th Progress report, PB-289690.

ENSCO, Incorporated, Federal Railroad Administration FRA/ORD-78/75, Apr. 1979, 99 p.

Contract DOT-FR-79-64113

ACKNOWLEDGMENT: NTIS
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PB-300760/6ST, DOTL NTIS

02 304679
TRUCK DESIGN OPTIMIZATION PROJECT. PHASE II. PHASE I. DATA EVALUATION AND ANALYSIS REPORT [Technical rept. Dec 77-Apr 79]
As part of the TDOP Phase II project, the FRA directed Wyle Laboratories to evaluate and analyze the test data acquired during TDOP Phase I for use in Phase II model validation and specification of performance indices. These data were contained on 204 magnetic tapes and computer printouts. The applicability of the Phase I test data to Phase II was evaluated from three points of view. The first was completeness of the test matrix. Most Phase I tests were conducted using the 70 ton refrigerator car on an ASF ride control truck with new wheel profiles. Although this over-emphasis on one configuration will necessitate additional testing of the Type I truck, it was possible to derive useful information from the Phase I test data. The second was measurement accuracy. The quality of measurements was acceptable except for measurements of lateral wheel force at the wheel/rail interface and in the detection of ALD targets. The third point of view was the Phase I data's adequacy to perform the Type I truck model validation and specification of performance indices. The data in the regimes of ride quality and lateral stability appear to be adequate. In the regimes of curve negotiation and trackability, the lack of adequate measurements of wheel/rail forces makes it difficult to extract meaningful information from the data.
See also PB-288739.

Gibson, DW Glaser, RJ
Wyle Laboratories, Federal Railroad Administration Tech Rpt. FRA-/ORD-78/52, TDOP/TR-02, Aug. 1979, 81 p.

Contract DOT-FR-742-4277

ACKNOWLEDGMENT: NTIS
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PB-300969/3ST, DOTL NTIS

02 304709
TRANSPORTATION OF VIBRATION SENSITIVE EQUIPMENT BY HIGHWAY TRAILER ON AN INTERMODAL RAILCAR-VOLUME I
The report includes the results of a cooperative research project between Government and industry to explore the potential for the use of highway trailers on intermodal railcars (Trailer on Flatcar) or (TOFC) to transport vibration sensitive lading. The purpose of the project was to characterize the operating environment of TOFC during the transport of vibration-sensitive teletypewriters. To this end, the lading, two types of trailers and the conventional TOFC flatcar were instrumented to quantify the shock and vibration environment during typical over-the-road revenue operation. The trailers used were a conventional railroad-owned leaf-spring trailer and an air-ride moving van. Various measurements of the accelerations experienced by the lading as well as the TOFC components were taken during the road test. Test equipment, test procedures and data processing techniques used are discussed in the report. The results of the test indicated that the ride quality of both types of trailers are similar and that TOFC is feasible for the transportation of vibration-sensitive equipment. Test results contained in the report provide useful information to traffic managers and packaging engineers.

Kenworthy, M
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/05.I, July 1979, 125 p.

Contract DOT-FR-64113

ACKNOWLEDGMENT: NTIS
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PB-301219/2ST, DOTL NTIS

02 305734
TRANSPORTATION OF VIBRATION SENSITIVE EQUIPMENT BY HIGHWAY TRAILER ON AN INTERMODAL RAILCAR. VOLUME II. TEST DATA
The report includes the results of a cooperative research project between Government and industry to explore the potential for the use of highway trailers on intermodal railcars (Trailer on Flatcar) or (TOFC) to transport vibration sensitive lading. The industrial participants in the study were the Boston and Maine Railroad, the Digital Equipment Corporation and Mooney Moving and Storage (representing Allied Van Lines). The purpose of the project was to characterize the operating environment of TOFC during the transport of vibration-sensitive teletypewriters. To this end, the lading, two types of trailers and the conventional TOFC flatcar were instrumented to quantify the shock and vibration environment during typical over-the-road revenue operation. The trailers used were a conventional railroad-owned leaf-spring trailer and an air-ride moving van. Various measurements of the accelerations experienced by the lading as well as the TOFC components were taken during the road test. The test was conducted using a special train operating over sections of the main line tracks and yards of the B&M Railroad between Boston and Mechanicville, NY. Test equipment, test procedures and data processing techniques used are discussed in the report. The results of the test indicated that the ride quality of both types of trailers are similar and that TOFC is feasible for the transportation of vibration-sensitive equipment. Test results contained in the report provide useful information to traffic managers and packaging engineers.
See also Volume 1, PB-301 219.

Kenworthy, M
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/05.II, July 1979, 356 p.

Contract DOT-FR-64113

ACKNOWLEDGMENT: NTIS
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PB80-114655, DOTL NTIS

02 308257
AERODYNAMIC FORCES ON FREIGHT TRAINS-VOLUME IV WIND TUNNEL TESTS OF FREIGHT CARS AND NEW TRAILER AND CONTAINER CAR DESIGNS
The aerodynamics of freight trains has been the subject of a series of reports in a continuing investigation. Volume 1 reported on a wind tunnel investigation of trailer on flatcar and container on flatcar tests; Volume 2, a full scale test of trailers on flatcars; and Volume 3 covered the correlation of the full scale tests and wind tunnel tests. This Volume 4 reports on a wind tunnel investigation of a variety of freight car, locomotive, and new trailer and container car configurations. Aerodynamic forces have been measured on a variety of different railroad freight car configurations. The first configuration consisted of blocks arranged in a train and the tests were to obtain information on the interaction between the blocks for different spacings and height. Next, a series of railroad freight cars and locomotives

were tested to obtain aerodynamic forces on them, both in a train of similar cars and with different cars. All cars were tested with a flatcar in the leading and trailing positions as a measure of the largest forces that might occur. The final series of tests were for various new railroad cars designed for trailers and containers. These cars were tested with their different design loadings.

Hammitt, AG
Hammitt (Andrew G) Associates, Federal Railroad Administration Final Rpt. FRA/ORD-76/295.IV, AGH 12-002-79, June 1979, 184 p., Figs., Tabs., 5 Ref.

Contract DOT-FR-8058

ORDER FROM: NTIS

PB80-174899, DOTL NTIS, DOTL RP

02 308259
NUMERICAL DETERMINATION OF CONTACT PRESSURES BETWEEN CLOSELY CONFORMING WHEELS AND RAILS. TECHNICAL REPORT NO. 8

A numerical method is developed for the determination of the contact pressure that arises when two elastic bodies with closely conforming non-Hertzian frictionless surfaces are pressed together. The method is a generalization of that recently developed by the authors for the case of counterformal contact, and includes a technique for automatically generating meshes that overlay the changing (load-dependent) contact patches. The method has been implemented in a computer program called CONFORM, and has been applied to problems of wheel and rail contact. The results have been verified by comparison with those generated by an independent program for the special case of relatively light wheel loading, where the contact is known a-priori to be essentially counterformal. The results given herein for a relatively heavy (but realistic) wheel loading on the throat of the flange represent the first known solution for conformal contact between a railroad wheel and rail.

Paul, B Hashemi, J
Pennsylvania University, Philadelphia, Federal Railroad Administration Tech Rpt. FRA/ORD-79/41, MEAM Rpt. 79-4, July 1979, 28 p., 8 Fig., 3 Tab., Refs.

Contract DOT-OS-60144

ACKNOWLEDGMENT: NTIS
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PB80-120462, DOTL NTIS, DOTL RP

02 308262
RAIL-WHEEL GEOMETRY ASSOCIATED WITH CONTACT STRESS ANALYSIS. TECHNICAL REPORT NO. 6

This report records the derivation of a number of results pertaining to wheel and rail geometry that are needed for the analysis of contact stresses and rolling-creepage phenomena. In particular, results utilized in the authors' computer programs COUNTACT (for COUNTerformal contACT problems) and CONFORM (for CONFORMal contact problems) are given. It is shown how the profile curves specified by engineering drawings for standard wheels and rails may be analyzed to find appropriate parameters needed to express the pertinent equations in the various coordinate systems utilized in contact stress analysis. For arbitrarily selected points of initial contact on the wheel tread and on the railhead, it is shown how to determine the feasibility of such contact, and how to determine the mutual separation of points on the two surfaces. It is also shown how to determine the curve of interpenetration which is used as an initial estimate of the contact patch boundary associated with a given relative approach (due to elastic deformation) of the loaded wheel and rail. The basis of a computer program (MIDSEP) to determine this separation is described.

Paul, B Hashemi, J
Pennsylvania University, Philadelphia, Federal Railroad Administration Tech Rpt. FRA/ORD-78/41, MEAM 79-6, Sept. 1979, 27 p., Figs., Refs., 1 App.

Contract DOT-OS-60144

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PB80-142656, DOTL NTIS, DOTL RP

02 308268
LATERAL RESISTANCE OF SOME NEW AND RELAY RED OAK CROSSTIES

To explore the effect of in-service use, comparative lateral resistance tests were performed on eight red oak crossties--four 24-year-old relay (used) ties and four new ties. One end of each tie was tested individually and the other was tested in a four-tie-group test. The ties were tilted to a 1 in 2 slope and the rail was loaded plumb. Displacements of the rail head and base were recorded as a function of load. Measured wood properties of small specimens from the relay ties were found to be comparable to properties of specimens from the new ties. Only one tie (individual, new) had the spikes bend (into an S shape) during the lateral resistance tests, but the rail base displaced laterally less than 0.5 inch at an applied load of 130,000 pounds.

Murphy, JF
Forest Products Laboratory, Federal Railroad Administration Final Rpt. FRA/ORD-79/03, Sept. 1979, 67 p., Figs., Tabs., 4 App.

Contract DOT-AR-74337

ACKNOWLEDGMENT: NTIS
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PB80-127012, DOTL NTIS, DOTL RP

02 308269
RESISTANCE OF A FREIGHT TRAIN TO FORWARD MOTION--VOLUME II, IMPLEMENTATION AND ASSESSMENT

This interim report is a supplement to a previous report and documents the results of the second portion of an investigation of the train resistance phenomenon. This portion of the effort was specifically directed toward determination of possible fuel savings to be effected through certain design improvements or equipment modifications when a freight train is operated over normal track, including grades and curves. The results of 52 simulated runs of various freight trains over various tracks, both real and artificial, are reported. The simulations show that fuel savings are not directly proportional to reductions in train resistance and that under certain circumstances only a portion of the theoretically attainable fuel savings can be achieved. It is also shown that fuel savings attributable to certain of these modifications are quite dependent upon the nature of the operation in which they are used. Within limits, the computer program developed during this study can be used to determine the fuel consumption of an arbitrary train operated over an arbitrary track to perform sensitivity analyses with respect to locomotive assignment policy, operational speed limit, and the like, and to determine the effect of design improvements or equipment modifications upon fuel consumption under normal operating conditions. The computer program which performs the calculation is explained in detail and the rationale behind its development is given. An example of the results from a separate plotting routine, which plots from the data generated a velocity profile on which is superimposed the instantaneous fuel consumption rate, is given. Complete information on trains and tracks used to generate the material for the report is given in an appendix.

See also FRA/ORD-78/04.I, Volume I,--Methodology and Evaluation, published April 1978, and FRA/ORD-78/04.III, Volume III,--Sensitivity and Computer Program.

Muhlenberg, JD
Mitre Corporation, Federal Railroad Administration Intrm Rpt. FRA-/ORD-78/04.II, MTR-79W00010, Apr. 1979, 164 p., Figs., Tabs., 15 Ref., 5 App.

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
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PB80-118326, DOTL NTIS, DOTL RP

02 308276
CONTACT STRESSES ON BODIES WITH ARBITRARY GEOMETRY, APPLICATIONS TO WHEELS AND RAILS. TECHNICAL REPORT NO. 7

A general formulation of frictionless contact stress problems is given. An inverse iterative method is introduced, which converts the problem to the solution of an integral equation subject to a boundary condition. By modifying the previously described simply discretized method, and by introducing an automatic mesh generating procedure for the changing contact region, it has been possible to solve the integral equation for pressure distribution and the contact patch, numerically. The method has made major improvements in the generality, stability, accuracy and efficiency of the numerical procedure. The method has been verified by comparison with known solutions for the Hertzian case. Several numerical examples of counterformal and conformal problems have been solved, which include the first known solutions of non-Hertzian counterformal and conformal contact of a railroad wheel and rail. The mesh generation and boundary iteration

procedure introduced is applicable to a wider class of problems with changing boundaries, such as: determination of wheel-rail adhesion-slip boundary, determination of elastic-plastic interfaces for residual stress problems, etc.

Hashemi, J Paul, B
Pennsylvania University, Philadelphia, Federal Railroad Administration Tech Rpt. FRA/ORD-79/23, MEAM Rpt. 79-2, Apr. 1979, 130 p., Figs., Tabs., 18 Ref.

Contract DOT-OS-60144

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02 308277
TRUCK DESIGN OPTIMIZATION PROJECT PHASE II. ANALYTICAL TOOL ASSESSMENT REPORT
One of the objectives of the Truck Design Optimization Project (TDOP) Phase II is to define the performance of newer Type II freight car truck designs versus the standard, three-piece Type I truck. To accomplish this dynamic performance evaluation, TDOP Phase II will utilize field test data and analytical tools. The analytical tools, consisting primarily of freight car truck simulation models and their supporting computer programs, will be used to extend and interpret the field test results. The purpose of this report is to document the selection of candidate analytical tools from existing models and computer programs for validation and for use in TDOP Phase II. This report establishes the assessment criteria, surveys 59 existing analytical tools, evaluates in detail 16 of the more promising, and from these, selects a set of tools for validation and subsequent use on TDOP Phase II.

The TDOP Phase II Analysis Plan (FRA/ORD-78/34) is a companion document to this report.

Johnson, L Gilchrist, A Healy, M Bush, C Sheldon, G
Wyle Laboratories, Federal Railroad Administration Tech Rpt. FRA-/ORD-79/36, TDOP Tech Rpt. TR-06, Aug. 1979, 57 p., Figs., Tabs., 1 App.

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PB80-104888, DOTL NTIS, DOTL RP

02 311011
LABORATORY INVESTIGATION OF TRACK GAUGE WIDENING CHARACTERISTICS
This report presents the results of a series of track gauge widening tests conducted at the Association of American Railroad's Track Structures Dynamic Test Facility. The tests investigated the gauge widening behaviour of conventional track structure under various combinations of vertical, lateral and longitudinal loads. The effect of single axle vs dual-axle loading and static vs dynamic lateral loading were also examined. The tests indicated that under loading representative of that imposed by traffic, significant widening of the track gauge can occur. It was further observed that the level of damage to the tie--fastener interface can be measured and evaluated by means of gauge widening type testing and that the potential exists for conducting "nondestructive" gauge widening tests in service track.

Zarembski, AM Choros, J Gitlin, I. FRA/ORD-80-33
Jan. 1980, pp 281-305, 17 Fig., 13 Ref.

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PB80-222003, DOTL RP

02 313979
AERODYNAMIC FORCES ON VARIOUS CONFIGURATIONS OF RAILROAD CARS FOR CARRYING TRAILERS AND CONTAINERS. WIND TUNNEL TESTS OF SIX SCALE MODEL CONFIGURATIONS
Toward improving the energy efficiency of rail intermodal service, the aerodynamic characteristics of the rolling stock offer a significant opportunity for betterment. At speeds above 45 miles per hour more than half of the resistance of an intermodal train is caused by the aerodynamic drag of the cars and their loads. Methods by which the aerodynamic drag may be minimized are, therefore, of considerable interest to railroads and car designers. This report covers the wind tunnel testing of scale models of railcars for carrying trailers and containers. The purpose was twofold: First, to determine whether significant differences in the aerodynamic characteristics of such scale models could be measured in the wind tunnel showing that it could be utilized as an evaluation tool in future railcar design programs and, second to obtain comparative performance data on five new intermodal railcar configurations.

See also Volume 4, PB80-174899.

Hammitt, AG
Hammitt (Andrew G) Associates, Federal Railroad Administration Final Rpt. FRA/ORD-79/39, 12-101-79, Jan. 1979, 95 p.

Contract DOT-FR-8058

ACKNOWLEDGMENT: NTIS
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PB80-174881, DOTL NTIS

02 314015
USERS' MANUAL FOR LATERAL STABILITY COMPUTER PROGRAMS FOR RAILWAY FREIGHT CAR MODELS
The dynamic performance of a rail vehicle is characterized by its curving behavior, vibration response and stability. The stability of a linear system can be studied by such classical methods as Eigenvalue/Eigenvector analysis. This report is a Users' Manual for four programs written in Fortran IV that use the Eigenvalue/Eigenvector analysis to determine the lateral stability of the 9, 17, 19, and 23 degree of freedom linearized models of the North American Freight Car. The program input, output, and the subroutines used are described herein and the results are in the form of printout. The manual includes program listings, sample deck setups and sample run outputs.

Prepared in cooperation with Arizona State Univ., Tempe. Dept. of Mechanical Engineering.

Hague, I Cooperrider, NK
Clemson University, Federal Railroad Administration Intrm Rpt. FRA/ORD-80/30, Apr. 1980, 254 p.

Contract DOT-OS-40018

ACKNOWLEDGMENT: NTIS
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PB80-176266, DOTL NTIS

02 314049
RESPONSE ANALYSES OF A BOXCAR WITH COMPLIANT LADING FOR SEVERAL TRACK PROFILE AND HUNTING CONDITIONS
The simulation in the FRATE computer program (Freight Car Response Analysis and Test Evaluation) was modified from a flexible TOFC (trailer on flatcar) to a rigid boxcar with compliant lading. Analyses were performed to obtain the response of boxcar elements and compliant lading to several track profile and body hunting conditions. Three types of track profile irregularities were simulated: (1) a single vertical irregularity on both rails, (2) a single vertical irregularity on one rail and (3) rectified sine representations of staggered joint bolted rail. Hunting conditions were simulated by imposing sinusoidal lateral motions at the wheel rail interface. Worst case conditions resulted in wheelrail separations and in potentially damaging accelerations of the lading.

Kachadourian, G Sussman, NE
Mitre Corporation, Federal Railroad Administration Tech Rpt. FRA-/ORD-80/4, MTR-79W00317, Apr. 1980, 90 p.

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PB80-177637, DOTL NTIS

02 314052
TOFC (TRAILER ON FLATCAR) LADING RESPONSE ANALYSES FOR SEVERAL TRACK PROFILE AND HUNTING CONDITIONS
The computer program FRATE is a non-linear, time domain digital computer program developed under Federal Railroad Administration sponsorship for the purpose of studying freight car response dynamics. The trailer on flatcar (TOFC) simulation contained in FRATE was expanded, for the purposes of the analyses of this report, to include a compliant lading representation. The compliant lading consisted of two spring mounted masses in each trailer with vertical, lateral and roll degrees of freedom. Analyses were performed to obtain the response of the TOFC vehicle and compliant lading to several track profiles and body hunting conditions. The

analysis results characterize the response of a standard TOFC configuration to typical service conditions. Undesirable response conditions are noted and recommendations are made for improvements.

Kachadourian, G
Mitre Corporation, Federal Railroad Administration Tech Rpt. FRA-/ORD-80/3, MTR-79W00318, Apr. 1980, 73 p.

Contract DOT-FR-54090

ACKNOWLEDGMENT: NTIS
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PB80-178171, DOTL NTIS

02 314067
THEORETICAL MANUAL AND USERS' GUIDE: LONGITUDINAL-VERTICAL TRAIN ACTION MODEL
A mathematical model for simulating the longitudinal-vertical motion of railroad cars in impact situations is described in this document. Development and validation of the model was part of a study concerned with the phenomenon of coupler bypass resulting from impact or squeeze. The model represents each car as an idealized dynamic system, consisting of springs, masses and dampers and possessing up to 6 degrees of freedom (12 state variables) per car. The degrees of freedom correspond to the longitudinal, vertical and pitching motion of car bodies, lading motion, and truck motion (front and rear separately). The model is capable of representing friction draft gears as well as hydraulic cushioning devices. The model accounts for friction between truck side frame and bolster, possible separation of the truck center plate from the truck bolster and coupler disengagement. A limitation of the model is that, in the absence of more accurate information, the force-deflection relationship of car underframes is represented by linear springs. However, it can be readily modified to represent non-linear force-deflection relationships once those relationships are quantified.

Yin, SK
Washington University, St Louis, Federal Railroad Administration Tech Rpt. FRA/ORD-76/278, Apr. 1980, 69 p.

Contract DOT-OS-40106

ACKNOWLEDGMENT: NTIS
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PB80-180557, DOTL NTIS

02 319047
A DESCRIPTION OF THE TESTS CONDUCTED AND DATA OBTAINED DURING THE PERTURBED TRACK TEST
This report describes the Perturbed Track Test, Pilot Test and Freight Test conducted at the Transportation Test Center in Pueblo, Colorado, in November and December 1978, August 1978, and February 1979, respectively. The tests involved two typical AMTRAK six-axle locomotives and two typical four-axle freight locomotives. The report documents the objectives of the test, the preparation, the test conduct, the data obtained, and the potential uses of the data. Discussions of instrumentation effectiveness and track geometry measuring procedures are included, and selected typical results are presented.

Coltman, M Brantman, R Tong, P
Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/15, DOT-TSC-FRA-80-3, Jan. 1980, 330 p., Figs., Tabs., 14 Ref., 2 App.

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PB80-16582, 2 DOTL NTIS, DOTL RP

02 319048
MEASUREMENTS OF WHEEL/RAIL LOADS ON CLASS 5 TRACK
Measurements have been made on two tangent test sections and a curved test section to characterize the wheel/rail load environment on Class 5 track. The tangent-track test sections included a 3-mile length of bolted-joint rail under a 3-mile length of continuous welded rail. Wayside measurements of loads under passing revenue traffic were obtained from randomly located strain gage patterns on the rail, while an instrumented 100-ton freight car was run over the test sections at a range of speeds to define the load spectrum from the vehicle. Joint impact loads were defined from the instrumented wheelset measurements, while special wayside measurements were included to define the influence of wheel flats. Additional measurements were obtained from the on-board instrumentation over a test section that included two 6-degree, 6-inch superelevation curves. This report presents the data obtained from these measurements and describes the wayside and vehicle-borne instrumentation, the experiment design and operation, and the data reduction and analysis approach employed. Statistical summaries of the load environments are presented.

Ahlbeck, DR Johnson, MR Harrison, HD Tuten, JM
Battelle Columbus Laboratories, Illinois Institute of Technology, Federal Railroad Administration Final Rpt. FRA/ORD-80/19, DOT-TSC-FRA-80-6, Feb. 1980, 292 p., Figs., Tabs., Refs., 6 App.

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PB80-196868, DOTL NTIS, DOTL RP

02 319052
ANALYTICAL METHODS FOR FREIGHT CAR/TRUCK DYNAMIC PROBLEMS
The analytical methods used to synthesize mathematical models of an 80-ton open hopper railroad car are presented in this report. The work described herein was performed as part of the Track-Train Dynamics program by the Analytical Mechanics Section, Martin Marietta Corporation, Denver Division. This effort was directed toward accurately characterizing the dynamic behavior of this specific railcar configuration. In a larger sense, model formulation and solution using the methods detailed here serve as a potential approach to the characterization of other railcar configurations. The report details the formulation of a nonlinear model including the carbody, trucks, and wheel/rail interactions. In particular hunting stability of the railcar was investigated, and analytical results were compared to actual test data. Test/analytical correlation was very good.

Martin Marietta Corporation, Federal Railroad Administration Tech Rpt. FRA/ORD-80/29, MCR-80-531, July 1980, 54 p., Figs., 5 Tab., 7 Ref.

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PB80-219389, DOTL NTIS, DOTL RP

02 319060
MATHEMATICAL MODELING OF DODX RAILCARS
This report presents the results of a project conducted to determine the roll stability characteristics of large capacity freight cars, 100 to 200 ton, loaded with high center of gravity containers. The model, obtained from AAR, is a 22 degree-of-freedom, non-linear, time domain model of railcars equipped with two axle trucks. The model was modified to include hydraulic dampers, an improved Coulomb friction damping model, and a track input to simulate perturbed track specified in AAR specification D-65. Also a lower order integration technique and a larger integration technique and a larger integration stepsize were employed to reduce computer run time. The model was validated against each of four vehicles on which full scale field tests had been conducted. In three of the four cases sufficient agreement was found between the results of the model and those of the field test to proceed with further simulations of other load/suspension configurations. Results of these simulations suggest that improvement in roll stability can be achieved by reducing the vehicle suspension spring rate or similarly increasing the load. It was also found that one of the vehicles studied possessed a dead band in the stroke of the hydraulic stabilizer. By modifying this stabilizer to operate over the full stroke, vehicle dynamic performance should show improvement.

Jones, CT
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-78/47, DOT-FR-77-20, Feb. 1980, 168 p., Figs., 7 Ref., 5 App.

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02 325730
PLATE INSTRUMENTED WHEELSETS FOR MEASUREMENT OF WHEEL/RAIL FORCES
Strain gauge instrumented wheelsets are an important research tool in experimental rail vehicle testing. This report expounds the principle of operation of the instrumented plate type of wheelset which is constructed by

the scientifically exact application of strain gauges on the plate region of railroad wheels so that the wheelset is transformed into a sophisticated force transducer. An example of the application of the principles expounded is presented for a locomotive wheelset having wheels with S-shaped plate regions and 40-in. (1016-mm) diameters. The corresponding measurement system that utilizes such instrumented wheelsets is synopsized. This information is useful to railroads and other research groups interested in measuring wheel/rail forces.

Thompson, WI, III
Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/58, DTS-733, Oct. 1980, 65p, 19 Fig., 3 Tab., 1 App.

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02 325736
G-SENSING DERAILMENT DETECTOR. FINAL REPORT
This report describes procedures used to arrive at design concepts for a displacement sensitive derailment sensor. It summarizes and analyzes wheel and coupling shock and vibration data derived from over-the-road and derailment- field tests as well as data derived from computer simulations of the track environment and wheel fall from the track. Also described are physical tests of several computer-defined derailment sensor models. Based on the results of these tests, a prototype derailment sensor having an iron seismic mass which is part of a magnetic damping circuit was designed and tested in the laboratory and at the Transportation Test Center, Pueblo, Colorado. Two electronic signal processing methods are discussed which showed feasibility for monitoring seismic mass position and damping coil voltage and determining if the respective position or velocity criterion for derailment was met. Finally, a discussion and analysis of a possible means of using the rail car's vertical motion to produce electrical energy for recharging a battery to run low power signal processing circuits is presented.

Nance, P
Naval Surface Weapons Center, Department of Transportation FRA-/ORD-80/75, Oct. 1980, 69p, Figs., 3 Tab.

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PB81-127466, DOTL NTIS, DOTL RP

02 325739
USER'S MANUAL FOR LINEAR FREIGHT CAR FORCED LATERAL RESPONSE ANALYSIS COMPUTER PROGRAM
This manual documents a FORTRAN IV computer program that solves for the forced lateral sinusoidal and random response of a linear, 9 degree-of freedom freight car. The vehicle model represents the lateral dynamics of typical North American freight cars equipped with three piece trucks. Responses to both roadbed center-line alignment and cross level irregularities are computed. The response is calculated using frequency domain techniques. The steady state sinusoidal transfer functions are computed, response power spectral densities obtained and R.M.S. values found by integration of the power spectra. Plots of selected output power spectra are prepared. The manual briefly describes the vehicle and roadbed model and the solution technique. The program description, a sample run and a complete program listing are included.

Cooperrider, NK Law, EH
Arizona State University, Tempe, Clemson University, Federal Railroad Administration Intrm Rpt. FRA/ORD-80/85, Dec. 1980, 58p, 6 Fig., 1 App.

Contract DOT-OS-40018

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DOTL RP

03 097307
COOPERATIVE RESEARCH EFFORT AMONG RAILROADS, RAILROAD ASSOCIATIONS, INDUSTRY AND GOVERNMENT
This 11th Annual Railroad Engineering Conference, now sponsored by the Federal Railroad Administration, had as its purpose: To provide a forum for parties interested in the promotion, well-being and progress of the free system of transport by rail to discuss the engineering aspects of railway freight equipment and its interface with track structure and thereby formulate answers to problems and develop advancements in the state of the art. Transcripts of 12 addresses and the 13 technical papers presented at the four sessions are included.

Proceedings of the 11th Annual Railroad Engineering Conference held at Southern Colorado State College, Pueblo, Colorado, October 23-24, 1974, some individual papers from this conference have been accessioned separately for RRIS. The following is a list of the RRIS numbers of these papers preceded by its section number as it is contained in the bulletin: 03 097308, 03 097309, 13, 097310, 04 097311, 03 097312, 03 097313, 04 097314, 03 097315, 03 097316, 03 097317, 03 097318, 03 097319.

Federal Railroad Administration FRA-ORD/D-75-73, Apr. 1974, 113 pp, Figs., Phots.

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03 099355
ODOMETERS FOR RAIL APPLICATION
Available mileage counters were evaluated, anticipating the possibility of using mileage intervals, rather than elapsed time, for freight car inspection. Simple, reliable and reasonably low costing devices were required. Only two unpowered mileage counting odometers were uncovered, one built in the U.S., the other in Switzerland. The Swiss device is not currently available in this country, presumably because of its particular suitability to European style trucks. The American built device was tested in eccentric rotation and for accuracy at both low and average freight car speeds. It was concluded that the American unit could serve satisfactorily in freight service, without modification, at what would appear to be acceptable cost levels.

This project was sponsored by US DOT, Federal Railroad Administration's Office of Research and Development.

Seekell, FM
Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-75-9) Intrm Rpt. FRA OR&D-75-70, May 1975, 16 pp, 4 Fig.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. pC, Microfiche
PB-244460/2ST, DOTL NTIS

03 099362
EFFECTS OF LONGITUDINAL IMPACT FORCES ON FREIGHT CAR TRUCK BOLSTERS
The design of truck bolster center plate rims was investigated as a result of increased reports of their failure on 100-ton capacity freight cars. The damage occurs when cars are coupled at moderate to high speeds, since the rapid deceleration of the truck causes high loads between the truck and body bolsters. Test measurements were made on an unloaded 100-ton hopper car impacting a string of loaded cars. The forces between the truck and body bolsters on the moving car were determined at impact speeds from 2.9 to 9.2 mph. Tests were made with two different energy absorbing capacities of draft gear. Loads at the truck-bolster/body-bolster interface averaged approximately 40,000 lbs for impact velocities up to 5 mph and reached 100,000 lbs at 7 mph. A peak load of 160,000 lbs was measured at 8.4 mph. Within the lower speed range there were no significant differences in load associated with the two draft gear, but at 6.7 mph the loads with the higher capacity gear were 25 percent less. Strain gages placed near the center rim indicated yielding on the first impact at 2.9 mph. Additional yielding continued as the impact velocity was increased. A finite-element stress analysis showed that loads of the magnitude measured on the test would cause severe stresses in the center plate rim and that yielding of the material would be expected. Several potential modifications of the truck bolster center plate rim were analyzed which showed that significant improvements could be obtained by making the rim wider and by increasing the radius of the fillet at the inside of the rim.

The project was sponsored by US DOT, Federal Railroad Administration's Office of Research and Development. IIT Research Institute was under contract to US DOT, Transportation Systems Center.

Johnson, MR
IIT Research Institute, Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-74-7) Final Rpt. FRA ORD&D-75-10, Sept. 1974, 42 pp, 18 Fig., 2 App.

Contract DOT-TSC-727

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244225/9ST, DOTL NTIS

03 126978
FRACTURE RESISTANCE OF RAILROAD WHEELS
The effects of manufacturing method, chemical composition, heat treatment, temperature, and loading rate on the plane strain fracture toughness KIC of railroad wheels have been determined. Carbon content of the wheels is shown to be the principal factor which controls their toughness. One hundred wheels which fractured in service are analyzed by means of fracture mechanics procedures. The locations, configurations, and size of thermal and plate cracks which initiated brittle fracture are reviewed, and estimates made of the stress levels which resulted in failure. Estimates have been made of the minimum size of crack which could result in the failure of wheels under adverse service conditions. These are discussed with respect to the minimum size of defect which can be reliably detected by NDT. Included in the report are state-of-the-art reviews on thermal and plate cracking and on the stresses developed in railroad wheels.

Sponsored by FRA.

Carter, CS Caton, RG
Boeing Company, (DOT-TSC-FRA-74-10) Intrm Rpt. FRA-ORD&D-75-12, Sept. 1974, 216 pp, Figs., Tabs., Phots., 45 Ref., 3 App.

Contract DOT-TSC-617

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB243638/AS, DOTL NTIS

03 127844
FREIGHT CAR TRUCK DESIGN OPTIMIZATION PROJECT. DETAILED TEST PLANS FOR SERIES 4
This document presents the detailed test plans for Series 4 Tests of Phase I of the Truck Design Optimization Project. It is a continuation of a previous report presenting the introduction and the detailed test plans for Series 1, 2, and 3 Tests, for Phase I of the same project. It describes the modifications to the trucks to be made prior to testing and lists the instrumentation to be used and the sequence of testing. The reader is referred to the previous document for details of the instrumentation and the data analysis.

This study was sponsored by Federal Railroad Administration, DOT. This report is a prerequisite to the report Freight Car Truck Design Optimization, Introduction and Detailed Test Plans-Series 1,2 and 3.

Southern Pacific Transportation Company, Federal Railroad Administration, (TDOP 75-152) Intrm Rpt. FRA OR&D 75-60, Aug. 1975, 23 pp, 4 Fig., 2 Tab.

Contract DOT FR 40023

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-246389/1ST, DOTL/NTIS

03 132965
PROGRESS REPORT ON THE TRUCK DESIGN OPTIMIZATION PROJECT
The Federally funded Truck Design Optimization Project (TDOP) is being conducted by Southern Pacific Transportation Company to furnish new technical and economic insights into the procurement and use of freight car trucks. A variety of outputs are emerging, including digital data tapes that may prove useful to future investigators of freight car truck dynamics. TDOP will furnish railroads with technical and economic information on freight car truck performance. Performance data is required to correct existing problems and establish future truck system needs. Phase I effort is anticipated to include technical performance specifications and an economic methodology for use in evaluating trucks.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958.

Byrne, R (Southern Pacific Transportation Company)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 59-64, 15 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

NTIS PB-252968/AS, DOTL NTIS, DOTL RP

03 132966
IMPROVED SUSPENSION FOR 100-TON CARS ON ROUGH TRACK

American Steel Foundries set out to develop a freight car suspension defined as a highly refined, state-of-the-art, three-piece truck designed as a system rather than a collection of components. This article discusses suspension reserve work capacity, optimum damping, design process, ride quality findings in the vertical, lateral and rocking modes, and the determination of the wheel-rail forces as evidenced by factors such as flange wear and truck component wear.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958.

Love, RB (American Steel Foundries)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 65-73, 20 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-252968/AS, DOTL NTIS, DOTL RP

03 132967
TRUCK DESIGN-A SYSTEMS APPROACH TO SOLVING PROBLEMS

The responsibility for freight-car truck design is difficult to fix. After examining the functions of various agencies involved in design, truck problems are examined. Two areas for improved truck performance are modification of existing trucks to improve reliability and complete redesign to improve performance.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Hawthorne, VT (Dresser Transportation Equipment Division)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 74-78, 9 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-252968/AS, DOTL NTIS, DOTL RP

03 132968
DESIGN SYSTEM APPROACH TO PROBLEM SOLVING

A systems approach to improved truck design has involved mathematical modeling and then field testing of arrangements for modification of existing trucks and for a completely redesigned radial truck. Railway Engineering Associates has worked with Canadian National Railways and with Dresser Industries in various phases of this self-steering truck. The economics of this method of controlling the tracking characteristics of the basic three-piece truck must still be worked out.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

List, HA (Railway Engineering Associates, Incorporated)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 79-84, 18 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-252968/AS, DOTL NTIS, DOTL RP

03 132969
MODIFIED THREE-PIECE TRUCK REDUCES HUNTING AND IMPROVES CURVING-STATUS REPORT

The often-condemned three-piece cast steel freight truck has two advantages: It is inexpensive to manufacture and it has excellent load equalization that allows it to negotiate large changes in crosselevation. This paper describes Standard Car Truck's work with the Anchor Truck design of the South African Railways which improves the basic three-piece truck's curving ability and yet gives it high-speed stability. Utilizing the creep theory in which a wheel is displaced from its position of pure rolling, various conclusions are drawn about wheelset and truck stability. The role of the SAR-developed diagonal anchors and the service experience on SAR's ore car and with a US installation on a 100-ton hopper are described.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Bullock, RL (Standard Car Truck Company)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 85-92, 16 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-252968/AS, DOTL NTIS, DOTL RP

03 147702
LOCOMOTIVE CAB DESIGN DEVELOPMENT. VOLUME 1: ANALYSIS OF LOCOMOTIVE CAB ENVIRONMENT & DEVELOPMENT OF CAB DESIGN ALTERNATIVES

This report presents an analysis of the line haul freight engineer's working and living environment, the resultant locomotive cab design and design alternatives. The analysis is based on a delineation of functional requirements found in current line haul operations together with those additional requirements which could arise during the next 10-15 years. The recommended design is the result of a detailed human factors engineering analysis of these requirements according to state-of-the-art criteria and system design practices. Substantial engineering analysis was devoted to the recommended design; this included disciplines of cost, occupant protection, component and subsystem reliability, and system safety analysis.

Research was sponsored by the DOT, FRA, Office of Research and Development, under contract to the Transportation Systems Center, Cambridge, Massachusetts.

Robinson, J Piccione, D Lamers, G
Boeing Vertol Company, (DOT-TSC-FRA-76-22-1) Intrm Rpt. FRA-/OR&D-76/275.1, Oct. 1976, 206 pp, Figs., Tabs., 3 App.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-262976/4ST, DOTL NTIS, DOTL RP

03 147703
LOCOMOTIVE CAB DESIGN DEVELOPMENT. VOLUME 2: OPERATOR'S MANUAL

Locomotive Cab 913 designed as a result of Contract DOT-TSC- 913 has been built as a hard mock-up. This Operator's Manual is to familiarize the user with the mock-up. Normal and emergency procedures and cab facilities are described.

Research sponsored by the DOT, FRA, Office of Research and Development, under contract to the Transportation Systems Center, Cambridge, Massachusetts.

Robinson, J Piccione, D
Boeing Vertol Company, (DOT-TSC-FRA-76-22-2) Intrm Rpt. FRA-/OR&D-76/275.2, Oct. 1976, 42 pp, 10 Fig.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-264114/AS, DOTL NTIS

03 147704
LOCOMOTIVE CAB DESIGN DEVELOPMENT. VOLUME 3: DESIGN APPLICATION ANALYSIS

In Volume II of this service of reports on Locomotive Cab Design Development, changes were recommended in the layout and equipment content of locomotive cabs. This report studies the impact of these changes on the interface of the cab with the rest of the locomotive, the required structure, the reliability, the development costs, and the cost of introduction to the operating locomotive fleet. In addition, this report assesses the uses of various techniques of mockup use during the development phases of the design.

Research sponsored by the DOT, FRA, Office of Research and Development, under contract to the Transportation Systems Center,

Cambridge, Massachusetts.
Robinson, J
Boeing Vertol Company, (DOT-TSC-FRA-76-22-3) Intrm Rpt. FRA-/OR&D-76/275.3, Oct. 1976, 82 pp, Figs., 8 Tab., 3 Ref.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-264115/AS, DOTL NTIS, DOTL RP

03 147711
EVALUATION OF PROTOTYPE HEAD SHIELD FOR HAZARDOUS MATERIAL TANK CAR
The structural integrity of a prototype tank car head shield for hazardous material railroad tank cars was evaluated under conditions of freight car coupling at moderate to high speeds. This is one of the most severe environments encountered in normal railroad service. Two versions of the shield were tested. They were installed on a DOT Spec. 112A340W tank car and instrumented to measure forces at the points of attachment between the shield and the car. Test data were obtained when the car was impacted into standing cars over a 3 to 9 mph speed range. The tests produced no visible damage to the shield or the structure connecting it to the tank car, but they demonstrated the presence of severe vibrations resulting from the car impact. The likelihood of fatigue damage was indicated in the connecting structural members where the weight of the shield was supported. Modifications to the supporting structure are recommended before proceeding with additional impact tests and over-the-road tests.

Research was sponsored by the FRA, Office of Research and Development, through the DOT's Transportation Systems Center.

Johnson, MR
IIT Research Institute, (DOT-TSC-FRA-76-8) Final Rpt. FRA/OR&D-75-96, Dec. 1976, 60 pp, 27 Fig., 1 Tab., 2 App.

Contract DOT-TSC-727

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-262430/2ST, DOTL NTIS, DOTL RP

03 151161
ULTRASONIC DETECTION OF PLATE CRACKS IN RAILWAY WHEELS
The results of experimental efforts established the feasibility of the detection of railway wheel plate cracks by an ultrasonic pulse echo testing technique from the tread surface. Feasibility and test sensitivities were established using artificial notches in a flat plate test reference and in full-size wheels. Concepts for manual inspection of stationary wheels and the automatic testing of moving wheels are described.

Sponsored by the FRA/U.S. DOT, through the Transportation Systems Center, U.S. DOT.

Becker, FL
Battelle Memorial Institute/Pacific Northwest Labs, Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-76-277, July 1976, 88 pp

Contract DOT-TSC-726

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-262644/8ST, DOTL NTIS

03 151221
FEASIBILITY OF FLAW DETECTION IN RAILROAD WHEELS USING ACOUSTIC SIGNATURES
The feasibility study on the use of acoustic signatures for detection of flaws in railway wheels was conducted with the ultimate objective of development of an intrack device for moving cars. Determinations of the natural modes of vibrating wheels under various conditions are reported. Differences in acoustic signatures are found between good and cracked wheels, including spectral changes and variations in the time decay of sound. Various sounds occurring in normal railroad practice, such as rolling noise on welded rail and over joints and retarder screech were investigated. It was concluded that special purpose impacters will have to be used for a servicable device. Pattern recognition techniques were used for selecting good and bad wheels with a computerized processing scheme. A laboratory demonstration system has been constructed and found to be 85% reliable when system malfunctions are discounted.

Prepared by Houston University, Texas, Department of Mechanical Engineering.

Nagy, K Finch, RD
Transportation Systems Center, Houston University, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-6, FRA/ORD-76/290, Oct. 1976, 206 p., Figs., Tabs., 27 Ref., 5 App.

Contract DOT-FRA-76-6

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-263248/7ST, DOTL NTIS, DOTL RP

03 154021
LTV/SIG METROLINER TRUCK TEST
No Abstract.

Set includes PB-265 134 thru PB-265 136, RRIS 154022 thru 154024; RRIS 03 154022-23,in RRIS 03 154024.

Vought Corporation, Federal Railroad Administration 3 Vols., 1975, 567 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-265133-SET/ST, DOTL NTIS

03 154022
LTV/SIG METROLINER TRUCK TEST. VOLUME I
This report presents the test plan and results for Phase 2 tests of the LTV/SIG Metroliner Truck. Section 4.0 is the test plan which was submitted to DOT/FRA on September 5, 1974. The test plan was approved by DOT/FRA before testing began. It became necessary to amend test procedure during the test program. The changes in test procedure were approved by DOT/FRA during the course of testing, and those amended procedures are described in Section 5.0 which also presents test results. An Additional Running Test followed Phase 2 tests, and the results of Additional Tests are presented.

Also available in set of 3 reports PC E09, PB-265 133-SET.

Sandlin, NH Bumgardner, HM Dean, FE Johnston, AW
Vought Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-76/251, Aug. 1975, 117 pp

Contract DOT-FR-20049

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-265134/7ST, DOTL NTIS

03 154023
LTV/SIG METROLINER TRUCK TEST. VOLUME II (SUSPENSION PARAMETER VARIATION TEST REPORT)
An additional running test program of the LTV/SIG Metroliner trucks was conducted with the objective of defining suspension system characteristics. The tests were conducted on revenue tracks of the Penn Central Railroad in the Northeast corridor between Washington, D.C. and Hudson, N.J. Testing began on February 28, 1975 and ended on May 7, 1975. A test train comprised of snack bar coach 850 and the fleet car, snack bar coach 855, was operated for a distance of 3657 miles. Test operations were conducted on 18 days, and a total of 65 runs was made. Three hundred and sixty-eight tests were conducted within the 65 runs. Tests were conducted with 21 different suspension system configurations. The final suspension system, tuned for optimum ride quality, demonstrated that Car 850 had a ride superior to Car 855. Test data also showed that Car 850 had a lower onboard noise level than Car 855. Data obtained during the test were sufficient to generate a load spectrum for the trucks and components when operated under the current Metroliner speed profile. In addition, load-to-speed relationships were obtained for the trucks and components.

See also Volume 1, PB-265 134. Also available in set of 3 reports PC E09, PB-265 133-SET.

Dean, FE Johnston, AW Sandlin, NH
Vought Corporation, Federal Railroad Administration Test Rpt. FRA-/ORD-76/252, Aug. 1975, 103 pp

Contract DOT-FR-20049

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-265135/4ST, DOTL NTIS

03 154024
LTV/SIG METROLINER TRUCK. FINAL DESIGN REPORT
The Vought Systems Division of the LTV Aerospace Corp. (LTV) in association with the Swiss Industrial Company (SIG) of Neuhausen Rhine Falls, Switzerland, has designed, manufactured, and tested the LTV/SIG Truck under contract to the Department of Transportation (DOT). The LTV/SIG Metroliner Truck design was derived from the SIG M-Type Truck. The primary design objective of the program, performed under contract to DOT, was to provide a truck having improved ride comfort at speeds to 160 mph for the Penn Central Metroliner route. The design features a welded steel frame and bolsters, a coil spring/bellcrank primary suspension, an air spring secondary suspension, and elastomeric components to minimize noise/vibration transmission. A worn wheel profile is used with its attendant advantages in wear and maintenance. Truck designs were completed to allow the use of either General Electric or Westinghouse propulsion systems. However, only the former configuration was completed through final assembly due to the unavailability of government-furnished Westinghouse traction equipment. Because most of the analysis and design was done in Switzerland, the metric notation is used extensively in this report.

See also volume 2, PB-265 135, RRIS 03 154023, 7702. Also available in set of 3 reports PC E09, PB-265 133-SET.

Bumgardner, HM Dean, FE Hall, DW, II
Vought Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-76/250, Aug. 1975, 345 pp

Contract DOT-FR-20049

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-265136/2ST, DOTL NTIS

03 154804
THE CAUSE OF THERMAL FATIGUE CRACKING IN METROLINER WHEELS
One new wheel and two used wheels (one with a thermal crack in the tread) were examined for mechanical properties, macrostructure, microstructure, and residual stresses. Similar examinations were conducted on three new wheels which were first subjected to various braking cycles designed to define the conditions that produce cracking. The braking tests were conducted on the laboratory dynamometer. The results of this study indicated that the wheel that had developed a thermal crack in service had been intermittently and severely heated around the tread surface and that such heating had altered the microstructure, produced residual tensile stresses and permitted the crack to initiate. The results further showed that neither altered microstructures nor cracking could be produced by many emergency brakings or speed-reduction brakings with normal brake shoes and forces.

Carpenter, GF
United States Steel Corporation, Federal Railroad Administration, Transportation Systems Center Final Rpt. 10-D-033(018-2), FRA-/ORD-77/17, Mar. 1977, 88 pp

Contract DOT-TSC-712

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-265751/8ST, DOTL NTIS

03 158197
STRESS MEASUREMENTS IN RAILROAD WHEELS VIA THE BARKHAUSEN EFFECT
The feasibility of utilizing the Barkhausen Effect in ferromagnetic steels as a nondestructive means for ascertaining residual stresses in railraod wheels was investigated. Railroad wheels are generally manufactured with compressive stress distributions in the rim to impede the propagation of fissures or thermal cracks caused by brake applications. In service, these compressive stresses may gradually become tensile, thus increasing the potential for wheel failure. Speciments examined using the Barkhausen noise measurement technique included four new wheels and two used wheels. Stress measurements form this nondestructive technique were compared with stress values determined by a dissection method of strain relaxation. Qualitative consistency in these data were observed, although testing of a larger data base will be required to determine the utility of the Barkhausen noise measurement technique for identifying those wheels which are potentially hazardous because of tensile stress buildup.

Sponsored by the FRA/U.S. DOT, through the Transportation Systems Center.

King, RR Barton, JR Perry, WD
Southwest Research Institute, Federal Railroad Administration, Transportation Systems Center, (DOT-TSC-FRA-76-32) Final Rpt. FRA-ORD-77/11, Feb. 1977, 86 pp, Figs., Tabs., 27 Ref., 4 App.

Contract DOT-TSC-713

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-271215/AS, DOTL NTIS

03 163790
LOCOMOTIVE CAB DESIGN DEVELOPMENTS
This is a status report on the development of a locomotive cab design predicated on human and other engineering disciplines which can lead to specifications for a cab that is in concert with operational and safety considerations. The development, sponsored by Transportation Systems Center, is based on a list of functional requirements derived from locomotive systems management tasks and train handling techniques. A mock up and a mobile idler car with the cab for controlling trailing locomotive units are also described.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Robinson, J (Boeing Vertol Company)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 33-44, 21 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

03 163795
FREIGHT DRAW GEAR SYSTEMS PAST-PRESENT-FUTURE
The evolution of the automatic coupler and the forces to which contemporary couplers are subjected are described. Current problems and forecasts of future requirements, including further automation, are then discussed.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Hinson, AE (Southern Railway Company)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 122-127, 13 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

03 163796
TRUCKS FOR 100 MPH FREIGHT SERVICE: DESIGN-PERFORMANCE-SAFETY-RELIABILITY
This paper describes the causes of unsatisfactory high speed performance of standard freight car trucks and the design philosophies which can avoid such problems. Test results and service experience with one such high-speed truck are detailed. Such a design provides a margin for future speed increases and offers reduced wear rates for present operations.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Weber, HB (Midland-Ross Corporation)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 128-137, 6 Fig., 1 Tab.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-272948/AS, DOTL NTIS

03 175266
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM TECHNOLOGY REVIEW. SEMIANNUAL REPORT
The status of three foreign rail technologies is analyzed in this the first of four semiannual reports. The three technologies are tilting car body mechanisms, pantographs, and passenger train brake systems. Tilting car bodies are used to increase train speed in curves while remaining within the safety requirements of overturning moment and the established levels of passenger comfort. Systems being developed in Europe and Canada are discussed. As train speeds increase in electrified corridors, power collection becomes a problem due to uneven track and catenary undulations. Slow response time due to pantograph mass is being overcome by staged pantographs where the final element is small and thus can respond to rapid changes in distance between the car roof and catenary. Two-stage pantographs and pantographs for tilting car bodies are discussed. Increasing train speeds on existing corridors requires improved braking systems so as not to exceed present signaling installations and corridor stopping distances. New concepts of brake systems in development are discussed.

Dow, AL
Unified Industries, Incorporated, Federal Railroad Administration FRA-/ORD-77/74, Oct. 1977, 32 pp

Contract DOT-FR-74249

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-277264/8ST, DOTL NTIS

03 179124
REPORT ON THE 5TH INTERNATIONAL WHEELSETS CONGRESS, TOKYO, JAPAN, 20-23 OCTOBER 1975
A summary is given for each of the thirty technical papers presented at the International Wheelsets Congress held in Tokyo, Japan, 20-23 October 1975. The papers were presented by international experts in rail research and covered a wide range of wheel/rail topics, including dynamic forces, material characteristics, stresses, failure mechanics, fatigue, maintenance and noise.
Prepared for U.S. Department of Transportation, Federal Railroad Administration.

Bray, DE
Oklahoma University Spec Rpt. FRA/ORD-77/65, Oct. 1977, 17 pp, Figs.

Contract DOT-OS-40091

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-287144/AS, DOTL NTIS, DOTL RP

03 181426
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM TECHNOLOGY REVIEW. SEMIANNUAL REPORT
The status of two foreign rail technologies is analyzed in this second of four semiannual reports. The two technologies are Trucks and Carbody Construction. Trucks are discussed from the viewpoint of their function in the rail vehicle suspension system. This function consists of vehicle guidance, vibration isolation, vehicle support, and traction and braking. Several current trucks are reviewed, followed by a discussion of radial-axle trucks. Carbody construction is reviewed from 1965 forward. French technology, 1965 to 1975, is covered, followed by discussion of two modern trains, the TGV (France) and the ET403 (Germany). Advanced technologies are then discussed, principally construction with aluminum extrusions followed by a short discussion of composite materials.
See also PB-277264. Prepared in cooperation with Klauder (Louis T.) and Associates, Philadelphia, Pa., and Carnegie-Mellon Univ., Pittsburgh, Pa.

DeVilliers, AL Dow, AL Watson, RB Uher, RA
Unified Industries, Incorporated, Klauder (Louis T) and Associates, Carnegie-Mellon University, Federal Railroad Administration FRA-/ORD-78/38, May 1978, 89 p.

Contract DOT-FR-74249

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-283659/1ST, DOTL NTIS

03 181924
COUPLING SYSTEM DESIGN OPTIMIZATION-A SURVEY AND ASSESSMENT OF AUTOMATIC COUPLING CONCEPTS FOR RAIL FREIGHT CARS. VOLUME I. EXECUTIVE SUMMARY
The purpose of this study is to provide an independent identification, classification, and analysis of significant freight car coupling systems concepts offering potential for improved safety and operating costs over the present system. The basic method of approach was to make a comprehensive search as a prerequisite to establishing significant coupler concepts which would be used to formulate candidate coupling systems. The search program consisted of a literature search, a patent search, and railroad industry interviews. Coupling development efforts have been decreased due to changing usage and profitability of the American railroads. The functional concepts of existing development efforts range in sophistication from increasing the gathering range of the present coupler system to providing automatic train air connection and a complete redesign of the mechanical coupler. A sufficient number of new concepts were identified to derive coupling systems which represent a significant improvement over the present system.

Nyquist, AE Boydston, GD Chanoux, JJ Halagera, RT Hall, RK
Kearney (AT) and Company, Incorporated, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-77-30.I, FRA-ORD-78/11.I, May 1978, 49 p.

Contract DOT-TSC-1087-1

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-284159/1ST

03 181982
COUPLING SYSTEM DESIGN OPTIMIZATION-A SURVEY AND ASSESSMENT OF AUTOMATIC COUPLING CONCEPTS FOR RAIL FREIGHT CARS. VOLUME II: TEXT AND APPENDICES
The purpose of this study is to provide an independent identification, classification, and analysis of significant freight car coupling system concepts offering potential for improved safety and operating costs over the present system. The basic method of approach was to make a comprehensive search as a prerequisite to establishing significant coupler concepts which would be used to formulate candidate coupling systems. The search program consisted of a literature search, a patent search, and railroad industry interviews. Coupling development efforts have been decreasing due to changing usage and profitability of the American railroads. The functional concepts of existing development efforts range in sophistication from increasing the gathering range of the present coupler system to providing automatic train air connection and a complete redesign of the mechanical coupler. A sufficient number of new coupler concepts were identified to derive coupling systems which represent a significant improvement over the present system. This is the second of two volumes. Volume I, 48 pages, is an executive summary.
See also Volume 1, PB-284159.

Nyquist, AE Boydston, GD Chanoux, JJ Halagera, RT Hall, RL
Kearney (AT) and Company, Incorporated, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-77-30-II, FRA-ORD-78-11.II, May 1978, 446 p.

Contract DOT-TSC-1087-1

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-284546/9ST, DOTL NTIS

03 188674
A METHODOLOGY FOR EVALUATING THE MAINTENANCE OF HIGH SPEED PASSENGER TRAIN TRUCKS
This report describes the application of a methodology, the simulation cost model (SCM), to the economic aspects of maintaining high speed passenger train trucks. The methodology provides a description of truck maintenance, gives the annual costs for this maintenance, and allows sensitivity analyses and time projections to be made. The report first reviews and classifies present and near-term trucks for consideration by the methodology. The SCM methodology is then presented and described. It is applied to two trucks--the truck of the Metroliner (powered) and that of the Amcoaches (unpowered). These applications are used to indicate data requirements, to present the type of results obtainable from the technique, and to show how the results can be used. The relationship between the SCM and truck specifications is explored.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Krauter, AI Smith, RL
Shaker Research Corporation Final Rpt. FRA/ORD-78/73, DOT-TSC-FRA-78-7, Dec. 1978, 234 p., Figs., Tabs., Refs., 7 App.

Contract DOT-TSC-1308

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB80-177553, DOTL NTIS, DOTL RP

03 188678
TRUCK DESIGN OPTIMIZATION PROJECT PHASE II. INTRODUCTORY REPORT
The Truck Design Optimization Project (TDOP) Phase II is being conducted to establish the performance and cost-effectiveness of premium freight car trucks with reference to the standard three-piece truck. This report sets up a framework for quantitative characterization of truck performance and outlines a method for collecting economic data. Means of achieving these objectives by road-testing, mathematical modeling, and review of maintenance and operational data are described. An important goal of the project is to supply the railroad industry with a basis for performance specifications for freight car trucks.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This report is the first of a series that will be published under the major title "Truck Design Optimization Project, Phase II as the multi-year program develops. It will be distributed at the second TDOP Phase II In-Progress Review to be held in San Francisco, California on December 15, 1978.

Cappel, K
Wyle Laboratories Tech Rpt. FRA/ORD-78/53, TDOP TR-03, Nov. 1978, 110 p., 9 Fig., 8 Tab., 2 App.

Contract DOT-FR-742-4277

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-288739/AS, DOTL NTIS, DOTL RP

03 188683
SELECTED TOPICS IN RAILROAD TANK CAR SAFETY RESEARCH VOLUME I: FATIGUE EVALUATION OF PROTOTYPE TANK CAR HEAD SHIELD
The characteristics of a prototype head shield for hazardous material tank cars were evaluated with respect to the maintenance of its structural integrity under normal service conditions. The primary concern was with the resistance to fatigue damage of head shield connections to the tank car. The evaluation was conducted by performing tests on a tank car equipped with the shield. The shield and its supporting structure were instrumented to determine the principal forces acting within the structure and at points of attachment to the tank car. Both car-coupling impact and over-the-road tests were conducted. The impact tests were conducted at speeds of from 3 to 8 mph. The over-the-road tests included 432 miles of operation at speeds up to 55 mph. Evaluation of the data revealed that the car-coupling impact environment was the most severe. A definite fatigue life was indicated for the most severely stressed region of the supporting structure. The most severe over-the-road environment occurred with the loaded car at speeds above 45 mph when the main suspension bottomed out. The loads associated with this phenomenon were below those of the car-coupling impact environment.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This is the first volume of a two-volume report. Volume II Test Plan for Accelerated LIFE Testing of Thermally Shielded Tank Cars, has 72 pages.

Johnson, MR
IIT Research Institute, Transportation Systems Center Final Rpt. FRA/ORD-78/32.I, DOT-TSC-FRA-78-12.I, Aug. 1978, 82 p., 36 Fig., 7 Tab., 5 Ref., 1 App.

Contract DOT-TSC-1043-1

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-289253/AS, DOTL NTIS, DOTL RP

03 188684
SELECTED TOPICS IN RAILROAD TANK CAR SAFETY RESEARCH VOLUME II: TEST PLAN FOR ACCELERATED LIFE TESTING OF THERMALLY SHIELDED TANK CARS
A test plan for the accelerated life testing of thermally shielded tank cars is described. The test program would be conducted at the DOT Transportation Test Center in Pueblo, Colorado. Eighteen tank cars would be included in the program. Five cars would be equipped with a jacketed thermal shield, and 13 cars would be equipped with a spray-on chemical insulation coating. In addition, most cars would be equipped with head shield end-of-car protection systems. The goal of the tests is to simulate the effects of 10 years of normal service operations. This will involve subjecting the cars to a large number of coupling impacts as well as running the cars for a mileage representative of the 10 year period.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This is the second volume of a two-volume report. Volume I, Fatigue Evaluation of Prototype Tank Car Head Shield, has 82 pages.

Johnson, MR Viergutz, OJ
IIT Research Institute, Transportation Systems Center Final Rpt. FRA/ORD-78/32.II, DOT-TSC-FRA-78-12.II, Aug. 1978, 72 p., 11 Fig., 10 Tab., 2 App.

Contract DOT-TSC-1043-2

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-289254/AS, DOTL NTIS, DOTL RP

03 188685
ENGINEERING DATA ON SELECTED HIGH SPEED PASSENGER TRUCKS
The purpose of this project is to compile a list of high speed truck engineering parameters for characterization in dynamic performance modeling activities. Data tabulations are supplied for trucks from France, Germany, Italy, England, Japan, U.S.S.R., Canada and the The United States.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Shapiro, SM
Budd Company Final Rpt. FRA/ORD-78/29, DOT-TSC-FRA-78-4, July 1978, 124 p., 30 Fig., 17 Tab., Refs., 2 App.

Contract DOT-TSC-1222

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-293246/5ST, DOTL RP

03 188694
LOCOMOTIVE CAB DESIGN DEVELOPMENT--VOLUME IV: RECOMMENDED DESIGN
This report presents a synopsis of the background analyses leading to the design of a line haul locomotive crew compartment. The design was incorporated into a full scale mockup which was evaluated by a nationwide representation of locomotive engineers. The report includes an analysis of these evaluations and identifies those areas of the original design that are recommended for design refinement. Specifications are included for the design being recommended as a nationally acceptable crew station for line haul freight locomotives. The reports in this series bear the general title: Locomotive Cab Design Development. The preceding volumes are: Volume I: Analysis of Locomotive Cab Environment and Development of Cab Design Alternatives, FRA/OR&D-76/275.I, October 1976, 206 p. PB-262976. Volume II: Operator's Manual, FRA/OR&D-76/275.II, October 1976, 42 p. PB-264114. Volume III: Design Application Analysis, FRA/OR&D-76/275.III, October 1976, 82 p. PB-264115. This volume Recommended Design, is the fourth and final report of this series.

Robinson, J
Boeing Vertol Company, (8-2792) Intrm Rpt. FRA/OR&D-76/275.IV, DOT-TSC-FRA-78-25, Nov. 1978, 132 p., 30 Fig., 27 Tab., 9 Ref., 3 App.

Contract DOT-TSC-1330

ACKNOWLEDGMENT: FRA, NTIS
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PB-290214/AS, DOTL NTIS, DOTL RP

03 196981
PREVENTION OF ROLLER BEARING-INITIATED BURNOFFS IN RAILROAD FREIGHT CAR JOURNALS
The objective of this program was to determine the technical feasibility and cost effectiveness of constructing three separate devices for the prevention of catastrophic roller bearing-initiated, railroad journal failure. 1. Construction of a low cost axle cap bolt which would replace one of the three bolts in a standard bearing assembly, and which would contain a self-powered, maintenance free transmitter to signal a train crew in the event of roller bearing overtemperature, was proven feasible. This is technically and economically superior to current wayside temperature sensing devices, and has the capability of preventing burnoffs associated with bearing failure by any mechanism. 2. The prevention of bearing overlubrication by use of automated ultrasonic test methods was seen to be feasible. Use of such a device in a railroad repair track would prevent regreasing a freshly greased bearing and thereby save the costs of setouts and derailments caused by overlubrication. 3. The early detection of bearing component damage (spalling, brinelling, and particulate contamination) by use of "Shock Pulse Analysis" techniques was also seen to be feasible. Use of an automated device in a railroad wheel shop could save the costs of burnoffs associated with progressive damage, and also of investigative bearing teardown as a result of derailment.

Allen, GE Lucas, JR Tomlinson, FH
SKF Industries, Incorporated, Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-78-16, DOT-TSC-FRA-79-5, Jan. 1979, 284 p., Figs., Tabs., 8 Ref., 6 App.

Contract DOT-TSC-935

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PB-299735/AS, DOTL NTIS

03 196984
ON-BOARD FAILURE-PROTECTION REQUIREMENTS FOR RAILROAD-VEHICLE EQUIPMENT
An analysis of the 1975 railroad-equipment-caused accidents was made. Data reported to the FRA were the primary source of derailment information; however, data from other sources were also used. Individual cause codes were consolidated into groups which had a common characteristic that might be used to detect the presence of the defect. Fifteen cause codes were identified to account for two of every three accidents. Existing on-board failure-detection systems were evaluated. A developmental on-board equipment failure-prevention system was identified. Purchase costs are given in terms of yearly damage loss due to accidents, allowable system-payback period, and fraction of accidents the system is intended to prevent. A development effort in the area of on-board sensor technology is recommended. This effort is directed toward the production of a multi-sensor protection system which may provide a maximum reduction in equipment failures while also being cost-effective.

Smith, RL Frarey, JL
Shaker Research Corporation, Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-78-72, DOT-TSC-FRA-79-6, Mar. 1979, 206 p., Figs., Tabs., 4 Ref., 8 App.

Contract DOT-TSC-1029

ORDER FROM: NTIS

PB-297678/AS, DOTL NTIS

03 304662
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM. TECHNOLOGY REVIEW: WHEELS, AXLES, COUPLERS
The status of two foreign rail technologies is analyzed in this report. The two technologies are Wheels and Automatic Couplers. The wheel development program for the French TGV is reviewed. It illustrates the application of classical wheel design to modern high-speed rail transport. The resilient wheel and its reduction of effective unsprung mass is studied; the SAB resilient wheel application on British Rail is reviewed. Lightweight axles are also discussed. The review of automatic coupler technology is primarily concerned with the latest coupler designs from both the mechanical and electrical train-line concepts. The evolution and development of advanced couplers in the United States and Europe are covered.

Prepared in cooperation with Small Business Administration, Washington, DC.

Bellovin, M DeVilliers, AL Dow, AL
Unified Industries, Incorporated, Federal Railroad Administration FRA-/ORD-79/45, Mar. 1978, 65 p.

Contract DOT-FR-717-4249

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-300775/4ST, DOTL NTIS

03 305894
TRUCK DESIGN OPTIMIZATION PROJECT. PHASE II. FRICTION SNUBBER FORCE MEASUREMENT SYSTEM (FSFMS). FIELD TEST REPORT
This report documents the results of the Friction Snubber Force Measurement System (FSFMS) special road test program that was performed during TDOP Phase II. The FSFMS was designed, built, and shop-tested during TDOP Phase I (see FRA/ORD-78/69). Descriptions of the test equipment, procedures, methods of data analysis, results, and recommendations are contained in this report. The test program was successfully completed using friction snubber transducers to obtain friction forces in over-the-road truck tests. The primary purpose of the tests was to obtain estimates of the friction coefficients associated with ASF Ride Control and Barber S-2 70-ton trucks. The report provides some preliminary analyses using the test data and recommends areas where additional information may be extracted.

Gibson, D
Wyle Laboratories, Federal Railroad Administration FRA/ORD-79/24, TDOP/TR-08, Oct. 1979, 64 p.

ACKNOWLEDGMENT: NTIS
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PB80-129596, DOTL NTIS

03 308258
EFFECTS OF RAIL VEHICLE SIZE: A SPECIAL BIBLIOGRAPHY
This document contains abstracts of documents related to the size, weight, or length of rail vehicles. These abstracts are drawn from the magnetic tape files of the Railroad Research Information Service (RRIS). These files are comprised of abstracts of technical reports, journal articles, and other materials from domestic and foreign sources.

Transportation Research Board, Federal Railroad Administration FRA-/ORD-79/49, Nov. 1979, 52 p.

ORDER FROM: NTIS

PB80-122955, DOTL NTIS, DOTL RP

03 308261
A STRUCTURAL SURVEY OF CLASSES OF VEHICLES FOR CRASHWORTHINESS
This document reviews three phases of study conducted to evaluate and improve the crashworthiness of passenger carrying vehicles in intercity service. Phase I surveyed the accident data over a period 1966 to 1973 and identified those areas responsible for the majority of accidents involving human injury (both operating personnel and fare-paying passengers). An analysis was also conducted on the structural integrity of a commuter car-identified as the single largest source of injuries in the subject time frame. Phase II extended the structural survey to the caboose and the locomotive cab and included both static and dynamic analyses of the crash scenarios. The design is predicated about the provision of a "Survivable Volume."

Widmayer, E
Boeing Vertol Company, Federal Railroad Administration Final Rpt. FRA/ORD-79-13, DOT-TSC-FRA-79-13, Sept. 1979, 130 p., Figs., Tabs., 1 App.

Contract DOT-TSC-856

ORDER FROM: FRA/ORD

DOTL RP

03 313211
REPORT OF AUGUST 1977 U. S. RAILROAD DELEGATION'S VISIT TO THE U.S.S.R. TO STUDY SOVIET ROLLING STOCK TECHNOLOGY
The report summarizes the observations and findings of a seven-member delegation that visited the U.S.S.R. in August 1977 to participate in the sixth meeting of the Joint American-Soviet Railroad Working Group and to study

and observe Soviet practices, procedures, and equipment used in designing, testing, manufacturing, and, to some degree, operating passenger and freight cars (including refrigerator cars). The delegation visited Soviet railroad facilities and related institutions in the Moscow, Kiev, Riga, and Leningrad areas, rode on intercity passenger trains, and conferred with numerous Soviet railroad officials. The delegation's observations and findings, together with some already published background data, are presented in this report in the form of detailed accounts of Soviet freight car maintenance activities, passenger car construction and maintenance, and refrigerator car manufacture and operations. The report also includes information on the Shcherbinka test loop and the Railway Engineering Institute (Leningrad), the full text of the recording of proceedings of the sixth working group meeting, and the titles and abstracts of the Soviet documents presented to the delegation.

Danahy, FA
Federal Railroad Administration Final Rpt. FRA/ORD-79/46, Sept. 1979, 57 p.

ACKNOWLEDGMENT: NTIS
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PB80-148646, DOTL NTIS

03 314013
TRUCK DESIGN OPTIMIZATION (TDOP), PHASE II ANALYSIS PLAN
The purpose of this document is to set forth the Analysis Plan which will be followed in the Truck Design Optimization Project (TDOP) Phase II. The Analysis Plan defines the means by which Type I (standard) and Type II (premium) freight car trucks will be characterized and compared. The specific objectives of the analysis task are: (1) to define the requirements for test data and simulation results which will establish performance specifications; (2) to determine the extent to which field test data can be extrapolated; and (3) to develop criteria for validating analytical models. The evaluation of Type I and Type II trucks addresses four important aspects of performance relating to railroad safety or effectiveness. The four are: lateral stability, trackability, curve negotiation, and ride quality. The Analysis Plan is divided into sections relating to each of the four performance regimes. Each section contains a discussion of performance indices, analysis requirements, model utilization, test data utilization, special considerations for Type II trucks, and summary.
See also report for Oct 78-May 79, PB80-104888.

Johnson, LL Gilchrist, AJ
Wyle Laboratories, Federal Railroad Administration FRA/ORD-80/31, TDOP/TR-04, Mar. 1980, 62 p.

Contract DOT-FR-742-4277

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-175995, DOTL NTIS

03 314073
TANK CAR HEAD PUNCTURE MECHANISMS
In a number of railroad accidents the shell heads of hazardous material tank cars have been punctured. This report is concerned with the description and analysis of head puncture mechanisms. Three classification yard accidents and one main line accident were studied in detail, train-to-train collision tests were analyzed and the results of impact experiments were evaluated. The main conclusion of the report is that head puncture in classification yards is invariably due to overspeed impact. Such accidents can be prevented either by providing some fail-safe control for keeping impact speeds below 8 mph or, if impact speeds cannot be kept below 8 mph, not humping or flat switching more than one hazardous material tank car, or cars following it, onto any one track and requiring tank car heads to be designed or retrofitted to absorb a minimum amount of impact energy to be specified on the basis of further experiments and analytical studies recommended in this report.

Peters, DA Szabo, BA Diboll, WB
Washington University, St Louis, Federal Railroad Administration Final Rpt. FRA/ORD-76/269, Apr. 1980, 107 p.

Contract DOT-OS-40106

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-181142, DOTL NTIS

03 319037
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--METHODOLOGY USED IN THE TRAIN REVIEWS
A number of new passenger train systems have been developed throughout the world and are now, or soon will be, available. They represent technology that is available for possible use in the United States. Starting in early 1977, the Improved Passenger Equipment Evaluation Program (IPEEP) initiated a detailed systematic review of advanced trains and equipment now in operation or under development. IPEEP methodology allows the performance and curving safety of a given trainset to be reviewed relative to a baseline train on an appropriate domestic rail passenger service corridor. The trains reviewed in IPEEP are divided into two categories: electric trains having potential for NEC application, and fuel-burning trains having potential for application on routes outside the NEC. To assess the various trainsets in terms of the United States environment, the features and characteristics of the trains were matched against United States regulations and practices, and computer analyses were conducted to determine the expected performance of the trains in the corridors of interest.
Task 2 contract.

Bachman, JA Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/13, Mar. 1979, 79 p., Figs., 5 Tab., 4 App.

Contract DOT-FR-717-4249

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PB80-161763, DOTL NTIS, DOTL RP

03 319038
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 1-BASELINE DATA
A number of new passenger train systems have been developed throughout the world and are now, or soon will be available. They represent technology that is available for possible use in the United States. Starting in early 1977, the Improved Passenger Equipment Evaluation Program (IPEEP) initiated a detailed systematic review of advanced trains and equipment now in operation or under development. IPEEP methodology allows the performance and curving safety of a given trainset to be reviewed relative to a baseline train on an appropriate domestic rail passenger service corridor. Baseline performance and review criteria are defined by an upgraded Metroliner on the Northeast Corridor (NEC), and by the Turboliner-and F40PH-hauled Amfleet equipment on the other corridors. The corridors, suggested by Amtrak, were simulated with respect to grade, alignment, and speed restrictions. A description of the baseline trains, corridors, and data used for computer simulation of performance is presented in volume 1. Individual train reviews are presented in volumes 2 through 9. A description of train performance methodology is contained in a separate report.
See also RRIS 03 319039 thru RRIS 03 319046.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.I, Mar. 1978, 354 p., Figs., Tabs.

Contract DOT-FR-717-429

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PB80-161789, DOTL NTIS, DOTL RP

03 319039
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 2-APTP(ENGLAND)
A description of the British APTP (Advanced Passenger Train Prototype) physical dimensions and performance parameters is presented. Various features of the train are reported. Among them are schedule time on the Northeast Corridor, passenger comfort, energy consumption, passenger safety, and development status. A review of the anticipated performance of the APTP on the Northeast Corridor is made. This performance is compared with existing corridor rolling stock. Modifications to the APTP structure to meet Association of American Railroads (AAR) interchange requirements

were estimated by the evaluators. Seating capacity of the APTP was increased to meet existing train capacity, and train consist was adjusted to meet the new seating capacity. The results are based on performance data supplied by British Rail Engineering Limited (BREL). Although the electric-powered APTP has not been tested as a train system, an experimental gas-powered trainset (APTE) was subjected to intensive testing from 1973 to 1976.

See also RRIS 03 319038.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.II, Mar. 1978, 50 p., 19 Fig., 6 Tab.

Contract DOT-FR-717-4249

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PB80-161797, DOTL NTIS, DOTL RP

03 319040
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 4-ET401 (ITALY)

A description of the physical dimensions and performance parameters of the Italian ETR401 passenger train is presented. Among them are schedule time, passenger comfort and safety, energy consumption, and development status. Modification necessary for North American operation is also described, as well as the special features such as tilting carbodies, lightweight construction, and body-mounted traction motors. A review of the anticipated performance of the Italian ETR401 on the Northeast Corridor is made. This performance is compared with the performance of existing rolling stock. Modifications to the ETR401 carbody and propulsion were estimated by the evaluators to meet the interchange requirements of the Association of American Railroads (AAR) and to fit the Northeast Corridor voltage and station platform dimensions. Seating capacity of the ETR401 was increased from the existing four-car trainset to twelve cars to provide seating capacity compatible with the baseline train. The performance results are based on data supplied by Fiat who designed and built the train. Two trainsets are in passenger revenue service, one in Italy, the other in Spain.

See also RRIS 03 319038.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.IV, Mar. 1978, 48 p., 18 Fig., 7 Tab.

Contract DOT-FR-717-4249

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PB80-161813, DOTL NTIS, DOTL RP

03 319041
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 3-ETR403 (GERMANY)

A description of the physical dimensions and performance parameters of the German ET403 passenger train is presented. Various features of the train are described. Among them are estimated schedule time, passenger comfort and safety, energy consumption, and development status. Modifications for North American operation are also described. A review of the anticipated performance of the ET403 on the Northeast Corridor (NEC) is made. This performance is compared to existing corridor rolling stock. Modifications to the ET403 carbody structure to meet the Association of American Railroads (AAR) interchange requirements were estimated by the evaluators. Seating capacity of the ET403 was increased by adding six coaches to provide passenger seating capacity compatible with a baseline train. The performance results are based on data supplied by the German Federal Railway and AEG-Telefunken. The train has been subjected to intensive testing and passenger revenue service.

See also RRIS 03 319038.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.III, Mar. 1978, 49 p., 17 Fig., 7 Tab.

Contract DOT-FR-717-4249

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PB80-161805, DOTL NTIS, DOTL RP

03 319042
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 5-SERIES 961 (JAPAN)

A description of the physical dimensions and performance parameters of the Japanese Series 961 passenger train is presented. Among them are estimated schedule time, passenger comfort and safety, energy consumption, and development status. Various features of advanced technology and passenger appeal are also reported. A review of the anticipated performance of the Series 961 on the Northeast Corridor is reported. This performance is compared with existing corridor rolling stock. Modification to the Series 961 carbody structure to meet Association of American Railroads (AAR) interchange requirements was estimated by the study team. The consist selected for review consisted of eight cars which are run as married pairs; these provided the closest number of seats to those provided in the baseline train. The results of the study are based on performance data supplied by the Japanese National Railway. One six-car trainset had been built and subjected to limited testing at the time the report was written.

See also RRIS 03 319038.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.V, Mar. 1978, 49 p., 15 Fig., 7 Tab.

Contract DOT-FR-717-4249

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PB80-161821, DOTL NTIS, DOTL RP

03 319043
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 6-TGV-PSE (FRANCE)

A review of the anticipated performance of the French TGV-PSE (Tres Grande Vitesse-Paris Sud Est) on the Northeast Corridor is reported. This performance is compared with existing corridor rolling stock. Modifications to the TGV-PSE structure to meet Association of American Railroads safety requirements were estimated by the study team. Seating capacity was increased to meet existing baseline train capacity by adding three articulated coach sections for a total of thirteen sections. The results of the study are based on performance data supplied by SNCF (the French National Railways) and Alsthom-Atlantique. Eighty-seven TGV-PSE trainsets have been ordered by SNCF for service beginning in 1981. An experimental turboelectric powered train, the TGV-001, has had intensive testing and many of the subsystems are used in the production version. A description of the physical dimensions and the TGV-PSE performance parameters are presented. Various features of the train are reported.

See also RRIS 03 319038.

Bachman, JA Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.VI, Mar. 1978, 42 p., 10 Fig., 7 Tab.

Contract DOT-FR-717-4249

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PB80-161839, DOTL NTIS, DOTL RP

03 319044
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 7-HST (ENGLAND)

A description of the physical dimensions and performance parameters is presented for the British HST (High Speed Train). Various features of the train are reported. Among them are estimated schedule time, passenger

comfort and safety, energy consumption, and development status. A review of the anticipated performance of the HST on four nonelectrified corridors is made. This performance is compared with the performance of existing corridor rolling stock. Modifications to the HST structure to meet the Association of American Railroads (AAR) interchange requirements were estimated by the evaluators. Seating capacity of the HST was increased to meet baseline train capacity, and train consist was adjusted to meet the new seating capacity. The results are based on performance data supplied by British Rail Engineering Limited (BREL). The HST has been in revenue service in England since 1976.

Task 1 contract. See also RRIS 03 319038.

Bachman, JA DeVilliers, AL Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Prelim. FRA/ORD-80/14.VII, Mar. 1979, 46 p., 15 Fig., 9 Tab.

Contract DOT-FR-717-4249

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PB80-161847, DOTL NTIS, DOTL RP

03 319045
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 8-LRC (CANADA)

A description of the physical dimensions and the performance parameters of the Canadian LRC (Light Rapid Comfortable) are presented. Various features of the train are reported. Among them are scheduled time on four nonelectrified U.S. rail corridors, passenger comfort, energy consumption, passenger safety, and development status. A review of the anticipated performance of the LRC on the four corridors is made. This performance is compared with that of existing corridor rolling stock. The train consist was adjusted to meet the seating capacity of the existing train. The results are based on performance data supplied by Bombardier Inc., Dominion Foundries and Steel, Ltd, and Alcan Canada Products, Ltd. with confirmation by the Canadian Research Council. A full LRC trainset had not yet been built at the time of this report. However, a prototype locomotive and coach were tested at the Transportation Research Center at Pueblo, Colorado and on the Northeast Corridor.

See also RRIS 03 319038.

Bachman, JA DeVilliers, AL Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Final Rpt. FRA/ORD-80/14.VIII, Mar. 1979, 59 p., 26 Fig., 11 Tab.

Contract DOT-FR-717-4249

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PB80-161854, DOTL NTIS, DOTL RP

03 319046
IMPROVED PASSENGER EQUIPMENT EVALUATION PROGRAM--TRAIN SYSTEM REVIEW REPORT. VOLUME 9-SPV2000 (UNITED STATES)

A description of the physical dimensions and the performance parameters of the Budd SPV2000 are presented. Various features of the train are reported. Among them are scheduled time on four nonelectrified U.S. rail corridors, passenger comfort, energy consumption, passenger safety, and development status. A review of the anticipated performance of the SPV2000 on four nonelectrified corridors is made. This performance is compared with that of existing corridor rolling stock for a SPV consist with the same seating capacity of the baseline train. The results are based on performance data supplied by the Budd Company. At this writing only a single prototype SPV2000 has been built. It is undergoing service evaluation on several U.S. railroads.

Task 1 contract. See also RRIS 03 319038.

Bachman, JA DeVilliers, AL Marchetti, JW (Marchetti, Incorporated); Meacham, HC, Jr (Battelle Columbus Laboratories); Uher, RA (Carnegie-Mellon University); Watson, RB (Klauder (Louis T) and Associates)
Unified Industries, Incorporated, Federal Railroad Administration, Small Business Administration Prelim. FRA/ORD-80/14.IX, Mar. 1979, 42 p., 12 Fig., 9 Tab.

Contract DOT-FR-717-4249

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03 319056
RAILROAD CAR ROLLER BEARING TEMPERATURE MEASUREMENT AND ANALYSIS

This report describes a series of field measurements of the operating temperatures of railcar roller bearings. These measurements included operating temperatures at train speeds of 30 mph and 50 mph with loaded and unloaded cars. Also included are measurements taken when all the lubrication was removed from the bearing and the bearing was allowed to fail due to overheating. These measurements were taken in support of the Department of Transportation System for Train Accident Reduction (DOT-STAR) Program. DOT-STAR was designed by the Naval Surface Weapons Center to detect overheated bearings and minor derailments and stop the train. Various overheated bearing (thermal) sensor locations were evaluated. A 300 deg F bearing surface temperature was established as the temperature at which to stop the train. A computer model was developed to predict railroad car roller bearing temperatures. This model was adjusted to agree with measured data. The model was used to predict bearing temperature at a train speed of 80 mph in an ambient temperature of 126 deg F. This prediction was discussed with roller bearing experts and was thought to be too high. Adjustments were made to the computer model.

Peacock, TV Snider, HH, Jr
Naval Surface Weapons Center, Federal Railroad Administration Prog Rpt. FRA/ORD-80/43, TN-78-28, Apr. 1980, 61 p., 32 Fig., 10 Tab., 2 App.

ORDER FROM: NTIS

PB80-193758, DOTL NTIS, DOTL RP

03 319057
DYNAMIC BEHAVIOR AND RESIDUAL STRESSES IN RAILROAD WHEELS

A study of the dynamic behavior and residual stresses in straight-plate and curved-plate 33-inch-diameter one-wear freight-car wheels has been conducted. The dynamic behavior was determined on instrumented wheels by simulating various loading and braking conditions on a dynamometer; residual stresses were determined by relaxation techniques. The data developed in this study, in conjunction with additional data to be developed in the overall program, can be used to verify finite-element computer programs and to conduct detailed analyses of the resistance of various wheels to fatigue failure. Also, the results of a preliminary assessment of the fatigue resistance of the wheels studied indicated that both wheels have adequate resistance to plate fatigue failures under 26.4-kip vertical-journal and 15-kip lateral loads and 60-mph emergency-braking conditions.

Carpenter, GF Wandrisco, JM Sonon, DE
United States Steel Corporation, Federal Railroad Administration Final Rpt. FRA-ORD-78/54, Apr. 1980, 82 p., 14 Fig., Tabs., 21 Ref., 4 App.

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PB80-194897, DOTL RP

03 319064
RESULTS AND ANALYSIS OF THE SWITCHYARD IMPACT TESTS

This report presents the results and analysis of series 3 through 7 and series 10 of the FRA/RPI/AAR Switchyard Impact Tests. The test results and analysis are used to evaluate the head shield and the shelf-E coupler as protective devices for hazardous-materials tank cars.

Orringer, O
Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80-6, DOT-TSC-FRA-80-2, Jan. 1980, 146 p., Figs., Tabs., 34 Ref., 7 App.

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PB80-162266, DOTL NTIS, DOTL RP

03 325713
ISSUES AND DIMENSIONS OF FREIGHT CAR SIZE: A COMPENDIUM
An investigation is made into the effects of the size, weight, and length of freight cars on the safety and efficiency of U.S. rail transportation. A review is made of the historical and present population and usage of the U.S. freight car fleet. Distinct trends toward the purchase of larger, heavier cars and the subsequent effect on the fleet are shown. Several data bases are used in a novel fashion to provide actual derailment rates for the fleet by car-miles and ton-miles as functions of various parameters, including car type, nominal weight capacity, and length. A key finding is that, historically, the use of 100-ton capacity freight cars, in itself, has not been detrimental to the safety of U.S. rail transportation. An overview of current analyses of the causes of derailments is given, with special considerations to tank car accidents and grade-crossing accidents. Based on these analyses, technical measures for improvement are outlined. In culmination, a series of options available to the government and industry is given, with consideration to technical, regulatory, and economic impacts.

Nayak, PR Palmer, DW
Little (Arthur D), Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/56, ADL-80589-11, Oct. 1980, 299p, Figs., Tabs., 6 App.

Contract DOT-FR-74261

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PB81-116998, DOTL NTIS, DOTL RP

03 325737
THERMAL SENSING UNIT TEST FOR RAILROAD CAR JOURNAL BEARINGS
The report is a summary of the temperature work done by the Naval Surface Weapons Center (NSWC) in support of the Department of Transportation, Federal Railroad Administration development of a thermal sensing unit used to detect overheating railroad journal bearings. The temperature related field work was conducted by Mr. A. M. Spangler of NSWC, now retired. The author, who was assisting him in the laboratory tests and has compiled this summary report, acknowledges his efforts. The test series included measuring the temperature of a railroad journal assembly during actual operation, reproducing field conditions in the laboratory for sensor development testing, and testing the thermal sensor in actual use. Normal operating temperature, over-heated bearing temperatures, and several journal surface temperatures were measured during field operation. The data obtained was used in determining the subsequent laboratory test parameters. A hot plate temperature test was used for testing the sensor in the early stages of development. Existing laboratory facilities were modified to provide simulated field temperature inputs to a partial side frame and journal assembly for confirmation tests. Data from all field and laboratory tests is included.

Donley, ME
Naval Surface Weapons Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/76, NSWC/WOL/TN 10527, Oct, 1980, 27p, 17 Fig., 3 Tab.

Contract DOT-AR-54162

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PB81-127458, DOTL NTIS, DOTL RP

03 325881
USER'S MANUAL FOR THE MAINTENANCE COST METHODOLOGY FOR HIGH SPEED PASSENGER TRAIN TRUCKS
This document is a user's manual for the simulation cost modeling (SCM) technique as applied to a passenger railcar truck and its component parts. The manual includes application of the technique through the development of an example maintenance schematic diagram, example truck component cost data, and example maintenance procedures. The computer program and its various operating modes are described with the aid of a full set of example data obtained from Amtrak personnel. A complete listing of the FORTRAN IV program and a set of example data for its operation are contained in the appendixes. A set of cost results from the example Amtrak data cover maintenance expenditures by maintenance actions and by component truck subassemblies. Also listed in the sample results are a set of cost sensitivities related to the modeled maintenance system. In addition to the present application, the SCM technique has been employed successfully for other railroad systems, including track maintenance. The technique is generally useful for fleets in which individual cost data are not available, such as a proposed transit system or the introduction of new sub-systems or components.

Smith, RL Krauter, AI Betor, J
Shaker Research Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-80/70, DOT-TSC-FRA-80-21, Sept. 1980, 252p, 20 Fig., 1 Tab., 2 Ref., 14 App.

Contract DOT-TSC-1619

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PB81-115479, DOTL NTIS, DOTL RP

03 326380
RAIL CAR COMPONENT DEFECT DETECTION USING PITLESS RAILWAY SCALES (A FEASIBILITY STUDY PLAN)
This report presents a feasibility study plan to help establish the practicality of utilizing modified pitless-in-motion rail scale systems to detect faulty railroad car components and component systems. This plan considers detecting critical components and performance conditions such as: lateral and vertical rail forces, defective wheels, brakes and bearings, centerplate friction, consist speed, hunting, creep, rock and roll.

Raskin, SH
Raskin (SH) Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-79/50, Sept. 1980, 101p, 7 Fig., 5 Tab., 5 App.

Contract DOT-FR-8003

ACKNOWLEDGMENT: NTIS
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PB81-110090, DOTL NTIS, DOTL RP

03 326399
TRUCK DESIGN OPTIMIZATION PROJECT (TDOP) PHASE II
The overall objective of the TDOP Phase II project is to characterize the behavior of existing trucks (defined as Type I trucks) and to generate performance and test specifications for new truck designs (referred to as Type II trucks). The purpose of this document is to report on the progress to date of TDOP Phase II. The report summarizes the methodology employed to develop performance and test specifications and the rationale used for selecting seven Type II trucks for field testing. The Interim Report also discusses preliminary conclusions reached in several economic areas, including car and truck maintenance costs, fuel consumption, and rail wear in curves. Further, the report describes on-going field test programs (the truck performance testing and wear measurement programs) and the completed Friction Snubber Force Measurement System test program. In the analysis area, an assessment and validation of 17 computer simulation models of freight cars is discussed in detail. The Interim Report concludes with a description of the work-in-progress for a Type I truck performance characterization.
See also PB80-175995.

Sheldon, G Bakken, G Cappel, K Gibson, D Gilchrist, A
Wyle Laboratories, Federal Railroad Administration Intrm Rpt. FRA-/ORD-80/59, TDOP/TR-12, June 1980, 105p

Contract DOT-FR-742-4277

ACKNOWLEDGMENT: NTIS
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PB81-104945, DOTL NTIS

03 326415
METROLINER TRUCK IMPROVEMENT PROGRAM

The report summarizes the results of design and ride testing procedures followed in developing a Metroliner Truck Improvement Program. The Metroliner cars had been used in high speed Corridor service for nearly ten years and upgrading the truck suspension to modern standards for improved passenger ride was considered to be very desirable. Preliminary design projections indicated this could be accomplished at comparatively modest cost and with potential savings in maintenance costs by modifications only to the primary and secondary spring systems.

Seely, RM
General Steel Industries, Incorporated, Federal Railroad Administration
Final Rpt. FRA/ORD-80/74, Sept. 1980, 66p

Contract DOT-FR-64237

ACKNOWLEDGMENT: NTIS
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PB81-113714, DOTL NTIS

04 071936
INPUT POWER CHARACTERISTICS OF A THREE-PHASE THYRISTOR CONVERTER
A phase delay rectifier operating into a passive resistive load was instrumented in the laboratory. Techniques for accurate measurement of power, displacement reactive power, harmonic components, and distortion reactive power are presented. The characteristics of the phase delay rectifier operating with unfiltered and inductively filtered resistive loads are presented using both derivations and measurements. The changes of the phase delay rectifier characteristics with a free wheeling diode in the circuit are also presented. /Author/

Wlodyka, RA Abbas, JD Ploetz, G
Transportation Systems Center, (DOT-TSC-FRA-73-4) Final Rpt. FRA-ORD/D-74-20, Oct. 1973, 90 pp

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-226281/4, DOTL NTIS

04 147710
FUEL EFFICIENCY IMPROVEMENT IN RAIL FREIGHT TRANSPORTATION: MULTIPLE UNIT THROTTLE CONTROL TO CONSERVE FUEL
From the results of the tests performed on the Kansas City Southern in regular freight service significant fuel savings were realized by using a semi-automatic throttle control device or "fuel saver" system to take one or more units of the locomotive consist off line when the available power and tractive effort exceeded the demand. This procedure effectively lowered the horsepower per ton ratio of the train and decreased the rate of fuel consumption. For the particular set of operating conditions tested the average fuel savings in percent reached 16.3% at a ruling grade of 0.5%. A prime ingredient for the effective use of such a device was the operating locomotive engineer. For the conditions encountered, testing of the fuel saver did not affect the total test time or the average operating speed. Using the ratio of thousand gross ton miles per gallon (MGTM/GAL) as a barometer of increased fuel efficiency indicated a possible trend toward greater fuel savings when using the throttle control device at increasingly higher operating speeds. For this test series the data results were inconclusive with respect to the correlation between the number of units of the consist in fuel save and the total gallons consumed. As presented in this report, the preliminary results have confirmed the application of the throttle control device as an effective means to reduce fuel consumption in an operating locomotive consist.

The DOT's Transportation Systems Center in Cambridge, Massachusetts, served as support agency for this report.

Jacobs, ME
Federal Railroad Administration Intrm Rpt. FRA/OR&D-76/297, Dec. 1976, 31 pp, 2 Fig., 7 Tab.

ACKNOWLEDGMENT: FRA, NTIS
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PB-262470/AS, DOTL NTIS, DOTL RP

04 166506
ASSESSMENT OF CONTROL TECHNIQUES FOR REDUCING EMISSIONS FROM LOCOMOTIVE ENGINES
The primary objective of this study was to determine the most effective method of reducing emissions of oxides of nitrogen from a two-cylinder version of an EMD series 567C locomotive engine. The NOx control techniques selected for use in this study included (1) change in fuel injector design, (2) variation in injection timing from the standard setting, (3) water induction, (4) air box bleed, (5) exhaust gas recirculation. Continuous measurements of unburned HC, CO, NOx and smoke opacity were made as the test engine was operated through a test cycle based on speed and load points characteristic of actual locomotive operation. Results of these tests are discussed.

See also PB-229 991,

Storment, JO Springer, KJ
Southwest Research Institute, Environmental Protection Agency, Transportation Systems Center Final Rpt. SWRI-AR-884, Apr. 1973, 320 pp. FRA-ORD&D-74-21

Contract EHS-70-108

ACKNOWLEDGMENT: NTIS
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PB-270395/7ST

04 176016
FUEL EFFICIENCY IMPROVEMENT IN RAIL FREIGHT TRANSPORTATION: MULTIPLE UNIT THROTTLE CONTROL TO CONSERVE FUEL
During tests performed in conjunction with the Burlington Northern and Union Pacific railroads and AMTRAK, significant fuel savings were realized by using a semi-automatic throttle control device or fuel saver system to take one or more units of the locomotive consist off-line when the available power and tractive effort exceeded the demand. This procedure effectively lowered the horsepower per ton ratio of the train, improved power management in various terrains, and decreased the rate of fuel consumption.

Prepared in cooperation with Transportation Systems Center, Cambridge, Mass. See also report dated Dec 75, PB-250673.

Jacobs, ME
Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-78/13, Feb. 1978, 58 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-279457/6ST, DOTL NTIS

04 191751
WAYSIDE ENERGY STORAGE STUDY. VOLUME I. SUMMARY
Volume I summarizes an in-depth application study which was conducted to determine the practicality and viability of using large wayside flywheels to recuperate braking energy from freight trains on long downgrades. The study examined the route structures of nine U.S. railroads and identified various wayside energy storage system (WESS) configurations. The optimum means of transferring energy from the train to the wayside was by means of a high-voltage ac catenary from either regenerative electric locomotives or modified dual-mode (diesel-electric/electric) locomotives. The application of WESS was then analyzed for four specific routes of typical U.S. railroads. These routes and the annual returns on investment (ROI's) resulting from WESS deployment on existing railroads were as follows: Atchinson, Topeka, and Santa Fe (Los Angeles to Belen), 27.1 percent; Black Mesa and Lake Powell, 17.3 percent; Conrail (Pittsburgh to Harrisburg), 22.0 percent; Union Pacific (Los Angeles to Salt Lake City) 20.2 percent.

Also available in set of 4 reports
PC E15, PB-293 856-SET.

Lawson, LJ Cook, LM
AiResearch Manufacturing Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-78/78, I, DOT-TSC-FR-79-7.I, Feb. 1979, 79 p.

Contract DOT-TSC-1349

ACKNOWLEDGMENT: NTIS
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PB-293857/9ST, DOTL NTIS

04 191752
WAYSIDE ENERGY STORAGE STUDY. VOLUME II. DETAILED DESCRIPTION AND ANALYSIS
Volume II summarizes an in-depth application study which was conducted to determine the practicality and viability of using large wayside flywheels to recuperate braking energy from freight trains on long downgrades. The study examined the route structures of nine U.S. railroads and identified various wayside energy storage system (WESS) configurations. The optimum means of transferring energy from the train to the wayside was by means of a high-voltage ac catenary from either regenerative electric locomotives or modified dual-mode (diesel-electric/electric) locomotives.

Also available in set of 4 reports
PC E15, PB-293 856-SET.

Lawson, LJ Cook, LM
AiResearch Manufacturing Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-78/78,II, DOT-TSC-FRA-79-7.II, Feb. 1979, 291 p.

Contract DOT-TSC-1349

ACKNOWLEDGMENT: NTIS

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PB-293858/7ST, DOTL NTIS

04 191753
WAYSIDE ENERGY STORAGE STUDY. VOLUME III. ENGINEERING ECONOMICS ANALYSIS: DATA AND RESULTS
Volume III contains the detail of the engineering economics analysis which showed attractive returns on investment for deployment of WESS on existing U.S. railroads.

Portions of this document are not fully legible. Also available in set of 4 reports PC E15, PB-293 856-SET.

Lawson, LJ Cook, LM
AiResearch Manufacturing Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-78/78, III, DOT-TSC-FRA-79-7.III, Feb. 1979, 570 p.

Contract DOT-TSC-1349

ACKNOWLEDGMENT: NTIS
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04 191754
WAYSIDE ENERGY STORAGE STUDY. VOLUME IV. DUAL-MODE LOCOMOTIVE: PRELIMINARY DESIGN STUDY
A preliminary design study was conducted to confirm the technical viability and economic attractiveness of the dual-mode locomotive concept based on the most common U.S. road locomotive, the SD40-2. The study examined the existing characteristics of the base locomotive and ensured that operation in the diesel mode would not be compromised by a locomotive which has a pantograph, transformer, converter, and choke added to permit operation from a 50 kV catenary. The study concluded that the concept is technically viable (although some equipment is only available overseas) and is economically attractive, the top line modification cost being $217,500.

Also available in set of 4 reports PC E15, PB-293 856-SET.

Lawson, LJ Cook, LM
AiResearch Manufacturing Company, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-78/78, IV, DOT-TSC-FRA-79-7.IV, Feb. 1979, 54 p.

Contract DOT-TSC-1349

ACKNOWLEDGMENT: NTIS
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PB-293860/3ST, DOTL NTIS

04 196988
OBSERVATIONS BY U.S. RAILROAD DELEGATION OF SOVIET ELECTRIC AND DIESEL-ELECTRIC LOCOMOTIVE TECHNOLOGY
In its Sixth Meeting held in Moscow in August 1977 the Joint American-Soviet Railroad Working Group agreed that a U.S. railroad delegation would visit the USSR for 12 days in the second quarter of 1978 to study the design, development, manufacture, repair, maintenance, and operations of Soviet electric and diesel locomotives. As a result, an eight member U.S. delegation made this visit in May/June 1978. Each member prepared a separate informal trip report of his observations. This report is a compilation of the individual reports (which are retained, along with some pictures and printed material, in the files of FRA). This report contains an Executive Summary, individual sections on locomotive design/manufacture, locomotive maintenance/repair, and locomotive operations as well as supporting appendix material. Prior to the visit, more than 90 specific questions were submitted to the Ministry of Railroads. Answers to these questions, as translated by the Soviets, were obtained in written form and through discussions and observations. The body of this report utilizes a format of questions and answers.

Spanton, DL
Federal Railroad Administration Final Rpt. FRA/ORD-79/16, Mar. 1979, 84 p., 8 App.

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04 303668
INPUT POWER CHARACTERISTICS OF THE THYRISTOR VARIABLE VOLTAGE POWER CONDITIONER
A laboratory study was made of transformer and thyristor voltage control for speed control of a rotary induction motor. The test program consisted of two parts; the first dealing with measurements of the induction motor characteristics and the second with the distribution of complex electric power in the system with both types of voltage-control. The current harmonics which are generated by thyristor control are shown to give rise to additional motor losses and reduction in motor efficiency. The non-sinusoidal currents present with thyristor control produce reactive distortion power. Suggestions are made regarding the suitable instrumentation to use in measuring the distortion power as well as the other components of complex power in the system.

See also PB-226281

Stickler, JJ Ploetz, GP Raposa, FL
Transportation Systems Center Final Rpt. FRA/ORD/D-74-24, DOT-TSC-FRA-73-12, Nov. 1973, 45 p.

ACKNOWLEDGMENT: NTIS
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PB-231048/0, DOTL NTIS

04 308260
EVALUATION OF SILICONE FLUID FOR REPLACEMENT OF PCB COOLANTS IN RAILWAY INDUSTRY
Electrical performance evaluations were made on a railway transformer which was retrofilled with 50 cs polydimethylsiloxane. Comparisons of the data from the PCB-filled transformer retrofilled with the silicone oil indicated no reduction in operating performance. Analyses of the various flushing cycles and of the final silicone fluid showed that the most efficient flush method was to circulate solvent in the completely filled unit, followed by solvent removal and a subsequent silicone fill. Residual levels of PCB's were found to be stabilized at 3.47% two weeks after retrofilling. Investigations were carried out to determine possible temperature changes which could occur with a silicone retrofilled transformer. A maximum rise of 2.7 degrees C was observed with this type of retrofill. This small increase in temperature for a forced air cooled transformer could have a minimal effect on transformer performance.

Walsh, EJ Voytik, DE
Westinghouse Electric Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-79/37, DOT-TSC-FRA-79-10, June 1979, 54 p., Figs., Tabs., 8 Ref., 1 App.

Contract DOT-TSC-1294

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DOTL RP

04 308279
FLYWHEEL ENERGY STORAGE SWITCHER. VOLUME II--FIELD DATA
This is Volume II of the two-volume report, Flywheel Energy Storage Switcher Final Report. The report comprises: Volume I-Summary and Detailed Description of Analysis; Volume II-Field Data; Volume II contains supporting information and detailed data developed during switchyard and locomotive test phases.

McConnell, R
AiResearch Manufacturing Company, Federal Railroad Administration Final Rpt. FRA/ORD-79/20.2, 79-15651-2, Apr. 1979, 363 p.

Contract DOT-FR-777-4247-2

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DOTL RP

04 308280
FLYWHEEL ENERGY STORAGE SWITCHER. VOLUME I--STUDY SUMMARY AND DETAILED DESCRIPTION OF ANALYSIS
An indepth study of the application of flywheel energy storage to the railroad switchyard locomotive was conducted to determine the practicality and viability of such a system. the system, as originally conceived, required the use of separately excited traction motors, and a major task of the study was to test separately excited version of the Electro-Motive Division's D77 traction motor. The attractiveness of the system is very dependent on the

operational scenario of the switching locomotive. Therefore, the study examined the operation of locomotives at three flatyards: Dillard (Southern Railway System), Baldwin (Seaboard Coast Line), and Whitefish (Burlington Northern). Also, a large amount of data concerning the operating environment of switching locomotives was collected. It was concluded early in the study that a boxcar was required to carry the energy storage unit because no room existed on the locomotive. This, combined with the increased auxiliary load, results in the same energy consumption with or without the FESS system, for a typical flatyard operation in spite of the energy recuperated and reused. Brake maintenance savings, although significant, are not sufficient to give an attractive return on investment.

Cook, LM Curran, WT McConnell, R Smith, AK
AiResearch Manufacturing Company, Federal Railroad Administration
FRA/ORD-79/20.1, 79-15651-1, Apr. 1979, 329 p., Figs., Tabs.

Contract DOT-FR-777-4247-1

ACKNOWLEDGMENT: NTIS
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PB80-121478, DOTL NTIS, DOTL RP

04 319065
FIRE BEHAVIOR OF TRANSFORMER DIELECTRIC INSULATING FLUIDS

This report presents results for the fire behavior of pure and askarel-contaminated fluids which are candidates for use as railroad transformer dielectric insulating fluids. In the study a hydrocarbon and a dimethyl-siloxane fluid were examined. The fire behavior of the fluids was examined on the basis of parameters obtained in the FM Laboratory-Scale Flammability Apparatus. The measured flash point, fire point and boiling point of the hydrocarbon fluid were lower than those of dimethyl-siloxane fluid both in the presence and absence of the askarel. There was some noticeable decrease in the flash and fire points when the amount of askarel in the mixture was increased from about 5 percent to 7 percent by weight. The analyses of the results indicated that: 1) Ignition and surface flame spread for the hydrocarbon fluid are expected to be about one and a half times as fast as for the dimethyl-siloxane fluid in larger-scale fires (the ignition and surface flame spread for red oak are expected to be about three times as fast as for the hydrocarbon fluid). Askarel contamination of hydrocarbon and dimethyl-siloxane fluids is expected to have insignificant effect on ignition and surface flame spreads of the fluids in larger-scale fires. 2) The heat release rate in the combustion of heptane, hydrocarbon and dimethyl-siloxane fluid in larger-scale fires is expected to be in the ratio of about 20:10:1 respectively. Askarel contamination of the hydrocarbon and dimethyl-siloxane fluid is expected to have insignificant effect on the heat release rate in larger-scale fires involving these fluids. The parameters from the FM Flammability Apparatus were found to be useful to predict satisfactorily the fire behavior of fluids expected in larger-scale fires.

Tewarson, A Lee, JL Pion, RF
Factory Mutual Research Corporation, Federal Railroad Administration
Final Rpt. FRA/ORD-80/08, DOT-TSC-FRA-80-1, Jan. 1980, 74 p., Figs., Tabs., 8 Ref., 2 App.

Contract DOT-TSC-1703

ORDER FROM: FRA/ORD

DOTL RP

04 325735
RAILROAD ELECTROMAGNETIC COMPATIBILITY LOCOMOTIVE VOLUME 1, SUMMARY OF E-60 CP ELECTROMAGNETIC EMISSION YARD MEASUREMENTS

Results of electromagnetic emission measurements performed on E-60 locomotives at AMTRAK's Wilmington, Delaware, Maintenance facility are presented. A description of the measurements and methodology employed is included.

O'Neill, DJ (IIT Research Institute)
Electromagnetic Compatibility Analysis Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-80/66.I, ECAC-CR-80-027, Oct. 1980, 178p, Figs., 3 Tab.

ORDER FROM: NTIS

PB81-117988, DOTL NTIS, DOTL RP

05 181921
BRAKE SYSTEM DESIGN OPTIMIZATION. VOLUME I. A SURVEY AND ASSESSMENT
Existing freight car braking systems, components, and subsystems are characterized both physically and functionally, and life-cycle costs are examined. Potential improvements to existing systems previously proposed or available are identified and described in functional and economic terms. Innovative braking systems which offer a potential benefit are identified, described, and assessed for functional and economic characteristics. Potential improvements are divided into two categories: those which could be implemented in the short term (10 years) and those which could be implemented in the long term (20 years). Areas which need additional study are identified.

Eshelman, LL Shelleman, CC Henderson, JP
Kearney (AT) and Company, Incorporated, Transportation Systems Center Final Rpt. DOT-TSC-FRA-78-1.I, FRA/ORD-78/20.I, June 1978, 140 p.

Contract DOT-TSC-1040

ACKNOWLEDGMENT: NTIS
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PB-284080/9ST

05 191446
PASSENGER VEHICLE BRAKING STUDY
The report is a summary of currently available brake components and braking systems that might be applicable to 150-mph passenger service. The summary includes an analysis of the braking problem, a description of braking systems now in use and an evaluation of several advanced braking systems. The report reviews whether or not eddy-current brakes should be developed for use on Amcoaches and/or Metroliners in high-speed service in the Northeast Corridor. This report also considers what systems or components should be developed in the event that eddy-current brakes prove unusable.

Serocki, J Scofield, R
ENSCO, Incorporated, Federal Railroad Administration Tech Rpt. FRA/ORD-78/33, May 1978, 84 p.

Contract DOT-FR-64113

ACKNOWLEDGMENT: NTIS
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PB-292650/9ST

05 313242
METHODOLOGY FOR EVALUATING THE COST AND BENEFIT OF ADVANCED BRAKING AND COUPLING SYSTEMS
The report presents a quantitative methodology for evaluating the costs and benefits of advanced railroad braking and coupling systems. Starting with a specification of the performance characteristics of candidate systems, the methodology employs four major elements to enable the user to compute financial impact and identify institutional changes required. The operations element is used to evaluate required manpower and operational changes and to estimate incremental costs for road and yard operations. The dynamics element deals primarily with accident and maintenance costs. Under the category of equipment, new maintenance procedures are identified and incremental equipment costs are estimated. Finally, the financial and institutional element is used to determine the likely results of developing and introducing advanced systems. This methodology is being utilized to evaluate the costs and benefit of nineteen candidate systems.

Bender, EK Berger, AJ Ernest, JW Wittig, LE
Bolt, Beranek and Newman, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-79/57, BBN-4142, Nov. 1979, 92 p.

Contract DOT-FR-8091

ACKNOWLEDGMENT: NTIS
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PB80-153042, DOTL NTIS

05 325719
EVALUATION OF THE COSTS AND BENEFITS OF ADVANCED BRAKING AND COUPLING SYSTEMS
This report presents an evaluation of the costs and benefits of sixteen advanced railroad braking and coupling systems. Most of the benefits result from improved classification yard efficiencies, with secondary benefits accruing through reduced accident rates, road delays, and maintenance related to component wear and failure. The most promising systems are couplers with wide gathering ranges, a brake condition monitoring system, and a remote controlled brake locking system. In addition, ultrasonic brake control on cars presently requiring special handling and direct electronic brake control all show promise of improving railroad productivity.

Bender, EK Wittig, LE Wright, HA
Bolt, Beranek and Newman, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/49, BBN 4417, Oct. 1980, 68p, 53 Fig., 10 Tab., 30 Ref.

Contract DOT-FR-8091

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PB81-123556, DOTL NTIS, DOTL RP

05 325731
AMTRAK/KNORR DISC BRAKE STUDY VOLUME I-FINAL REPORT
This report describes the Amtrak/Knorr Disc Brake Study which was developed: (1) To evaluate candidate replacement disc brakes for the Knorr disc brakes presently in use on Amfleet and Turboliner cars. (2) To explain the cause of the loosening of the attaching pins and the excessive wear experienced by the disc-brake friction ring on the Knorr disc brakes. (3) To find out why the disc brake failure rate was much higher when the outside temperature was below 32 degrees Fahrenheit. This report covers the first six months of a three-year controlled revenue service test, an over-the-road test, and laboratory tests to correlate over- the-road test results to pin wear.

Scofield, R Avant, R
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/62.1, DOT-FR-80-12, Sept. 1980, 205p, Figs., 9 Tab.

Contract DOT-FR-64113

ORDER FROM: NTIS

PB81-109837, DOTL NTIS, DOTL RP

05 325732
AMTRAK/KNORR DISC BRAKE STUDY VOLUME II-APPENDICES A THROUGH I
This volume contains the following appendices to Volume I, Final Report: Appendix A-Wheel Condition Effects; Appendix B-Effects of Cyclic Loads on Pin Wear; Appendix C-Over- the-Road Test Acceleration Data from the Boston Run; Appendix D-Over-the-Road Test Acceleration Data from the Montreal Run; Appendix E-Laboratory Test-Lateral Dynamic Load Test (Pendulum/Bong Test); Appendix F-Vertical Impulse Loading- Laboratory Test; Appendix G-Static Load Test; Appendix H- Temperature, Precipitation, and Snow-on- the-Ground Plots; and Appendix I- Test Plan.

Scofield, R Avant, R
ENSCO, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/62.2, DOT-FR-80-12, Sept. 1980, 239p, Figs., Tabs., 9 App.

Contract DOT-FR-64113

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PB81-109845, DOTL NTIS, DOTL RP

05 327750
DESIGN, FABRICATION AND EVALUATION OF PROTOTYPE WAYSIDE BRAKE INSPECTION SENSORS
Prototype Wayside instrumentation has been designed, developed, and tested that proves the feasibility of measuring braking system effectiveness on moving rail cars. The instrumentation system includes a specially

designed short section of instrumented rail and two infrared detectors. The rail section deflects elastically under each passing wheel load, and two orthogonally placed transducers discriminate between rail reaction to braking and to weight. A pair of infrared detectors viewing the rims on both wheels of each axle provide thermal data useful in determining the side to side ratio of total axle braking effort. Together these sensors can generate data to evaluate the braking performance of each wheel. Field tests to evaluate the system were conducted on a commercial rail line and at the U.S. Department of Transportation's Transportation Test Center at Pueblo, CO. Test results showed that the sensors were able to indicate normal and abnormal braking conditions. Also included in the report are a railcar brake system fault and malfunction analysis, structural analysis of the instrumented rail, design analysis of the infrared sensor, detail specifications of the rail and infrared sensors, and recommendations for further system development and testing.

Spaulding, DB Lentz, KWJ Fryklund, GG Gillespie, JR
Novatek, Incorporated, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/20, DOT-TSC-FRA-80-8, June 1980, 205p

Contract DOT-TSC-1323

ACKNOWLEDGMENT: NTIS
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PB81-116105, DOTL NTIS

06 084727
MEASUREMENTS OF LEAKY COAXIAL CABLES AND POSSIBLE APPLICATIONS TO TRAIN COMMUNICATION

The electrical and radiation properties of the Radiax have been measured. The main results are: i) the surface wave exists, ii) the radial radiation follows 1/r2 relation for frequency below 190 MHz and 1/r relation for frequency near 400 MHz, iii) the transverse radiation pattern is nearly omnidirectional, iv) the coherent band-width is on the order of 3 MHz and the operating frequency range is several hundred megahertz; and v) better coupling efficiency is observed at lower frequency. Possible applications for railroad communication are discussed.

This work was sponsored by the Office of Research and Development, FRA/DOT.

Yoh, P Esposito, R Gagnon, R Kodis, RD
Transportation Systems Center, (DOT-TSC-FRA-73-15) Final Rpt. FRA-ORD&D-74-43, May 1974, 90 pp, 57 Fig., 4 Tab.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
DOTL TF23:U68A34, PB-262000/3ST, DOTL NTIS

06 126975
A COMMUNICATION LINK APPROACH TO ACTUATION OF GRADE-CROSSING MOTORIST-WARNING SYSTEMS

Previous studies indicate that one promising avenue to grade-crossing motorist-warning systems, offering lower cost and independent of railroad-track circuits, is use of a radio-communication link for signal activation. By this means, the presence of a train approaching a crossing can be communicated to the crossing from an appropriate distance. This study describes analysis, development, and test activities carried out at the Transportation Systems Center to determine the basic feasibility and practicality of a microwave realization of this approach. A brief review of the conceptual framework is followed by detailed discussion of field-test procedures and results, with special attention then given to train detectors, microwave-propagation aspects, use of solar power, and radar train detection.

Hopkins, JB Abbott, R Holmstrom, FR White, EF Newfell, AT
Transportation Systems Center, (DOT-TSC-FRA-75-7) Final Rpt. FRA-OR&D-75-80, July 1975, 118 pp, Figs., Tabs., Phots., 7 Ref.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244584/AS, DOTL NTIS

06 131042
LIGHTNING AND ITS EFFECTS ON RAILROAD SIGNAL CIRCUITS

This study discusses the occurrence of lightning, its effects on railroad signal equipment, and protection of such equipment from lightning damage, with special attention to known protective techniques which are employed in a variety of situations in the power, communications, and railroad industries. A brief review is offered of the causes of lightning and other surges, followed by an extensive treatment of the means by which lightning and power-line transients induce surges and over-voltages in signalling circuits. Specific topics include the effects of the direct stroke current, the collapsing electric field when the stroke occurs, inductive coupling, and the effects of ground currents in the earth. A survey of protective devices and techniques currently in use for specific types of equipment is presented, including categorization of arrestors by type and application. Preferred lightning protection practices in railroad signalling are examined and related to practices in other fields. The problem of lightning protection is addressed from an overall systems viewpoint, encompassing development and testing of protective systems and design of systems, so that they can more easily be protected. Recommendations for future research are made.

Lowell Technological Institute is under contract to Transportation Systems Center.

Holmstrom, FR
Lowell Technological Institute Research Foundation, (DOT-TSC-FRA-75-21) Final Rpt. FRA-OR&D-76-129, Dec. 1975, 106 pp, 16 Fig.

Contract DOT-TSC-589

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250621/AS, DOTL NTIS

06 139459
OPTICAL AUTOMATIC CAR IDENTIFICATION (OACI). FIELD TEST PROGRAM

The results of the Optical Automatic Car Identification (OACI) tests at Chicago conducted from August 16 to September 4, 1975 are presented. The main purpose of this test was to determine the suitability of optics as a principle of operation for an automatic car identification. Readabilities by standard and "modified" scanners were measured. Based on the optical information available in the label-scanner communication channel and the determination of the non-read causes, the label-scanner readability and limit of readability were obtained. Also the same readabilities were obtained using multiplexed data from two scanners, one at each side of the track. The benefits of redundancy in the multiplexed data are based on the analysis of the test results. Conslusions and recommendations are presented. No attempt has been made to evaluate the hardware implementation of the OACI systems used during the Chicago test.

Sponsored by Federal Railroad Administration, U.S. DOT.

Ingrao, HC
Transportation Systems Center, (DOT-TSC-FRA-76-9) Final Rpt. FRA/ORD-76/249, May 1976, 186 pp, Figs., Tabs.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-254810/5ST, DOTL NTIS

06 151243
STANDBY POWER FOR RAILROAD-HIGHWAY GRADE CROSSING WARNING SYSTEMS

The requirements for standby power at railroad-highway grade crossings, as established by the states, the Association of American Railroads, and the individual railroads, are described. Standard means of satisfying these requirements, using 115 vac primary power and storage batteries for standby, are compared with a number of new techniques, now passing from experimental to operational use, that incorporate solar cells or thermoelectric generators. In addition, other even more innovative techniques are examined. The conclusion of this survey is that for most railroad grade crossing applications, the existing standard techniques (reliance on ac primary power and standby storage batteries) will continue to be the preferred choice. In a number of circumstances in which the provision of ac primary power is very expensive, the combination of solar cells or thermoelectric generators as the primary source, with storage batteries as standby, will be optimal.

Holmstrom, FR
Lowell University Research Foundation, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-15, FRA-ORD/D-76-286, Sept. 1976, 26 pp

Contract DOT-TSC-589

ACKNOWLEDGMENT: NTIS
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PB-263592/8ST, DOTL NTIS

06 163787
THE SAFETY OF ELECTRONICS IN RAILROAD CONTROL SYSTEMS

Ever-increasing demands for increased safety and efficiency in railroad operations has caused the designers of railroad control systems to consider ever more seriously the use of electronic parts and sub-systems in formulating control systems to satisfy these demands. This paper reviews the evolution of railroad control systems, identifies the major design principles upon which they have been based, and addresses the applicability of these principles to underpin electronic control systems having acceptable safety and efficiency.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroad Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Boyd, RK (TRW Railroad Control Systems)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 7-15, 2 App.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-272948/AS, DOTL NTIS

06 165081
SURVEY OF INDUCTIVE COMMUNICATION SYSTEMS
A survey is made of various inductive systems proposed for low frequency train communication. It is found that thick dielectric jackets or coaxial and metallic shields may be required to reduce the environmental effects that lead to high attenuation. Twisted wire cables with inversely connected coupling antennas attain reduction of induced electrical noise and of radiated fields. External noise interference in various environments is discussed. Analysis is made of the coupling variation effect due to wire separation.

Chin, GY Yoh, P
Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-74-13) Intrm Rpt. FRA-ORD&D-75-35, Apr. 1975, 60 pp, 20 Fig., 5 Tab., 16 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-276189/AS, DOTL NTIS, DOTL TF23.U68A34

06 176669
OPTICAL AUTOMATIC CAR IDENTIFICATION (OACI). READABILITY AND SCANNER PERFORMANCE
The results of the Optical Automatic Car Identification (OACI) study on readability and scanner performance conducted on the Chicago Railroad Terminal Information System (CRTIS) data which includes operation from February 1 to June 15, 1977 are presented. The main purpose of this study was to determine the scanner non-read and error-read contributions to overall OACI readability measurements, the use of the calibration train concept as a method of OACI network analysis, and possible network automatic checkout. The study attempts to separate the non-read and error-read components due to the scanner performance from other label factors which affect the readability measurements. The scanner performance contribution to non-read and error-reads was estimated on the basis of scanner readability differences observed by means of calibration trains. The calibration train concept is suggested as an effective tool to evaluate OACI scanner network performance. The present study complements the one conducted in 1975 by the Federal Railroad Administration (Final Report No. FRA/ORD-76/249, May 1976). Conclusions are presented.

This is one of four reports which provides the final reports for the FRA OACI Improvement Effort. Consistent with the four interim reports (Report No. FRA/ORD-77/38), the other final reports (to be published) will cover the subjects of: Scanner System Performance and Cost Improvements (78/15.I); Optical Properties of Labels (78/15.III); System Alternatives Evaluation Model (78/15.IV).

Ingrao, HC Thompson, WI, III
Cambridge Systems Corporation FRA/ORD-78/15.II, Mar. 1978, 221 pp, Figs., 6 Tab., 15 Ref., 5 App.

Contract DOT-FR-74292

ACKNOWLEDGMENT: FRA
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PB-280550/AS, DOTL NTIS, DOTL RP

06 179117
OPTICAL AUTOMATIC CAR IDENTIFICATION VOLUME-IV--SYSTEM ALTERNATIVES EVALUATION MODEL
The report presents the development of an analytical model together with descriptions and illustration of how it can be applied in analyzing the comparative benefits and costs of using ACI to improve typical railroad operation and control management information systems (MIS). Summaries are made of background studies of how ACI has been employed by different railroads. The system implementations at these organizations were found to vary significantly. The basic measure of the overall MIS operational effectiveness is defined. Also the report identifies and discusses basic kinds of errors which can occur relating to car handling and clerical reporting. The ACI system is described and analytical (probabilistic) representations are made for characterizing the imperfect status and performance accuracies. The report provides a qualitative discussion of the considerations underlying systematic integration of pre-car movement information produced by yard level operations with actual car movement reports produced by ACI to generate updated advance consist reports with enhanced accuracy. Four appendices covering the analytical development, procedures for applying (manual or computer) the model, and illustrations of model applications, are considered an integral part of model development.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This is one of four reports which provides the final reports for the FRA OACI Improvement Effort. Consistent with the four interim reports (Report No. FRA/ORD-77/38), the other final reports cover the subjects of: Scanner System Performance and Cost Improvements 78/15.I (to be published); Readability and Scanner Performance 78/15.II (March 1978); Optical Properties of Labels 78/15.II (to be published).

Kooharian, A
Kooharian (A) Final Rpt. FRA/ORD-78/15.IV, May 1978, 99 pp, 5 Fig., 5 Tab., 2 Ref., 4 App.

Contract DOT-FR-74296

ACKNOWLEDGMENT: FRA
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PB-282488/AS, DOTL NTIS, DOTL RP

06 186227
RAILROAD ELECTROMAGNETIC COMPATIBILITY. VOLUME II. ASSESSMENT FOR CLASSIFICATION YARDS AND ELECTRIFICATION
The automated freight classification yard electromagnetic environment is composed of electrical and electronic devices that are each potential sources and/or victims of electrical interference. The electromagnetic radiation of the environment and selected railroad yard devices such as doppler radars and switch machines was measured at three railroad classification yards. The susceptibilities of selected yard devices were measured to determine operational sensitivity to the yard electromagnetic radiations. In addition to yards, since railroad electrification has important implications, radiations from an electrified railroad operating at 50 kilovolt 60 Hertz were also measured to formulate a measurement methodology and to determine the potential interference effects on railroad operations.

Prepared in cooperation with IIT Research Inst., Chicago, IL. See also Volume 1 dated March 78, PB-281705.

Speh, PE Griffin, S
Electromagnetic Compatibility Analysis Center, IIT Research Institute, Federal Railroad Administration Final Rpt. FRA/ORD-77/77.II, ECAC-PR-78-038, Sept. 1978, 172 p.

ACKNOWLEDGMENT: NTIS
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PB-287802/3ST, DOTL NTIS

06 188687
OPTICAL AUTOMATIC CAR IDENTIFICATION (OACI) VOLUME I--ADVANCED SYSTEM SPECIFICATION
A performance specification is provided in this report for an Optical Automatic Car Identification (OACI) scanner system which features 6% improved readability over existing industry scanner systems. It also includes the analysis and rationale which support this specification. This improved system is a result of design and test of selected modifications to existing equipment. It is projected that a cost reduction of fifty percent and a reliability improvement by a factor of three, along with a savings of seventeen hundred dollars per year due to maintainability considerations, could be realized using the new system. Sections of this report contain descriptions of test data showing the improvement in readability for degraded labels and difficult ambient conditions. Also included in this specification are guidelines for a compact, self calibrating scanner requiring no air conditioning. At the conclusion of the hardware and testing phase of the program, the modified scanner configuration was tested and demonstrated in the areas of optics, electronics, data processing, and packaging. Test results are included in this report.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This is one of four volumes which provide the final reports for the FRA OACI Improvement Effort. The other final reports cover the subjects of: Systems Alternatives Evaluation Model 78/15, IV (May 1978): Readability and Scanner Performance 78/15.II (March 1978); Optical Properties of Labels 78/15.III.

Long, LE
Transportation Systems Center, (DTS-733) Final Rpt. FRA/ORD-78/15.I, DOT-TSC-FRA-78-22.I, Dec. 1978, 220 p., 45 Fig., 16 Tab., 4 App.

ACKNOWLEDGMENT: FRA
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PB-291877/9ST, DOTL NTIS, DOTL RP

06 197315
OPTICAL AUTOMATIC CAR IDENTIFICATION (OACI). VOLUME III. OPTICAL PROPERTIES OF LABELS
The results of a study on the optical properties of Optical Automatic Car Identification (OACI) labels (modules) and the review of the physical and chemical properties leading to a better understanding of the tests conducted on Improved Surface Treatment, Standard, and overlayed labels are presented. Label operational lifetime is defined using as criteria a reduction to 5% of the original label retroreflectance during that period. Based on the IST tests, the estimated operational life of those labels in that environment will be on the order of 12 years, provided that no failure in substrate or mechanical action on the label occurs. This life estimate is compatible with test data from OACI modules. Solar radiation is identified as the major cause of non-reversible mechanisms determinant of OACI label operational life. Other operational and environmental factors with reversible and non-reversible components are identified. Some OACI label alternatives are suggested. Experiments and evaluations of OACI labels by the Association of American Railroads and railroads are indicated.
See also Volume 1, PB-291 877.

Ingrao, HC
Cambridge Systems Corporation, Federal Railroad Administration Final Rpt. FRA/ORD-78/15.III, CSC-77-102, Mar. 1979, 238 p.

Contract DOT-FR-74292

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-294202/7ST, DOTL NTIS

06 198186
EVALUATION OF SIGNAL/CONTROL SYSTEM EQUIPMENT AND TECHNOLOGY. TASK 1: ASSESSMENT OF SIGNAL/CONTROL TECHNOLOGY AND LITERATURE REVIEW
The report presents the results of an investigation to obtain an assessment of the present technologies in use throughout the world for railroad signals and control systems applicable to high-speed passenger trains. Questionaires were developed and sent to foreign and domestic railroads, rapid transit systems, and manufacturers of signal and control equipment. Railroads, transit systems and manufacturers were visited and interviewed. Many hundreds of articles and technical papers were researched. Over 250 were cataloged, translated and cross-indexed to form a complete technical library. This inventory data has been arranged to permit a logical review of all known technology in relation to each type of railroad signal or control system or subsystem(s).
Prepared in cooperation with Kentron, Inc., Dallas, TX.

Taylor, SF Marshall, JF Schultz, CM Whalen, RB
STV, Incorporated, Dyer (Thomas K), Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-78/39.1, Dec. 1978, 191 p.

Contract DOT-FR-773-4236

ACKNOWLEDGMENT: NTIS
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06 308263
EVALUATION OF SIGNAL/CONTROL SYSTEM EQUIPMENT AND TECHNOLOGY. TASK 2 STATUS OF PRESENT SIGNAL/CONTROL EQUIPMENT
This report presents the status of present signal/control equipment in service on passenger rail routes in the United States and in foreign countries. It also provides an evaluation comparison of the features of signal and control Systems currently used by selected domestic and foreign major operating railroad/transit systems. The report was developed from a literature review, visits to domestic and foreign railroads, discussions with railroad signal engineers, transportation personnel and from data gathered from domestic and foreign railroad/transit systems.

Taylor, SF Marshall, JF Schultz, CM Whalen, RB
STV, Incorporated, Kentron International, Incorporated, Dyer (Thomas K), Incorporated, Federal Railroad Administration Final Rpt. FRA-/ORD-78/39.2, Jan. 1979, 122 p., Figs., 1 App.

Contract DOT-FR-773-4236

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06 313147
EVALUATION OF SIGNAL/CONTROL SYSTEM EQUIPMENT AND TECHNOLOGY. TASK 3: STANDARDIZATION, SIGNAL TYPES, TITLES
This report analyzes and summarizes current signal types and associated aspects, titles and indications employed by U.S. Railroads over which Amtrak operates as well as by several foreign railroads. A review of the historical development of signal technology is presented. The report concludes with recommended standards for signal types, aspects, titles and indications.
Prepared in cooperation with Dyer (Thomas K.), Inc., Lexington, MA., and Kentron International, Inc., Dallas, TX. See also Task 2, PB-299 891.

Taylor, SF Marshall, JF Schultz, CM Whalen, RB
STV, Incorporated, Federal Railroad Administration Final Rpt. FRA-/ORD-78/39.3, Dec. 1979, 358 p.

Contract DOT-FR-773-4236

ACKNOWLEDGMENT: NTIS
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PB80-142441, DOTL NTIS

06 314045
EMC CONSIDERATIONS IN CLASSIFICATION YARD DESIGN
The automated freight classification yard is composed of many electrical and electronic devices working in a complex interrelationship, with the goal of safe and efficient transportation of goods. Since many of these devices potentially emit and/or are susceptible to electromagnetic energy, thus degrading equipment reliability and overall safety, electromagnetic compatibility considerations are of great concern in the design of new yards or the upgrade of presently existing yards. Important railroad electromagnetic compatibility considerations are discussed in a tutorial manner. In addition, measurement techniques used to obtain source and susceptibility data, and techniques to successfully mitigate electromagnetic interference are presented.
Prepared in cooperation with IIT Research Inst., Annapolis, MD.

O'Neill, DJ
Electromagnetic Compatibility Analysis Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/12, ECAC-PR-79-035, Jan. 1980, 137 p.

ACKNOWLEDGMENT: NTIS
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PB80-176621, DOTL NTIS

06 319053
IDENTIFICATION AND EVALUATION OF OFF-TRACK TRAIN DETECTION SYSTEMS FOR GRADE CROSSING APPLICATIONS
The study focused on a detailed investigation of all potential train detection techniques which do not use the track. Both point sensing and continuous sensing system approaches were analyzed. It was found that the transmission line sensor and magnetic point sensor offer the greatest likelihood of yielding a practical off-track detection system. A comprehensive system analysis and evaluation of these concepts is made. The study included a limited field test of the transmission line concept, which was then selected as the most promising for follow-on development.

Nylund, EE Holtermann, PC
GARD, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/32, Apr. 1980, 117 p., Figs., 3 Tab., 27 Ref., 1 App.

Contract DOT-TSC-1448

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PB80-186430, DOTL NTIS

06 325714
PROCEEDINGS OF THE OCTOBER 1979 WORKSHOP FOR CLASSIFICATION YARD TECHNOLOGY "A STATUS REPORT ON YARD RESEARCH"
The Classification Yard Technology Workshop was sponsored by the Federal Railroad Administration (FRA) to present the results of current yard research under the Railroad Operational Improvements Program. The major program objectives are the development of technologies, quantification of areas for improvement, evaluation of components and systems, and improvement of effectiveness of railroad communication and control

systems. These proceedings include the technical papers, responses to the workshop questionnaire, and comments of conference participants and panel members of the following areas of research: Yard Design Methods, New Concepts in Car Speed Control, Improvements for Car Presence Detection, Measurements of Rolling Resistance, Electromagnetic Compatibility, and Yard Computer Systems.

Witt, ES Shedlock, N
Pacific Consultants, Federal Railroad Administration FRA/ORD-80/17, PC-DOT-01, Dec. 1980, 208p, Figs., Tabs., Refs.

Contract DOT-FRA-9126

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PB81-143315, DOTL NTIS, DOTL RP

06 325738
FEASIBILITY OF LORAN-C IN DETERMINING POSITION OF RAIL VEHICLES IN TRANSIT
This report describes nine field tests to evaluate the feasibility of using the LORAN-C system to locate rail vehicles in transit. The test was conducted over railroad routes between Van Wert, OH and Bound Brook, NJ. The test indicates that the LORAN concept is feasible although there are technical limitations: power and communication lines create severe electromagnetic interferences; terrain and structures distort the LORAN signal. The overall accuracy is on the order of one mile. For test runs totalling 300 miles, a usable signal was received for 77% of the mileage covered.

Donahue, J Conner, J
ENSCO, Incorporated, Federal Railroad Administration FRA/ORD-80/84, DOT-FR-80-32, Nov. 1980, 28p, 8 Fig., 2 Tab.

Contract DOT-FR-53-80-C-00002

ORDER FROM: FRA/ORD

DOTL RP

06 326382
EVALUATION OF SIGNAL/CONTROL SYSTEM EQUIPMENT AND TECHNOLOGY. TASK 4: ELECTRICAL NOISE DISTURBANCE
This report defines electromagnetic interference (EMI) generated by wayside and vehicle-mounted equipment associated with railroad electrification. The report describes the adverse effects of EMI upon existing and potentially applicable signal/control systems. Functional requirements for EMI control are defined and recommendations are made for follow-on testing activity. The problems of vandalism are also considered.

See also report on Task 3, PB80-142441. Prepared in cooperation with Dyer (Thomas K.), Inc., Lexington, MA., and Kentron International, Inc., Dallas, TX.

Taylor, SF Marshall, JF Schultz, CM Whalen, RB
STV, Incorporated, Federal Railroad Administration Final Rpt. FRA-/ORD-78/39.4, July 1980, 133p, 17 Fig., 4 Tab.

Contract DOT-FR-773-4236

ACKNOWLEDGMENT: NTIS
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PB81-111130, DOTL NTIS, DOTL RP

07 117495
RESEARCH LOCOMOTIVE AND TRAIN HANDLING EVALUATOR DEFINITION -CONCEPT 1. VOLUME III. ESTIMATED COSTS
Volume III describes the concept definition for a Research Locomotive and Train Handling Evaluator. Volume III presents cost estimates for designing, constructing and installing the Research Evaluator. Support facilities and buildings alongwith appropriate staffing are described but not costed. The Research Evaluator concept provides for growth from a basic facility to the full facility ultimately needed to carry out the FRA research program. Cost estimates are presented for both the basic, entry level facility and the ultimate facility.

See also Volume 2, PB-276 365. Also available in set of 4 reports PC E13, PB-276 362-SET.

Hulbert, S Wheeler, J Dompe, R Witham, C Csanky, L
MB Associates, Federal Railroad Administration Final Rpt. FRA-/ORD-77/47-VOL-3, MB-R-77/25-VOL-3, Sept. 1977, 37 pp

Contract DOT-FR-64260

ACKNOWLEDGMENT: NTIS
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PB-276366/2ST, DOTL NTIS

07 125893
HUMAN FACTORS IN RAILROAD OPERATIONS: ACTIVITIES IN FISCAL YEAR 1973
This is an interim report covering human factors services rendered by TSC to the FRA under the project: "Human Factors in Railroad Operations," during fiscal year 1973. It reviews all activities briefly and contains more detailed reports on a research plan for use with a locomotive cab simulator, a training survey, studies of train handling, and fault-tree analysis of railroad accident data.

Devoe, D Feehrer, CE Hill, JH Sussman, ED
Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-73-11) Tech. Rpt. FRA-OR&D-74-32, Feb. 1974, 114 pp, Figs., Tabs., 3 App.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche

PB-244540/1ST, DOTL NTIS

07 132201
PROPOSED QUALIFICATION REQUIREMENTS FOR SELECTED RAILROAD JOBS
This report proposes minimum, safety-related knowledge, performance and training requirements for the jobs of railroad engineer, conductor, brakemen and train dispatcher. Analyses performed were primarily based upon job and task analytic documentation already in existence, and were critically reviewed by government and civilian railroad specialists. Recommendations are also offered for the conduct of job training and for techniques to measure and evaluate job knowledge and performance.

Sponsored by the Federal Railroad Administration, U.S. DOT.

Hale, A Jacobs, HH
Dunlap and Associates, Incorporated, Federal Railroad Administration, Transportation Systems Center, (DOT-TSC-FRA-75-8) Final Rpt. FRA-OR&D-75-44, May 1975, 130 pp, 1 Fig., 12 Tab., Refs., 3 App.

Contract DOT-TSC-736

ACKNOWLEDGMENT: FRA, NTIS
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PB-251115/AS, DOTL NTIS, DOTL RP

07 134602
TASK ANALYSIS FOR THE JOBS OF FREIGHT TRAIN CONDUCTOR AND BRAKEMAN
This document describes the results of a research effort undertaken to detail the tasks of freight train conductors and brakemen. Included with text are detailed operational sequence diagrams for both conductor and brakeman. This task analysis is subsequent to a similar study conducted by McDonnell Douglas describing the tasks of freight train engineers.

Sanders, MS Jankovich, J
Naval Ammunition Depot, (DOT-TSC-FRA-75-10) Final Rpt. FRA-OR&D 75-69, May 1975, 236 pp

Contract RDTR 263

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

AD-A007528, DOTL NTIS, DOTL RP

07 145562
A SURVEY OF ALCOHOL AND DRUG ABUSE PROGRAMS IN THE RAILROAD INDUSTRY
A survey of 20 industrial alcoholism and counseling programs run by railroad corporations covering 58 variables was made by semi-structured interviews of program directors, union officials, and by questionnaires applied to individual clients. Descriptions of program policy, practices, penetration rates, success rates, relationships to discipline and client population parameters are given along with other topical areas. A factor analysis and intercorrelations between all variables measured are also displayed. Included is a comprehensive literature review on Industrial Alcoholism programs covering topics parallel to the survey.
(PC A11/MF A01)

Hitchcock, LC Sanders, MS
Naval Weapons Support Center, Federal Railroad Administration Final Rpt. NWSC/CR/RDTR-38, FRA/OPPD/ORD-76/283, Nov. 1976, 244 pp

Contract DOT-AR-64216

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-259470/3ST, DOTL NTIS

07 148276
STUDIES OF FREIGHT TRAIN ENGINEER PERFORMANCE
As a part of the International Government-Industry Program on Track Train Dynamics, the performance of engineers in freight train handling was studied by recording and analyzing train operations and engineer responses under field conditions. Data collection took place during regular revenue freight operations over five representative railroads containing varied terrain and operating conditions. Data collection was accomplished by using a digital data aquisition system specifically designed for this study. Levels of engineer performance was evaluated through the use of an objective rating form specifically designed for this study. Scores on this form was correlated with digitally recorded data. Engineers were found to consistently respond to changes in locomotive drawbar force as indicated on the cab loadmeter. Higher-rated engineers tended to make fewer and more accurate responses than lower-rated engineers. No systematic pattern of response to cab accelerations was found, nor was a systematic change in smoothness of performance revealed over the length of a trip. Frequency of the use of various controls was found to depend more on railroad terrain and procedures then on indicidual engineer skills.

Research was sponsored by the Federal Railroad Administration, DOT.

Sussman, ED Ofsevit, D
Transportation Systems Center, (DOT-TSC-FRA-76-31) Final Rpt. FRA/OR&D-76-306, Dec. 1976, 72 pp, Figs., Tabs., 4 App.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-267622/9ST, DOTL NTIS, DOTL RP

07 155352
MAINTAINING ALERTNESS IN RAILROAD LOCOMOTIVE CREWS
The problem of assuring alertness in railroad locomotive crews is defined. Principles for maintaining alertness are derived from the experimental literature on vigilance and several unresolved questions are explored through three experiments. The findings are summarized in a set of criteria for evaluating alerting devices and techniques, and devices currently in use on the railroads are evaluated against these criteria. Recommendations are offered for improving current devices and for exploring new techniques.

Devoe, DB Abernethy, CN
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-29, FRA/ORD-77/22, Mar. 1977, 68 pp, 4 Fig., 4 Tab., Refs.

ACKNOWLEDGMENT: NTIS
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PB-266273/2ST, DOTL NTIS

07 163788
TRAIN DYNAMICS ANALYZER
The Train Dynamics Analyzer is a compact, computer-based system designed as a training tool for locomotive engineers. The system uses a mathematical model to predict the longitudinal dynamic conditions encountered during operation of freight trains. A CRT display provides operating instructions to assist with the set up procedures for a simulated run, provides graphic and tabular descriptions of the train selected for the run and in the final phase presents a performance summary. The TDA can also be used for developing handling procedures for special train consists or unusual track conditions and for investigating certain aspects of train accidents.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Stephenson, JG (Freightmaster Division, Halliburton Services)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 16-23, 21 Fig.

ACKNOWLEDGMENT: FRA
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PB-272948/AS, DOTL NTIS

07 170067
RESEARCH LOCOMOTIVE AND TRAIN HANDLING EVALUATOR DEFINITION--CONCEPT 1. VOLUME I--EVALUATOR PERFORMANCE SPECIFICATION
Performance specifications for a train handling and locomotive research evaluator are set forth in Volume I. These are based upon a study of design concept trade-offs to create a research facility capable of eliciting realistic behavior from railroad train operators. Results of these studies are presented in Volume II along with examples of research programs that could be carried out. Initial cost, operating staff and costs, buildings and utilities test subject logistics and downstream improvements are included in Volume III. The overall research needs that can be met uniquely by such a research evaluator facility are presented along with a schedule for design, procurement, delivery and installation of such a simulator.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Hulbert, S Wheeler, J Dompe, R Witham, C Csanky, L
MB Associates, Federal Railroad Administration, (MB-R-77/25) Final Rpt. FRA/ORD-77/47.I, Sept. 1977, 86 pp, Figs., Tabs.

Contract DOT-FR-64260

ACKNOWLEDGMENT: FRA, NTIS
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PB-276364/AS, DOTL NTIS

07 170068
RESEARCH LOCOMOTIVE AND TRAIN HANDLING EVALUATOR DEFINITION--CONCEPT 1. VOLUME II--DETAILED SYSTEM STUDIES
Performance specifications for a train handling and locomotive research evaluator are set forth in Volume I. These are based upon a study of design concept trade-offs to create a research facility capable of eliciting realistic behavior from railroad train operators. Results of these studies are presented in Volume II along with examples of research programs that could be carried out. Initial cost, operating staff and costs, buildings and utilities test subject logistics and downstream improvements are included in Volume III. The overall research needs that can be met uniquely by such a research evaluator facility are presented along with a schedule for design, procurement, delivery and installation of such a simulator.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Hulbert, S Wheeler, J Dompe, R Witham, C Csanky, L
MB Associates, Federal Railroad Administration, (MB-R-77/25) Final Rpt. FRA/ORD-77/47.V2, Sept. 1977, 258 pp, Figs., Tabs., Refs., 3 App.

Contract DOT-FR-64260

ACKNOWLEDGMENT: FRA, NTIS
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PB-276365/AS, DOTL NTIS

08 099354
STATE GRADE CROSSING PROGRAMS: A CASE STUDY
This report reviews the California Railroad-Highway Grade Crossing program, analyzing the factors influencing the reduction in grade crossing accidents. The report concludes that the greater than average success in grade crossing safety in California has resulted from the long standing financial support of the installation and maintenance of grade crossing warning devices, a strong, well managed Public Utilities Commission providing the analytical support for crossing improvement decisions, unusually strong safety efforts by the financially healthy railroads operating within the state, and an effective framework for city-county-state cooperative determination of grade crossing priorities. California ranks eighth overall in terms of active protection installed and first in the percentages of total crossings equipped with automatic gate installations. Areas for potential improvement and refinement of the California program are likewise discussed.

This program was sponsored by US DOT, Federal Railroad Administration's Office of Research and Development.

Kennedy, RG, III
Consad Research Corporation, Transportation Systems Center, Federal Railroad Administration, (DOT-TSC-FRA-74-5) Final Rpt. FRA ORD&D-75-8, Sept. 1974, 66 pp, Figs., Tabs.

Contract DOT-TSC-34

ACKNOWLEDGMENT: FRA, NTIS
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PB-244175/6ST, DOTL NTIS

08 099360
FIELD EVALUATION OF LOCOMOTIVE CONSPICUITY LIGHTS
Flashing xenon strobe lamps were installed on locomotives in revenue service as a means of alerting motorists to the hazards they are approaching at a rail-highway grade crossing. Effectiveness of these lights in attracting motorists' attention was evaluated. The reactions of both motorists and locomotive crews to the use of strobe lights were also evaluated. Field observations, interviews, and experiments confirmed the attention-getting value of locomotive-mounted strobe lights used in revenue service to alert motorists and suggested operational procedures and device specifications that are the subject of a separate application guideline report. Experimentation and observation of the strobe lights under railroad operating conditions verified that these lights do not interfere with perception of trackside signals or with normal motorist and crew operations. The work reported in this document supports a technical recommendation favoring use of strobe lights on more extensive research tests in railroad operational service.

The project was sponsored by US DOT, Federal Railroad Administration's Office of Research and Development.

Devoe, DB Abernethy, C
Transportation Systems Center, (DOT-TSC-FRA-74-11) Final Rpt. FRA-OR&D-75-54, May 1975, 66 pp, Figs., Tabs.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244532/8ST, DOTL NTIS

08 099361
GUIDELINES FOR ENHANCEMENT OF VISUAL CONSPICUITY OF TRAINS AT GRADE CROSSINGS
This report summarizes a comprehensive study of potential means of reducing the probability of train-motor vehicle collisions at railroad-highway grade crossings through enhancement of the visual conspicuity of locomotives. Passive techniques are reviewed, and requirements and constraints upon active systems are described. Past research is reviewed, followed by derivation of functional specifications and discussion of practical operating considerations. Operational tests of devices deemed most appropriate to the application are described, with detailed recommendations. The preferred system consists of clear (white) xenon flash-tube beacons mounted on opposite sides of the locomotive cab roof, flashed alternately, used in conjunction with amber incandescent lamps outlining the locomotive.

This project was sponsored by US DOT, Federal Railroad Administration's Office of Research and Development.

Hopkins, JB Newfell, AT
Transportation Systems Center, (DOT-TSC-FRA-74-75) Final Rpt. FRA-OR&D-75-71, May 1975, 56 pp, 17 Fig., 8 Ref.

ACKNOWLEDGMENT: National Safety Council, Safety Research Info Serv (SRIS 760348 R), NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244551/8ST, DOTL NTIS

08 129263
LOCOMOTIVE TO AUTOMOBILE BASELINE CRASH TESTS
Four Locomotive to Automobile Crash tests were performed by the Dynamic Science Division of Ultrasystems at DOT's High Speed Ground Test Center under contract to the Transportation Systems Center, which is conducting the work for the Federal Railroad Administration. This report documents these four tests, which will provide baseline data for evaluation of future locomotive front structure modifications designed to attenuate the severity of the grade crossing accident. The automobiles were all 1973 standard size sedans of the same model with similar options. For each test, a 130-ton Alco locomotive impacted a stationary automobile at a nominal 50 mph. The first two tests contained no instrumentation on either the locomotive or automobile except for high-speed cameras. The last two tests were instrumented repeats of the first two tests which also involved a direct side impact and a side impact centered on the automobile front fender. The last two tests had an anthropomorphic dummy in the automobile and over 50 accelerometers installed in it. Each test had extensive high frame rate photographic coverage.

Sponsorship was from Federal Railroad Administration, DOT.

Anderson, RL
Ultrasystems, Incorporated, (DOT-TSC-FRA-75-18) Final Rpt. FRA-OR&D-76-03, Aug. 1975, 150 pp

Contract DOT-TSC-700

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250564/AS, DOTL NTIS

08 145547
A METHODOLOGY FOR DETERMINATION OF GRADE CROSSING RESOURCE-ALLOCATION GUIDELINES
The report describes a computer-aided analytical approach to estimation of the potential benefits, costs, and implementation associated with allocation of grade crossing safety resources. Three types of information are required as input: (1) the grade crossing population, categorized by hazard, location (urban/rural), and existing warning systems; (2) warning system alternatives, characterized by cost and effectiveness; and (3) criteria for acceptable or preferred resource-allocation strategies (required benefit-cost ratio, total resources available, number of fatalities to be prevented, etc). A computer program has been prepared that determines all solutions meeting stated criteria and characterizes them in detail (specifying warning systems for each crossing category). Operation is highly interactive, and requires only seconds of computer time. Examples are presented based upon national statistics, and cases are chosen to indicate sensitivity to uncertainties in input data. (PC A04/MF A01)

Hopkins, JB Hazel, ME
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-75-15, FRA/ORD-76/04, Aug. 1975, 68 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-259005/7ST, DOTL NTIS

08 154800
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING AUTOMATIC GATE SYSTEMS, VOLUME I: OVERVIEW AND LOW COST RAILROAD/HIGHWAY GRADE CROSSING GATE SYSTEMS
This report, Volume I of a two-volume study, examines the potential for reduction of the cost of installing and maintaining automatic gates at railroad-highway grade crossings. It comprises a general overview; a review of current practices, equipment, and standards; a consideration of modification of existing specifications to permit use of alternative technologies; the generation of design concepts for new gate systems or subsystems intended to offer significant economic benefits; an analysis and comparative evaluation of the more promising concepts; and conclusions concerning further design, development, and test activities. Concepts found to be particularly promising include a low-cost gate-drive mechanism utilizing high-reliability commercially available components; a swing-away, gravity resetting arm

support intended to reduce the incidence of gate breakage; and a gate arm using new materials to obtain resistance to breakage.
See also PB-265 725.

St. Amant, A
MB Associates, Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-77/067.I, Feb. 1977, 90 pp

Contract DOT-TSC-859

ACKNOWLEDGMENT: NTIS
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PB-265724/5ST, DOTL NTIS

08 154801
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING AUTOMATIC GATE SYSTEMS. VOLUME II. IMPROVED GATE ARM CONCEPTS FOR RAILROAD/HIGHWAY GRADE CROSSINGS
This report, Volume II of a two-volume study, examines the potential for reduction of the cost of installing and maintaining automatic gates at railroad-highway grade crossings. It includes a review of current practices, equipment, and standards; consideration of modification of existing specifications to permit use of alternative technologies; generation of design concepts for new gate systems or subsystems intended to offer significant economic benefits; analysis and comparative evaluation of the more promising concepts; and conclusions concerning further design, development, and test activities. Concepts found to be particularly promising include a pneumatic gate-drive mechanism and a swing-away, gravity-resetting arm support intended to reduce the incidence of gate breakage; and a gate arm using new materials to obtain resistance to breakage.
See also PB-265 724.

Duttera, J Friedland, M
MB Associates, Federal Railroad Administration, Transportation Systems Center Final Rpt. Feb. 1977, 66 pp. FRA/ORD/77/06.II

Contract DOT-TSC-858

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-265725 2ST, DOTL NTIS

08 155407
IMPROVEMENT OF THE EFFECTIVENESS OF MOTORIST WARNINGS AT RAILROAD-HIGHWAY GRADE CROSSINGS
Flashing red incandescent lamps have formed the primary motorist warning device at grade crossings for several decades, in spite of technical constraints that inherently limit the overall effectiveness possible. In this report an examination of appropriate literature and existing standards reveals preliminary requirements of function and desirable qualities for such motorist warnings. A consideration of relevant lighting technology shows that significant improvement is possible through the use of xenon flashlamps in standard crossing mountings. This study includes a discussion of optimal specifications, relevant technology, field tests, and related topics including system credibility and the use of highway traffic signals.

Hopkins, JB White, E Final Rpt. DOT-TSC-FRA-76-25, FRA/ORD-77/07, Feb. 1977, 98p, 34 Fig., 2 Tab., 31 Ref.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-266784/ST, DOTL NTIS, DOTL RP

08 167399
INNOVATIVE CONCEPTS AND TECHNOLOGY FOR RAILROAD-HIGHWAY GRADE CROSSING MOTORIST WARNING SYSTEMS. VOLUME I. OVERVIEW AND CONCEPT GENERATION AND ANALYSIS
The document includes a general review of innovative conceptual and technical approaches to train-activated motorist warning systems for use at railroad-highway grade crossings, and also contains a specific report describing a study directed toward the generation, analysis and evaluation of innovative concepts. The review includes a discussion of communication-link systems, radar train detection, locomotive-mounted transmitters and several other concepts. The basic application constraints of safety, reliability, resistance to serve environments and low cost are used as the basis for evaluating the merits of the alternative concepts. The special study reported here explores the communication-link concept in detail, with particular emphasis on train-detection techniques. The use of microprocessor technology is advocated, along with substantial changes in motorist warnings.

Raab, FH Brooker, MC Ryan, TE Waechter, JR
Cincinnati Electronics Corporation, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-19.I, FRA/ORD-77/37.I, Sept. 1977, 209 pp

Contract DOT-TSC-841-1

ACKNOWLEDGMENT: NTIS
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PB-273354/1ST

08 167400
INNOVATIVE CONCEPTS AND TECHNOLOGY FOR RAILROAD-HIGHWAY GRADE CROSSING MOTORIST WARNING SYSTEMS. VOLUME II. THE GENERATION AND ANALYSIS OF ALTERNATIVE CONCEPTS
The report describes the results of a study directed toward the generation, analysis and evaluation of innovative conceptual and technical approaches to train-activated motorist warning systems for use at railroad-highway grade crossings. Particular attention is given to the use of the track as a transmission line in a guided reflection (radar-like) technique operating at audio frequencies. Attention is also given to improve special road surfaces in advance of the crossing, and to optically programmed traffic lights.
See also Volume 1, PB-273 354.

Peterson, DD Boyer, DS
Tracor Jitco, Incorporated, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-19.II, FRA-/ORD-77/37.II, Sept. 1977, 98 pp

Contract DOT-TSC-842-2

ACKNOWLEDGMENT: NTIS
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PB-273355/8ST

08 175477
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOLUME I. OVERVIEW, TECHNOLOGY SURVEY AND RELAY ALTERNATIVES
The results of a recent study of railroad-highway grade crossing warning system technology are presented. Emphasis in the investigation was placed on the determination of the potential for significant reduction in equipment, installation and maintenance costs through improvements sought within a framework of the basic (track circuit) system concepts now prevalent. This study comprises a comprehensive survey of current practices and hardware, an analysis of all major cost elements, and a consideration of potentially beneficial technical changes. The effort is concentrated on the equipment involved in train detection and the activation of warning devices. Special attention is given to European practices. The applicability of European signal relays and of mercury-wetted reed relays to the North American situation is analysed.
See also Volume 2, PB-277947, RRIS 08 175478.

DuVivier, CL Rogers, LM Sheffeld, W Foster, HJ
Storch Engineers, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-21-I, FRA/ORD-77/45-I, Dec. 1977, 178 pp

Contract DOT-TSC-870

ACKNOWLEDGMENT: NTIS
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PB-277946/0ST

08 175478
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING MOTORIST-WARNING CONTROL EQUIPMENT. VOLUME II. COMPARISON OF SOLID STATE AND RELAY DEVICES AND TECHNIQUES
Consideration is given to the properties of solid-state circuits, miniature relays and large gravity-operated relays when applied to control systems for grade crossings equipped with train-activated motorist warnings. Factors discussed include original cost and service-life cost, vulnerability to environment, reliability and fail-safety, power requirements, maintainability, complexity of tasks to be performed and economic scale.

See also Volume 1, PB-277946, RRIS 08 175477.

Holmstrom, FR

Lowell University, Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-21-II, FRA/ORD-77/45.II, Dec. 1977, 50 pp

Contract DOT-TSC-589

ACKNOWLEDGMENT: NTIS

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PB-277947/8ST

08 318987

OPERATIONAL TESTING OF LOCOMOTIVE-MOUNTED STROBE LIGHTS

The report describes revenue-service tests of locomotive-mounted strobe lights used to make trains more conspicuous to motorists at rail-highway crossings. The testing, conducted in cooperation with four railroads, had the objectives of assuring practicality compatibility with normal operations, validating previous cost estimates, and obtaining a measure of safety effectiveness. Prior research underlying the tests is reviewed briefly.

Sponsored in part by Federal Railroad Administration, Washington, DC. Office of Research and Development.

Hopkins, JB

Transportation Systems Center, Federal Railroad Administration Intrm Rpt. DOT-TSC-FRA-80-15, FRA/ORD-80-48 80-48, June 1980, 37 p

ACKNOWLEDGMENT: NTIS

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PB80-224348. DOTL NTIS

09 129149
ANALYSIS OF FINDINGS OF FOUR TANK-CAR ACCIDENT REPORTS
A comprehensive overview of the findings and metallurgical analyses of tests conducted at the National Bureau of Standards on samples of tank-car materials submitted by the Federal Railroad Administration is presented. The submitted samples were taken from tank cars which had been involved in accidents during the period January 1970 to January 1971. The testing conducted during the metallurgical analyses included full chemical analyses, ambient temperature tensile tests on longitudinal and transverse specimens, quantitative metallography to determine ferrite grain size, peralite colony size, and inclusion content, size, and shape, hardness tests, bend tests on longitudinal and transverse specimens, and a very comprehensive program of impact testing, which is covered in a separate report on Impact Properties.
Sponsorship was from Federal Railroad Administration, DOT.

Interrante, CG Early, JG Hicho, GE
National Bureau of Standards, Federal Railroad Administration, (NBSIR 75-655) Final Rpt. FRA-ORD/D-75-50, Jan. 1975, 76 pp, 13 Fig., 4 App.

Contract DOT-AR-40008

ACKNOWLEDGMENT: FRA, NTIS
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PB-251097/AS, DOTL NTIS

09 131039
A METALLURGICAL INVESTIGATION OF A FULL-SCALE INSULATED RAIL TANK CAR FILLED WITH LPG SUBJECTED TO A FIRE ENVIRONMENT
An analysis of the failure of an insulated rail tank car, RAX 202, which had been tested to failure in a fire environment at White Sands Missile Range, New Mexico, was requested by the Federal Railroad Administration, Department of Transportation. The tank car, filled with approximately 33,000 gallons of liquefied pertoleum gas (LPG), failed after approximately 94 minutes of exposure to a JP-4 jet fuel fire. The car fractured into four fragments which were examined in the field. Five plate samples from the four fragments were selected for laboratory study at the National Bureau of Standards.

Early, JG Interrante, CG
National Bureau of Standards, Federal Railroad Administration, (NBSIR 75-657) Final Rpt. FRA-OR&D 75-52, Jan. 1975, 71 pp, 31 Fig., 3 Tab., 7 Ref.

Contract DOT-AR-40008

ACKNOWLEDGMENT: FRA, NTIS
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PB-250587, DOTL NTIS

09 131040
A METALLURGICAL ANALYSIS OF FIVE STEEL PLATES TAKEN FROM A TANK CAR ACCIDENT NEAR CRESCENT CITY, ILLINOIS
A metallurgical analysis of five steel samples (numbered FRA-1 through FRA-5) was requested by the Bureau of Railroad Safety, Federal Railroad Administration, Department of Transportation. These steel samples were taken from two tank cars (numbered SOEX 3037 and SOEX 3219) which had been involved in an accident near Crescent City, Illinois. Sample FRA-1, FRA-4, and FRA-5 were reported to be shell plates and sample FRA-3, a head plate. Sample FRA-2 was a welded sample of head plate and shell plate and it was used for most of the mechanical properties determinations in this report. An investigation was conducted at the National Bureau of Standards to determine if the samples conformed with the appropriate specifications for tank car materials and to gather information pertinent to the question of the suitability of these steels for use as plate materials of tank cars. Samples FRA-1,-2, and-5 were reportedly produced to the specification for ASTM A 212-65 Grade B, flange quality steel (A 212-B); and FRA-3 and-4 were reportedly produced to specification AAR M128 Grade B, flange quality steel (M128-B).

Interrante, CG Hicho, GE Harne, DE
National Bureau of Standards, (312.01/39) Final Rpt. FRA-OR&D 75-48, Mar. 1972, 95 pp, 26 Fig., 9 Tab., 12 Ref., 2 App.

Contract DOT-AR-10023

ACKNOWLEDGMENT: FRA
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PB250530/3ST, DOTL NTIS

09 132205
PREPARATION OF THE BRL TANK CAR TORCH FACILITY AT THE DOT, TRANSPORTATION TEST CENTER, PUEBLO, COLORADO
The Tank Car Torching Facility was designed and fabricated on a site located at the Transportation Test Center, Pueblo, Colorada. The torch configuration was calibrated and the operational procedures and requirements determined. A series of thirteen (13) tests were run on specimen tank car plates, both bare and thermally insulated with the two different coatings. This report concerns itself with the instrumentation and procedural requirements; however, none of the data from these tests are reported at this time. The next phase of the program is briefly discussed.

Townsend, W Markland, R
Ballistic Research Laboratory Final Rpt. FRA-OR&D 76-72, Nov. 1975, 24 pp, 12 Fig.

Contract DOT-AR-30026

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-251151/AS, DOTL NTIS, DOTL RP

09 133031
METALLURGICAL ANALYSIS OF A STEEL SHELL PLATE TAKEN FROM A TANK CAR ACCIDENT NEAR SOUTH BYRON, N.Y
A metallurgical analysis of a steel plate sample (the South Byron sample) was requested by the Federal Railroad Administration. The steel sample was taken from a tank car (number PPGX9990) which had been involved in an accident near South Byron, New York. This sample was reported to have been produced to specification AAR-M-128-65-DTD-1966-Flange Quality-Grade B, and it was reportedly taken from the second course of shell plate of car number PPGX9990. The fracture in this course circumscribed the tank car and resulted in the division of the car into two sections. An investigation was conducted at the National Bureau of Standards to determine if the plate sample conformed with the above Association of American Railroads (AAR) Specifications for Tank Cars and to gather information pertinent to the question of the suitability of this type of steel for use as the shell plate of tank cars.

Interrante, CG Hicho, GE
National Bureau of Standards, Federal Railroad Administration Final Rpt. NBS-312.01/35, FRA/ORD-75/47, Oct. 1971, 57 p., 14 Fig., 7 Tab., 2 App.

Contract DOT-AR-10023

ACKNOWLEDGMENT: NTIS
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PB-250063/5ST, DOTL NTIS

09 133088
A METALLURGICAL ANALYSIS OF ELEVEN STEEL PLATES TAKEN FROM A TANK CAR ACCIDENT NEAR CALLAO, MISSOURI
A metallurgical analysis of eleven steel plate samples designed as Callao samples K-1, K-2, K-3 and K-5 to K-12 was requested by the Bureau of Railroad Safety, Federal Railroad Administration, Department of Transportation. The Callao samples were removed from a tank car numbered GATX 94451 which had been involved in an accident near Callao, Missouri where the ambient temperature was reportedly 15F. An investigation was conducted at the National Bureau of Standards to determine if the plate sample conformed with the Association of American Railroads (AAR) Specification AAR-TC128-65 (flange quality, grade B, fine-grain practice) for high-tensile strength, carbon-manganese steel plates for tank cars, and to gather information pertinent to the question of the suitability of this type of steel for use as plate materials of tank cars.

Interrante, CG Hicho, GE Harne, DE
National Bureau of Standards, Federal Railroad Administration Final Rpt. NBS/312.01/51, FRA/ORD-75/49, Sept. 1972, 175 pp, 42 Fig., 9 Tab., 9 App.

Contract DOT-AR-10023

ACKNOWLEDGMENT: NTIS

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PB-250544/4ST, DOTL NTIS

09 133091
HAZARDOUS MATERIALS TANK CARS-EVALUATION OF TANK CAR SHELL CONSTRUCTION MATERIAL

A metallurgical analysis of a steel plate sample (the Bell sample) was requested by the Federal Railroad Administration. The steel sample was taken from a tank car (number 88300) which had been involved in an accident near Bell, West Virginia. An investigation was conducted at the National Bureau of Standards to characterize the steel from the failed tank car and to determine whether the steel meets the specification AAR TC 128-69. Another purpose of the investigation is to determine the nature of the fracture of the head plate of the failed tank car.

Hicho, GE Brady, CH
National Bureau of Standards, Federal Railroad Administration Final Rpt. FRA/ORD-75/46, Sept. 1975, 40 p., 25 Fig., 6 Tab.

Contract DOT-AR-10023

ACKNOWLEDGMENT: NTIS
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PB-250607/9ST, DOTL NTIS

09 141001
IMPACT PROPERTIES OF STEELS TAKEN FROM FOUR FAILED TANK CARS

An overview of the results and metallurgical analyses of the findings of impact tests conducted at the National Bureau of Standards on samples of tank-car materials submitted by the Federal Railroad Administration is presented. The submitted samples were taken from tank cars which had been involved in service accidents during the period January 1970 to January 1971. One of these tank cars had been fabricated from ASTM A212 steel and the remaining four tank cars from AAR TC128 steels. The impact test data were reported earlier in four tank-car accident reports.

Sponsored by the Federal Railroad Administration U.S. DOT.

Interrante, CG
National Bureau of Standards, Federal Railroad Administration, (NBSIR 75-656) Final Rpt. FRA.OR&D-75-51, June 1976, 160 pp, Figs., Tabs.

Contract DOT-AR-40008

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-255854/2ST, DOTL NTIS

09 141002
MECHANICAL PROPERTIES OF AAR M128-69-B STEEL PLATE SAMPLES TAKEN FROM INSULATED FIRE TESTED TANK CAR RAX 202

Studies were undertaken to measure the elevated-temperature mechanical properties and to determine the elevated- temperature fracture behavior of selected AAR M128-B steel plates. In addition, the ambient-temperature mechanical properties were measured to determine if the requirements of specification AAR M128-69-B were satisfied. The NBS results of check chemical analyses, hardness surveys, thickness measurements, macroscopic observations, and metallographic analyses of the plate samples had been reported previously. The results of ambient-temperature tensile tests showed that all plate samples met the strength and tensile ductility requirements of specification AAR M128-69-B. The results of hot-tensile tests showed a continuous decrease in strength properties and an increase in tensile ductility as the test temperature was increased from 1100 F to 1250 F. An analysis of stress-rupture data for specimens from all plant samples in the same temperature range indicated that a straight line in a log-log plot of initial stress versus rupture life reasonably represented the data at each test temperature. In the temperature and stress range studied, a decrease in the initial stress of about 20 to 30 percent resulted in a twelvefold increase in rupture life from 15 minutes to three hours. A comparison of the results of the metallographic analysis of hot-tensile and representative stress-rupture specimens with the previously reported metallographic results on the initial rupture site in the failed shell course indicate the presence of the identical fracture mode. This mode is characterized by many intergranular voids which originate primarily at the proeutectoid ferrite-pearlite boundaries. These results confirm the previously reported finding that the initial rupture of the tank car was a stress-rupture crack.

This is the eight in a series of reports on the properties of tank car steels.

Early, JG
National Bureau of Standards, Federal Railroad Administration, (NBSIR 75-725) Final Rpt. FRA/OR&D-76-74, June 1976, 82 pp, 25 Fig., 3 Tab., 19 Ref.

Contract DOT-AR-40008

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-255907/8ST, DOTL NTIS

09 179125
FAST BALLAST AND SUBGRADE MATERIALS EVALUATION-BALLAST AND FOUNDATION MATERIALS RESEARCH PROGRAM

The ballast, subballast, and subgrade materials from the FAST Project at Pueblo, Colorado were evaluated. Conventional characterization testing and repeated load triaxial testing were conducted with the various materials The data included in this report were developed for bulk material samples forwarded to the University of Illinois. The test results do not reflect any "material variability" which would be encountered in the completed FAST Project.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Thompson, MR
Illinois University, Urbana Test Rpt. FRA-ORD-77/32, Dec. 1977, 31 pp, 17 Fig., 7 Tab., 2 Ref.

Contract DOT-FR-30038

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-281167/AS, DOTL NTIS, DOTL RP

09 196980
FRACTURE RESISTANCE AND FATIGUE CRACK GROWTH CHARACTERISTICS OF RAILROAD WHEELS AND AXLES

The effects of chemical composition, temperature and loading rates on the plane strain fracture toughness K sub I sub c of railroad wheels have been determined. Similarly, the effects of these variables were determined for grade U and F railroads axles. The carbon content was determined to be the principal factor controlling K sub I sub c. Sensitivity to loading rate (K sub I sub d) was seen to be a function of the microstructure. Estimates have been made of the minimum size of crack, which could result in the failure of wheels and axles under adverse service conditions. Also investigated were the effects of chemical composition, heat treatment, temperature, stress ratio (R), environment and peak loads on the fatigue crack growth characteristics of wheels and axles. It was seen that the effects of R could be predicted by the Forman equation and that crack growth rates were predominantly affected by R. Otherwise, all values fell within the same scatterband. Predictions of crack growth to criticality as a function of cycles were made for wheels and axles. Based on these calculations, it was concluded that detection of subcritical flaws with a good degree of confidence would only be possible for the classes A and sub A wheels and the grades U and F axles.

Carter, CS Caton, RG Guthrie, JL
Boeing Commercial Airplane Company, Federal Railroad Administration, Transportation Systems Center Final Rpt. FRA/ORD-77/50, DOT-TSC-FRA-77-20, Nov. 1977, 138 p., 71 Fig., 25 Tab., 32 Ref., 1 App.

Contract DOT-TSC-617

ORDER FROM: NTIS

PB-298312/AS, DOTL NTIS

09 312192
THERMODYNAMIC PROPERTIES OF LIQUEFIED PETROLEUM GASES (LPG)

The thermodynamic properties of serveral liquefied petroleum gases (with particular emphasis on propane) are discussed in detail. It is concluded that the widely used propane data by Stearns and George are too inconsistent and too inaccurate to be used for mass flow calculations of propane and propane mixtures through safety valves of rail tank cars. Accordingly, the thermodynamic properties of propane, propylene, n-butane, and a mixture of 65% (by mole) propane, 25% propylene, and 10% n-butane are recalculated using equations of states proposed by Benedict-Webb-Rubin (BWR) and by Starling. It is shown that Starling's equation results in thermodynamic

properties which are more consistent and compare better with measured values than the BWR equation. Thermodynamic data for the four liquefied petroleum gases discussed above are calculated and presented in tabular form. In addition, predictions of pure propane mass flow rates (based upon isentropic), homogeneous equilibrium flow) are given. The influence of the thermodynamic data upon the predicted mass flow rates is demonstrated.

Sallet, DW Wu, KF
Maryland University, College Park, Federal Railroad Administration
Intrm Rpt. FRA-ORD-76-299, Apr. 1980, 99 p., 11 Ref.

Contract DOT-FR-64181

ORDER FROM: NTIS

PB80-189053, DOTL NTIS, DOTL RP

09 314084
TWO-PHASE FLOW MODEL TEST FACILITY

This report describes test facilities for the investigation of two-phase flows. The test facility completed to this date consists of the Blow-Down Test Apparatus and the Bubble and Slug Flow Tunnel. It is the purpose of the test facilities to support, test and aid in the development of safety valve sizing equations when different two-phase regimes occur.

Sallet, DW Guehler, M Tsui, CY
Maryland University, College Park, Federal Railroad Administration
Intrm Rpt. FRA/ORD-76/298, Apr. 1980, 26 p.

Contract DOT-FR-64181

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-181647, DOTL NTIS

09 319059
THE CALCULATION OF THE THERMODYNAMIC PROPERTIES OF PROPANE, PROPYLENE, N-BUTANE AND ETHYLENE

The thermodynamic properties of propane, propylene, n-butane and ethylene were calculated and are presented in tables. The tables list the values of the specific volume, the enthalpy, the entropy, the specific heat at constant pressure, the specific heat at constant volume and the sonic velocity of the four hydrocarbons in a temperature and pressure range which can be encountered when these commodities are shipped by rail tank cars. This includes subcooled states, saturation equilibrium states and superheated states. The computer program with which the tables were generated is discussed in detail and a complete listing of the program is given. The underlying thermodynamic theory and the equation of state used in the development of the presented data was given in Report No. FRA-ORD 76/299 and is not repeated. The present report is user-oriented in that it gives extensive tables and a complete listing of the computer program with which these tables were generated.

Sallet, DW Palmer, ME
Maryland University, College Park, Federal Railroad Administration
Final Rpt. FRA/ORD-76/300, Apr. 1980, 157 p., 9 Tab., 5 Ref.

Contract DOT-FR-64181

ORDER FROM: NTIS

PB80-189061, DOTL NTIS, DOTL RP

10 144092
AN ASSESSMENT OF RAILROAD LOCOMOTIVE NOISE
Measurements of the noise generated by an SD40-2 diesel electric locomotive are described. The noise was measured in three types of moving tests: the first with the locomotive passing a 6-microphone array while under maximum power acceleration, the second with the locomotive simulating the pulling of a train, and the third with the locomotive coasting by unpowered. Stationary noise measurements were made at 16-microphone positions around the locomotive while it was attached to a load cell. The moving tests show that at the lower throttle settings, wheel/rail noise may be an important contributor to the overall locomotive noise signature even at modest speeds (20 mph and above at throttle 1 and 30 mph and above at throttle 4). At throttle 8, wheel/rail noise does not become a significant source until speeds in excess of 50 mph are reached. At throttle 8 and at speeds below 50 mph, noise spectra measured opposite the moving locomotive are comparable to noise spectra measured opposite the stationary locomotive. Diagnostic tests to determine how much the various sources contributed to the overall noise were performed at seven positions on one side of the locomotive. The engine exhaust and intake, the engine/generator, the radiator cooling fans, the dynamic brake fans, the traction motor blowers, the dust bin blower compressor, and structure-borne noise have all been identified. At high throttle settings the exhaust and radiator cooling fans dominate. At low throttle settings the engine/generator, the exhaust and the cooling fans all contribute to the overall noise.

Work was performed under contract to Transportation Systems Center, DOT, and sponsored by Office of the Secretary and Federal Railroad Administration, DOT.

Remington, PJ Rudd, MJ
Bolt, Beranek and Newman, Incorporated, (DOT-TSC-OST-76-4) Final Rpt. DOT-TSC-OST-76-4, FRA-OR&D-76-142, Aug. 1976, 168 pp, Figs., Tabs., 6 App.

Contract DOT-TSC-1016

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-260410/6ST, DOTL NTIS

10 152663
TRAIN GENERATED AIR CONTAMINANTS IN THE TRAIN CREW'S WORKING ENVIRONMENT
This document contains data on the levels of air contaminants in the train crew's working environment. Measurements were made in locomotive cabs and cabooses of freight trains travelling through long tunnels and over mountainous terrain. In addition, measurements were performed in long-hood forward locomotives during through freight operations and in switchyard locomotives. The data from this study indicate that the breathing environment of railroad operating crews is acceptable within the guidelines of the published Occupational Safety and Health Administration (OSHA) standards. Appendix A covers the sources of air contaminants in the railroad environment and Appendix B gives a detailed description of the measurements in this study. A review of related studies is given in Appendix C.

Sponsorship was provided by the FRA, U.S. DOT.

Hobbs, JR Walter, RA Hard, T Devoe, DB
Transportation Systems Center, (DOT-TSC-FRA-76-34) Final Rpt. FRA/ORD-77/08, Feb. 1977, 52 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-265355/AS, DOTL NTIS

10 167115
STRUCTURAL VIBRATION NOISE ABATEMENT OF A LARGE DIESEL ENGINE
This report presents a vibration-noise investigation and a redesign of the top deck and the hand hole covers of GM 645E series railroad diesel engine for reduction of vibration and radiated noise. This was achieved by incorporating in the redesigned components, isolation, stiffening and damping. For damping, the solid friction, constrained layer and viscous air damping approaches were utilized. Experimental results on vibration and noise of the original and redesigned covers were obtained. It was found that a composite design with channel stiffened constrained layer outer panel and a fiberglass filled inner cavity offered the best solution. On-engine tests at full load showed acceleration reductions of 2-40 dB for the redesigned composite top deck cover and 2-16 dB for the redesigned constrained layer hand hole cover. The composite design is recommended for both covers.

See also PB-232 626.
Varma, PK Kumar, S
Illinois Institute of Technology, General Motors Corporation, Association of American Railroads, Federal Railroad Administration Intrm Rpt. FRA/ORD-76/273, IIT-TRANS-74-1, July 1976, 100 pp

Contract DOT-OS-40103

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB-271503/5ST, DOTL NTIS

10 179116
HEALTH AND SAFETY IMPLICATIONS OF DIESEL LOCOMOTIVE EMISSIONS
A review of the published literature was made to determine whether there are health and/or safety effects of long-term exposure to low concentrations of diesel emissions within the ranges reported in actual railroad operations. No consistent evidence was found linking low concentrations of diesel emissions to long-term health effects or short-term respiratory function. Evidence was found linking emissions to eye irritation. Interviews with union officials and operating crews, letters from union members, union file material, and miscellaneous locomotive and caboose inspection reports pointed to the conclusion that diesel emissions are not a widespread or frequent problem in the railroad environment.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development at the request of Naval Weapons Support Center, Crane, Indiana.

Peay, JM Sanders, MS
Navy Personnel Research and Development Center, (NPRDC Code 311) FRA/ORD-78/18, Apr. 1978, 69 pp, 7 Tab., Refs.

Contract AR-74312

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

AD-A053455/2ST, DOTL NTIS, DOTL RP

10 313114
THE MEASUREMENT OF LOCOMOTIVE NOISE AT EXISTING RAILROAD TEST SITES
A study was undertaken to examine the feasibility of accurately measuring the noise from locomotives at existing load cell sites in the absence of sites conforming with U.S. Environmental Protection Agency standards. It was found through measurements at seven typical sites and one conforming load cell test site involving ten locomotives that reasonably accurate measurements were possible for the locomotive operating fully loaded at throttle 8. Errors, when they occurred, were due primarily to sound reflecting off nearby buildings. Measurements with the locomotive in idle were generally difficult because of high background noise at these sites. A passby test procedure was also examined and found to provide reasonably accurate measurement of locomotive noise at throttle 8, full load.

Remington, PJ Alakel, MN Ernest, JW Dixon, NR
Bolt, Beranek and Newman, Incorporated, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-79/55, DOT-TSC-FRA-79-17, Nov. 1979, 139 p.

Contract DOT-TSC-1474

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-137334, DOTL NTIS

10 325740
ASSESSMENT OF LOCOMOTIVE CREW IN-CAB OCCUPATIONAL NOISE EXPOSURE
The railroad industry, unlike most other U.S. industries, is not subject to the safety regulations of the Occupational Safety and Health Administration. Instead, railroad workers are covered by the safety regulations of the Federal Railroad Administration (FRA). This report documents an extensive study designed to assess the noise environment in locomotive cabs. Operational duty cycle and in-cab sound level data are presented for 18 test runs made on 16 different locomotives used in wide range of operational modes (e.g., through freight and local transfer freights), varied terrains (mountainous, undulating and flat) and varied trip lengths (6 to 12 hours). The general conclusion of this study is that there does not appear to be a widespread problem of overexposure to noise based on the same type of evaluation as

currently used by OSHA (only 1 out of 18 test runs exceeded the criteria). The noise exposure is within acceptable limits because the operational duty cycle is such that the sources which generate high sound levels (horn and brake) are operating only for short periods of time and because the locomotive spends a great deal of time idle (diesel engine sound levels below 90 dB). However, there was one test run for which an overexposure to noise was measured. To pinpoint such cases where overexposure to noise may occur, a simplified testing procedure is developed. This test consists of making in-cab sound level measurements of engine notch 8 (no load), horn sounding and brake application with the locomotive stationary. With these three sound level measurements and an estimate of the time that the locomotive is operating on-line, the in-service noise dose can be estimated and a pass/fail assessment made of whether the noise exposure might exceed acceptable limits.

Kilmer, RD

National Bureau of Standards, Federal Railroad Administration Final Rpt. FRA/ORD-80/91, Dec. 1980, 83p, 21 Fig., 57 Tab., 39 Ref., 1 App.

ORDER FROM: NTIS

PB81-154395, DOTL NTIS, DOTL RP

11 051897
THE AERODYNAMICS OF HIGH SPEED GROUND TRANSPORTATION
This is a comprehensive book covering the topics of ground vehicle aerodynamics, tunnel or tube and air cushion aerodynamics. It is the first book to treat all these categories, and with the current interest in new transportation systems it should have immediate use by design engineers. The complexity and diversity of topics covered presents a thorough treatment of each item. Essential features are discussed and information necessary for preliminary aerodynamic design of ground vehicles is provided. Speeds up to 300 mph are currently being considered for ground transportation systems, and at these speeds the drag, lift, and side-forces can be of the order of the weight of the vehicle. The basic principles of air cushion vehicles are given and discussed. Both plenum and peripheral jet air cushions are considered along with the effects of forward speeds. A major difficulty with the air cushion vehicle is its stability, and the author gives an introduction to the static and dynamic stability associated with such vehicles. A significant portion of this book is devoted to the aerodynamics of vehicles in tunnels and tubes. At speeds in the range of 300 mph compressible flow analysis must be used to describe some of the flow fields caused by a vehicle moving at such speeds in the confined environment of a tunnel or a tube.

Hammitt, AG
FRA-ORD/D-75/17 1973, 434 pp

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS PB-239865/9SL

11 072688
INVESTIGATION OF REDUCED COST GUIDEWAY DESIGNS FOR THE TRACKED AIR CUSHION RESEARCH VEHICLE. PART A
A study was made of alternate low cost guideway design concepts for the 300 mph Tracked Air Cushion Research Vehicle which will be tested at the DOT High Speed Ground Test Center at Pueblo, Colorado. The proposed concepts are both within present state of the art, and are designed to take maximum advantage of the existing technology used in the highway construction industry. The chief requirements are low construction cost and safe operation of vehicles at speeds up to 300 miles per hour. The various guideway design constraints imposed by the vehicle are discussed and used to evolve the preferred design concepts. The requirement for acceptable passenger ride comfort is interpreted in terms of guideway surface smoothness considerations by means of a probabilistic analysis of vehicle response. Various construction techniques are investigated and cost estimates are presented for each of the preferred concepts. The costs of the two preferred quideway design concepts are compared to the cost of the existing design which is being used for the initial construction phases at HSGTC. The sensitivity of the construction cost to certain guideway design features is discussed. Estimates showed that the tow preferred concepts should cost 30-50% less than the existing design.

Research was done jointly by ABAM Engineers and TRW Systems. The work was sponsored by the Department of Transportation, Transportation Systems Center, Cambridge, Massachusetts.

Birkeland, PW McCullough, BF Meisenholder, SG Oye, J
TRW Systems Group, (96030-L003-0) FRA-ORD&D-74-55, Dec. 1972, 230 pp, Figs., 7 Tab., 4 App.

Contract DOT-TSC-442

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC
PB-235123/7SL, DOTL NTIS

11 072689
AN EVALUATION OF THE DYNAMICS OF A MAGNETICALLY LEVITATED VEHICLE
An analytical and experimental evaluation was made of the stability and dynamic characteristics of a small scale magnetically levitated vehicle. The vehicle was levitated over a variety of guideway perturbations in an attempt at stimulating unstable modes of oscillation. No instabilities developed in the five degrees of freedom measured using either passive or active damping. The analytical model was used to simulate the observed motions of the vehicle using a computer. Reasonable agreement was found although more damping was observed than was simulated using the model. This work was performed as a part of the Federal Railroad Administration's program of research and development on high speed ground transportation for use in intercity passenger service.

Related reports are NTIS PB-221696, Study of a Magnetically Levitated Vehicle, and NTIS PB-210505, The Feasibility of Magnetically Levitating High Speed Ground Vehicles. Research was sponsored by Federal Railroad Administration, office of Research Development and Demonstration.

Coffey, HT Colton, JD
Stanford Research Institute, (No. 1080) Final Rpt FRA-ORD&D-74-41, Mar. 1974, 160 pp, 75 Fig., 4 Tab., 8 Ref., 2 App.

Contract DOT-FR-10001

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC
PB-236671, DOTL NTIS

11 080781
AERODYNAMICS OF VEHICLES IN FINITE LENGTH TUBES
High speed vehicles may operate in tunnels or tubes to minimize impact on the surrounding environment. Operation in tunnels or tubes minimizes the impact of surface obstacles, high noise levels, weather constraints and street congestion in metropolitan areas. The performance of these vehicles is significantly affected by the aerodynamics and needs to be understood. The aerodynamics of vehicles traveling through tubes are significantly affected by the constraints of the tube wall and the relative size (blockage ratio) of the vehicle. Steady flow conditions are reached only after long travel times. In this report, the flow created by vehicle travel in a tube is analyzed using numerical integration of the unsteady flow equations. Steady state conditions are rarely obtained for closed-end tubes up to several hundred miles in length. Solutions are presented for various blockage ratio vehicles with choked and unchoked flow conditions about them. Various tube lengths are also considered. The solution for a doubly infinite tube is found to be approaching the asymptotic long time solution.

This document was prepared for the Federal Railroad Administration, DOT.

Hammitt, AG
TRW Transportation and Environmental Operations, (96034-L014-0) Final Rpt. FRA-ORD&D-74-10, Apr. 1974, 86 p., 33 Fig., 2 Tab., 11 Ref., 3 App.

Contract DOT-FR-30004

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-236692, DOTL NTIS

11 080883
DESIGN, DEVELOPMENT AND TEST OF A WAYSIDE POWER DISTRIBUTION AND COLLECTION SYSTEM FOR THE TRACKED LEVITATED RESEARCH VEHICLE
This document presents test activity description and results of the wayside power distribution and collection system designed for the TLRV, a high-speed ground transportation vehicle. The system was assembled at the U.S. Navy testing grounds, China Lake, California to prove the design concept and feasibility of transferring high-electrical power between rail and collector brushes at elevated speeds while subjected to prevailing environmental conditions. With minor modifications, the initial design conformed to specified requirements up to speeds in excess of 300 mph. Analysis of the rail configuration and test results indicated that distance between the wayside rail supports could be doubled (25 ft) lessening by half the number of supports required to maintain the rail's alignment integrity at design speeds. Installation of the wayside rail system at HSGTC, Pueblo, Colorado will be constructed using the 25 ft span configuration.

This document was prepared for the Office of High Speed Ground Transportation, Federal Railroad Administration, DOT.

Webster, JO Shapiro, H Guenther, C Kalman, G Clemence, J Mitchel, S
AiResearch Manufacturing Company, (73-9436) Final Rpt. FRA-/ORD&D74-25, Apr. 1974, 200 pp, Figs., Tabs.

Contract DOT-FR-10002

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-238910/AS, DOTL NTIS

11 082925
LIM RESEARCH VEHICLE REACTION RAIL CURRENT DISTRIBUTION TESTS
A linear induction motor (LIM) operates, in principle, in the same manner as a conventional rotating induction motor. But LIM performance is subject to degration by so-called end effects, particularly at relatively high vehicle speeds (100 mph upwards). End effects are the phenomena caused by rapid generation of currents in the reaction rail at the entrance end of the LIM and their equally rapid decay at the exit end. Specific knowledge of dynamic current distribution and directional characteristics will materially aid the future design of improved LIMs. This report documents an investigation of current distribution in the LIM research vehicle (LIMRV) reaction rail at the U.S. Department of Transportation High-Speed Ground Test Center, Pueblo, Colorado.
See also PB-226283.

D'Sena, G McConville, JH
AiResearch Manufacturing Company, Federal Railroad Administration Intrm Rpt. 73-9431, Sept. 1973, 35 pp. FRA/ORD/D-75-18

Contract DOT-FR-30026

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-237768/7SL, DOTL NTIS

11 090174
PARAMETER OPTIMIZATION STUDIES OF MAGNETIC SUSPENSIONS FOR HIGH SPEED GROUND TRANSPORTATION
The study investigates efficient, cost-effective methods of high speed ground transportation for intercity travel. Previous aspects of the program have demonstrated the technical feasibility of two types of magnetic suspensions (the attractive-force, and the repulsive-force suspensions) for such applications, and have developed a baseline design for a TMLRV (tracked magnetically levitated research vehicle). The attractive force suspension considers the development of a mathematical model which predicts the magnetic behavior of the magnet-rail system for high speed, and a parameter optimaization of the magnet. The repulsive-force suspension examines various track geometries to see if the amount of aluminum in the track could be reduced without loss of performance. Experimental studies have been carried out to support the analytical aspects of the program.
Related reports include NTIS PB 223237 "Preliminary Design Studies of Magnetic Suspensions for High Speed Ground Transportation" (Ford Motor Co.) and FRA-ORD&D-74-41 "An Evaluation of the Dynamics of a Magnetically Levitated Vehicle" (SRI).

Borcherts, RH Davis, LC Wan, CC Mohdulla, AU Reitz, JR
Ford Motor Company, Federal Railroad Administration Final Rpt. FRA-ORD&D-74-42, Apr. 1974, 159 pp, 74 Fig., Tabs., 15 Ref., 2 App.

Contract DOT-FR-10026

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-238773/6ST, DOTL NTIS

11 090185
CABLE-STAYED GUIDEWAY. ANALYSES AND DYNAMIC MODEL TESTS
This report presents the results of scale model tests and parametric structural analyses which were performed in support of a conceptual investigation of cable-stayed guideways for suspended vehicle systems (SVS). The SVS concept would use high speed ground transportation (HSGT) vehicles suspended from an overhead guideway and which could achieve large cabin bank angles for high speed turns. This cabin bank mechanism allows the SVS to maintain a high speed, even when the guideway is collocated with an existing freeway or railroad with relatively tight turn radii. The possibility of collocating the SVS guideway is further improved by the use of cable-stayed guideways with spans of 200 feet or greater. This report describes the static and dynamic tests of a 1:24 scale model of a 250-foot span cable stayed guideway which was designed for a conceptual SVS.

Whitelaw, RL Szeless, AG Counts, J Garst, DA
Virginia Polytechnic Institute & State University, Federal Railroad Administration Final Rpt. Apr. 1974, 239 pp

Contract DOT-FR-3004. FRA/ORD/D-74-18

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-238915/3SY, DOTL NTIS

11 094113
CONCEPTUAL DESIGN AND ANALYSIS OF THE TRACKED MAGNETICALLY LEVITATED VEHICLE TECHNOLOGY PROGRAM (TMLV). REPULSION SCHEME
No abstract available.
Set includes PB-247 931 thru PB-247 934. See also RRIS 11 129199, 11 129155, 11 094115, and 11 094116.

Philco-Ford Corporation, Federal Railroad Administration Feb. 1975, 639p-in 4v. FRA/OR&D/75/21

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC
PB-247930-SET/ST, DOTL NTIS

11 094115
CONCEPTUAL DESIGN AND ANALYSIS OF THE TRACKED MAGNETICALLY LEVITATED VEHICLE TECHNOLOGY PROGRAM (TMLV). REPULSION SCHEME. VOLUME II. APPENDICES A-F
This report summarizes the studies of a program to establish the technology of magnetic suspension for ultimate use in a passenger-carrying high-speed ground transportation (HSGT) system-at speeds on the order of 134 m/s (300 mph). Magnetic Levitation (MAGLEV) is one of the advanced vehicle suspension concepts considered as alternatives to conventional transportation modes in the short-haul regime. This volume presents some details of the mathematical analysis associated with the MAGLEV vehicle dynamics and control (i.e., ride quality) in Appendices A through D; the noise or acoustic characteristics associated with the baseline Hamilton Standard Q-fan air propulsion system (Appendix E); and the Raytheon final report for the linear synchronous motor (LSM) studies (Appendix F).
Prepared in cooperation with Ford Motor Co., Dearborn, Mich. Scientific Research Staff. Paper copy also available in set of 4 reports as PB-247 930-SET.

Philco-Ford Corporation, Federal Railroad Administration, First Atomic Ship Transport, Incorporated Final Rpt. PF-TMLV-TR-0037A, FRA-/ORD-75-21A, Feb. 1975, 142 pp

Contract DOT-FR-40024

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247932/7ST, DOTL NTIS

11 094116
CONCEPTUAL DESIGN AND ANALYSIS OF THE TRACKED MAGNETICALLY LEVITATED VEHICLE TECHNOLOGY PROGRAM (TMLV). REPULSION SCHEME. VOLUME III. APPENDIX G. 5 DOF COMPUTER PROGRAM
This report summarizes the studies of a program to establish the technology of magnetic suspension for ultimate use in a passenger-carrying high-speed ground transportation (HSGT) system-at speeds on the order of 134 m/s (300 mph). Magnetic Levitation (MAGLEV) is one of the advanced vehicle suspension concepts considered as alternatives to conventional transportation modes in the short-haul regime. This third volume contains the computer programs for the solution of the equations of motion for 5 degrees-of-freedom, and a summary of the analytical background. These programs provide the capability for performing stability analyses of magnetically levitated vehicles, and for evaluating vehicle response and ride quality characteristics for operation over guideways with irregularities. Each program is listed along with a sample run. The programs are written in BASIC language for use on time-sharing systems.
Prepared in cooperation with Ford Motor Co., Dearborn, Mich. Scientific Research Staff. Paper copy also available in set of 4 reports as PB-247 930-SET.

Philco-Ford Corporation, Federal Railroad Administration, Ford Motor Company Final Rpt. PF-TMLV-TR-0037B, FRA/ORD-75-21B, Feb. 1975, 93 pp

Contract DOT-FR-40024

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247933/5ST, DOTL NTIS

11 094413
TRACKED LEVITATED RESEARCH VEHICLE PERIODIC TEST SUMMARY REPORT INDEPENDENT CUSHION SUSPENSION AEROPROPELLED-SMOOTH GUIDEWAY
The results of the first tests of the aeropropelled Tracked Levitated Research Vehicle (TLRV) in the smooth guideway at the Transportation Test Center (TTC) are presented for the TLRV in the Independent Cushion Suspension mode. Vehicle and cushion dynamic response behavior are discussed. Braking performance is presented for the speed range from 0 to 90 mph.
See also PB-249 259.

Fischer, G Zetkov, G
Grumman Aerospace Corporation, Federal Railroad Administration Summ Rpt. PMT-B4-R75-1, FRA/ORD/D-76-130, Aug. 1975, 120 pp

Contract DOT-FR-30041

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-249258/5ST, DOTL NTIS

11 094414
TRACKED LEVITATED RESEARCH VEHICLE PERIODIC TEST SUMMARY REPORT INDEPENDENT CUSHION SUSPENSION IN PERTURBED GUIDEWAY. AEROPROPELLED
The results of the first tests of the Tracked Levitated Research Vehicle (TLRV) in the Independent Cushion Suspension mode over the perturbed guideway at the Transportation Test Center (TTC) are presented. Vehicle dynamic response behavior is discussed for the speed range from 0 to 90 mph, including comparisons of test data with the responses computed using the TLRV Dynamics Simulation Program.
See also PB-244 282.

Bauer, E Magnani, E Zapotowski, B
Grumman Aerospace Corporation, Federal Railroad Administration Summ Rpt. PMT-B4-R75-2, FRA/ORD/D-76-131, Sept. 1975, 247 pp

Contract DOT-FR-30041

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-249259/3ST, DOTL NTIS

11 095721
ANALYSIS AND SIMULATION OF VEHICLE/GUIDEWAY INTERACTIONS WITH APPLICATION TO A TRACKED AIR CUSHION VEHICLE
Several analytical methods for investigating the problem of vehicle/guideway dynamic interactions are presented. These methods include several digital programs, each tailored to solve a particular aspect of the vehicle/guideway problem. Also included are computerized frequency domain methods for rapid estimation of system sensitivity to principal parameters and for use in selecting candidate guideway parameters. The major tool is the full scale vehicle/guideway dynamic interaction simulation, TRAVSIM, which includes coupled vehicle/guideway dynamics, independently generated guideway roughness profiles, and data processing for obtaining vehicle output data in the various ride quality formats. An example of the use of these methods to analyze the effects of guideway roughness and flexibility on a specific vehicle is illustrated. Roughness parameters are given in terms readily understandable to guideway contractors and include camber, pier settlement, pier survey error and surface finish. Results show that it is possible to vary roughness and cross section parameters and tolerances while achieving equivalent vehicle performance. Therefore, it seems possible to allow the guideway contractor to select the least costly set of tolerances to achieve the specified ride quality.

Ravera, RJ Anderes, JR
Mitre Corporation, (MTR-6839) Tech. Rpt. FRA-ORD & D-75-38, Feb. 1975, 102 pp, Figs., 20 Ref., Apps.

Contract DOT-FR-30015

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-242014/AS, DOTL NTIS

11 099174
COMPARISON OF TWO HSGT MAGNETIC SUSPENSION SYSTEMS (ATTRACTION)
Two alternate attraction magnetic suspension systems are compared on a magnetic performance basis as well as on their lift-to-weight (L/W) capabilities. On an equal current basis, the lower reluctance, flat track configuration has higher lift force and better L/W than the U shaped track configuration with its larger leakage flux. With equal magnetization (unequal currents) and low guidance forces, the U shaped track has a higher L/W ratio, but both attraction systems suffer from low L/W when all elements of the suspension system are considered.
This report supplements NTIS PB238773 "Parameter Optimization Studies of Magnetic Suspensions for High Speed Ground Transportation" (Ford Motor Co.) April, 1974. Prepared for DOT, Federal Railroad Administration.

Borcherts, RH
Ford Motor Company, Federal Railroad Administration Final Rpt. FRA-OR&D 75-75, Feb. 1975, 13 pp, 5 Fig., 11 Ref.

Contract DOT-FR-10026

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244226/AS, DOTL NTIS

11 099181
TRACKED LEVITATED RESEARCH VEHICLE DYNAMICS SIMULATION PROGRAM USER'S MANUAL. ADDENDUM
A digital computer program was generated to evaluate the dynamic characteristics of the Tracked Levitated Research Vehicle. Additional programming and new input data requirements are described in this addendum that enable the reduction and plotting of vehicle test data stored on magnetic tape concurrently with simulated responses. The changes incorporate inproved theory and algorithmas and permit more comprehensive theoretical dynamic analyses to be performed. This manual is an addendum to the Tracked Air Cushion Research Vehicle-Dynamics Simulation Program User's Manual, Department of Transportation Report FRA-RT-73-19, October 1972, NTIS Accession No. PB 219 984/2.
This program was sponsored by Federal Railroad Administration's Office of Research and Development.

Zapotowski, B
Grumman Aerospace Corporation, Federal Railroad Administration, (PMT-B4-R75-4) FRA-OR&D 75-78, Feb. 1975, 95 pp, Figs., Tabs., 1 Ref.

Contract DOT-FR-30041

ACKNOWLEDGMENT: FRA, NTIS
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PB-242907/4ST, DOTL NTIS

11 125889
TRACKED LEVITATED RESEARCH VEHICLE BODY/CHASSIS SUSPENSION IN PERTURBED GUIDEWAY AEROPROPELLED
The results of the first tests of the Tracked Levitated Research Vehicle (TLRV) in the Body/Chassis Suspension mode over the perturbed guideway at the High Speed Ground Test Center (HSGTC) are presented. Vehicle dynamic response behavior is discussed for the speed range from 0 to 70 mph, including comparisons of test data with the responses computed by the TLRV Dynamics Simulation Program.
Sponsored by DOT Federal Railroad Administration.

Zapotowski, B Bauer, B Magnani, E
Grumman Aerospace Corporation, Federal Railroad Administration, (PMT-B4-R74-4) Test Sum. FRA-OR&D-75-98, Nov. 1974, 117 pp, Figs., Tabs., 5 Ref.

Contract DOT-FR-30041

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-249258/AS, DOTL NTIS

11 125890
TRACKED LEVITATED RESEARCH VEHICLE PERIODIC TEST SUMMARY REPORT BODY/CHASSIS SUSPENSION AEROPROPELLED-SMOOTH GUIDEWAY
The results of the first tests of the Tracked Levitated Research Vehicle (TLRV) in the guideway at the High Speed Ground Test Center (HSGTC) are presented for the Body/Chassis Suspension mode. Vehicle dynamic response behavior and secondary suspension characteristics are discussed. Braking performance is discussed for the speed range from 0 to 78 mph.
See also PB-244281/2ST

Fischer, G Zapotowski, B
Grumman Aerospace Corporation, Federal Railroad Administration, (PMT-B4-R74-2) Test Sum. FRA-OR&D 75-97, Aug. 1974, 157 pp, Figs., Tabs., 5 Ref.

Contract DOT-FR-30041

ACKNOWLEDGMENT: FRA, NTIS
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PB-243987/5ST, DOTL NTIS

11 129155
CONCEPTUAL DESIGN AND ANALYSIS OF THE TRACKED MAGNETICALLY LEVITATED VEHICLE TECHNOLOGY PROGRAM (TMLV)-REPULSION SCHEME; EXECUTIVE SUMMARY
This report is an Executive Summary of FRA report OR&D-75-21 which summarizes studies to establish the technology of repulsion magnetic suspension for ultimate use in a passenger carrying high speed ground transportation (HSGT) system-at speeds on the order of 134m/s (300 mph). A baseline revenue system is described in terms of vehicle/guideway configuration, system performance and cost. Levitation and guidance is provided by eight superconducting magnets. The magnetic fields interact with a pair of L-shaped aluminum guideway elements. Propulsion alternatives are discussed but this is the area where much work remains to be done to provide adequate performance and cost data for a final selection. This technology, designed to free ground transportation from the speed and noise limitations imposed by steel wheel on steel rail, will make possible the short trip times of planes with the huge capacity of trains. Both speed and capacity are essential to meet the demonstrated demand for rapid travel in the nation's congested corridors.
Sponsorship was from Federal Railroad Administration, DOT.

Ford Motor Company, Philco - Ford Corporation, Federal Railroad Administration Final Rpt. FRA-OR&D 75-21C, Feb. 1975, 22 pp

Contract DOT-FR-40024

ACKNOWLEDGMENT: FRA, NTIS
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PB-247934/3ST, DOTL NTIS

11 129199
CONCEPTUAL DESIGN AND ANALYSIS OF THE TRACKED MAGNETICALLY LEVITATED VEHICLE TECHNOLOGY PROGRAM (TMLV)--REPULSION SCHEME; VOLUME 1-TECHNICAL STUDIES
This report summarizes the studies of a program to establish the technology of magnetic suspension for ultimate use in a passenger-carrying high-speed ground transportation (HSGT) system-at speeds on the order of 134 m/s (300 mph). Magnetic Levitation (MAGLEV) is one of the advanced vehicle suspension concepts considered as alternatives to conventional transportation modes in the short-haul regime. These advanced systems have the potential of alleviating the heavy traffic congestion predicted for the highly populated regions of the U.S. in the 1985-1995 period. The national energy shortage has intensified the search for more energy-efficient and cost-effective transportation modes. This volume summarizes the analyses and designs which demonstrate the performance of the system including the ability to meet the DOT ride quality standards on straight and level guideways as well as on curves and grade transitions. Conceptual designs and costs are shown for the vehicles, guideways, and the complete system. Various propulsion systems and guideway configurations are investigated, and a simple economic model is developed for the evaluation of MAGLEV systems on a cost per seat-mile or cost per passenger-mile basis.
This project was sponsored by the Federal Railroad Administration, DOT.

Ford Motor Company, Philco-Ford Corporation, Federal Railroad Administration, (TMLV-37) Final Rpt. FRA-OR&D-75-21, Feb. 1975, 380 pp, Figs., 7 App.

Contract DOT-FR-40024

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247931/9ST, DOTL NTIS

11 131038
TRACKED LEVITATED RESEARCH VEHICLE. FINAL TECHNICAL REPORT: AEROPROPELLED
The results of the 1973 aeropropelled tests of the Tracked Levitated Research Vehicle (TLRV) at the Transportation Test Center (TTC) are presented for the three basic suspension modes (Primary, Body/Chassis and Independent Cushion) at speeds up to 90 mph attained in the 3 mile guideway, which includes straight, transition to curve and superelevated segments. General vehicle and suspension characteristics are reviewed, and the system performance with respect to the air supply system, acoustics, vehicle speed and braking, cushion lift and ride comfort is discussed. Vehicle dynamic responses to perturbations installed in the guideway are compared with the results computed by the TLRV Dynamics Simulation Program.

Magnani, E Zapotowski, B
Grumman Aerospace Corporation, Federal Railroad Administration, (PMT-B4-R75-3) Final Rpt. FRA-ORD&D 76-132, Oct. 1975, 139 pp, Figs.

Contract DOT-FR-30041

ACKNOWLEDGMENT: FRA, NTIS
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PB-249126/4ST, DOTL NTIS

11 137312
MATRIX ANALYSIS OF LINEAR INDUCTION MACHINES
A new method of analyses for linear induction machines, the matrix method, has been developed. The method handles linear induction motors, both single-and double-sided, and linear induction liquid metal pumps and generators, both flat and annular. The primary currents can be prescribed, calculated from prescribed phase voltages, or optimized for maximum machine efficiency. The matrix method incorporates accurate modeling of the magnetic field of the finite-length iron including the fields due to fringing, variable gap, slots, coils, and phase belts. The coils may have any arbitrary phase connections.

Elliott, DG
Jet Propulsion Laboratory, Federal Railroad Administration Final Rpt. JPL-SP-43-24, FRA/ORD-75/77, Sept. 1975, 358 pp

ACKNOWLEDGMENT: NTIS
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PB-254574/7ST, DOTL NTIS

11 143945
EXPERIMENTS IN GUIDEWAY-LEVITATION VEHICLE INTERACTION DYNAMICS
This investigation involves the design and interpretation of laboratory-scale dynamic experiments of vehicles traversing multiple-span or cable-stayed guideways. The nondimensional responses of such systems, including critical span bending moments and vehicle heave accelerations, depend on the system parameters derived in Chapter 2. A point load 'vehicle' and two vehicles closely resembling advanced operational prototypes were designed and tested: the 150 mph Prototype Tracked Air Cushion Vehicle (PTACV), and the 300 mph Tracked Levitated Research Vehicle (TLRV). In Chapter 3, general experiments are designed, all based on these dimensionless system parameters and the capability of instrumentation and data processing minicomputers to measure and interpret response data. The remaining chapters include discussions and comparisons of response data for critical six and three-span guideway moments and for rms vehicle heave accelerations.

Wilson, JF
Duke University, Federal Railroad Administration Final Rpt. FRA-/OR&D-76/259, Jan. 1976, 88 pp

Contract DOT-FR-4-4098

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-257941/5ST, DOTL NTIS

11 147396
LINEAR INDUCTION MOTOR ELECTRICAL BRAKING TEST
This report describes the electrical braking characteristics of a 2500-hp (at 250 mph) linear induction motor (LIM), which is used to propel and brake the LIM research vehicle. Three methods of electrical braking were investigated: ac dynamic braking, dc eddy current braking, and plugging.

From the data acquired the following information was derived and is presented herein for each of the braking methods investigated: (1) LIM electrical braking characteristics in terms of braking force developed as a function of vehicle speed, with all data referred to a 2000-A primary current, (2) powerplant characteristics, (3) the location and magnitude of the braking energy dissipated, and (4) power and control equipment requirements. Pertinent LIM design information is also included to enable independent investigators to correlate analytical predictions with the test data published herein.

Powell, RB
AiResearch Manufacturing Company, Federal Railroad Administration
Final Rpt. 75-11969-Rev-1, FRA/ORD-76/264, Apr. 1976, 115 pp

Contract DOT-FR-40016

ACKNOWLEDGMENT: NTIS
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PB-261851/0ST, DOTL NTIS

11 147397
LINEAR INDUCTION MOTOR ELECTRICAL PERFORMANCE TEST
This report describes the electrical performance characteristics of a 2500-hp (at 250 mph) linear induction motor (LIM), based on data acquired while propelling the LIM research vehicle over a 0-to-250-mph speed range. Pertinent LIM design information is included to enable independent investigators to correlate their mathematical models with the test data published herein. The principal end product of this effort is tabulated LIM performance, in terms of thrust, voltage, power factor, efficiency, input and output power, velocity, and percent slip at five excitation frequencies and at 1-Hz slip frequency increments, with all data referred to a 2000-A primary current. From the acquired data the following information was derived and included in this report: LIM performance characteristics (thrust vs slip at constant current, power factor vs slip, and efficiency vs slip), voltage-and current-source presentation of LIM data, influence of LIM end effects, and other LIM data relevant to future design activities.

Powell, RB
AiResearch Manufacturing Company, Federal Railroad Administration
Final Rpt. 75-11919-Rev-1, FRA/ORD-76/265, June 1976, 161 pp

Contract DOT-FR-40016

ACKNOWLEDGMENT: NTIS
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PB-261856/9ST, DOTL NTIS

11 147572
LINEAR INDUCTION MOTOR RESEARCH VEHICLE SPEED UPGRADING TESTS (190 TO 250 MPH)
The linear induction motor research vehicle (LIMRV) was subjected to a series of test runs at speeds of 190 to 250 mph on the Department of Transportation 6.2-mile-long, standard gauge railroad track at the Transportation Test Center, Pueblo, Colorado. High-speed dynamic performance data on the vehicle, trucks, suspension systems, and LIM guidance system were acquired by means of instrumentation that measured accelerations and displacements. For these tests the LIMRV was fitted with two jet engines that enabled it to accelerate to high speeds during the first 2.3 miles of travel, leaving nearly 4 miles of track for constant-speed data collection and braking. The LIMRV operated in a fully stable manner dynamically up to the maximum speed attained, 255.7 mph. Sufficient data was collected so that a safe LIMRV operating profile could be constructed as a baseline for conducting LIM electrical performance tests with full confidence in the vehicle's dynamic stability up to its design speed of 250 mph.

Research was sponsored by the Federal Railway Administration, Office of Research and Development.

Chi, CC
AiResearch Manufacturing Company of California, (74-11035, Rev. 1) Final Rpt. FRA-OR&D 76-268, June 1976, 102 pp, Figs., Tabs., 6 Ref., 1 App.

Contract DOT-FR-30026

ACKNOWLEDGMENT: FRA, NTIS
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PB-261852/8ST, DOTL NTIS

11 147576
LINEAR INDUCTION MOTOR RESEARCH VEHICLE REACTION RAIL EDGE EFFECT INVESTIGATION. THE EFFECT OF RAIL SLOTTING
The purpose of this investigation was to obtain full-scale linear induction motor performance data with a slotted reaction rail. The motor thrust characteristics were determined with two different airgap widths at each of two different slot pitches. Test results showed essentially no variation in motor thrust characteristics with a slotted vs. an unslotted reaction rail. On the basis of this investigation (35 separate test runs were performed) it is concluded that slotting the reaction rail does not enhance LIM performance. This is a significant finding because slotting increases the cost of reaction rail fabrication.

Research sponsored by the Federal Railroad Administration, Office of Research and Development.

Powell, RB
AiResearch Manufacturing Company of California, (75-11825, Rev. 1) Final Rpt. FRA-OR&D-72-263, Apr. 1976, 28 pp, Figs., Tabs., 8 Ref., 1 App.

Contract DOT-FR-40016

ACKNOWLEDGMENT: FRA, NTIS
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11 147578
THE AIR-CORE LINEAR SYNCHRONOUS MOTOR--AN ASSESSMENT OF CURRENT DEVELOPMENT
The development of the air-core linear synchronous motor (LSM) is examined primarily on the basis of work done in the United States and Canada during the past five years. The outstanding performance features of these motors are demonstrated in terms of a simple theory, numerous design examples, and discussions of practical aspects. Comparisons to iron-core LSMs and linear induction motors are made. Also, the possibility of using air-core LSMs as an alternative to conventional railroad electrification techniques is pointed out.

Research sponsored by the FRA, Office of Research and Development.

Skalski, CA
Mitre Corporation, (MTR-7028) Final Rpt. FRA-OR&D-76-260, June 1976, 144 pp, Figs., Tabs., 59 Ref., 5 App.

Contract DOT-FR-54090

ACKNOWLEDGMENT: FRA, NTIS
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PB-261770/2ST, DOTL NTIS

11 150468
A COMPARISON OF LIMRV LIM GUIDANCE SYSTEM EXPERIMENTAL DATA WITH MATHEMATICALLY PREDICTED VALUES USING REACTION RAIL SURVEY DATA
This document discusses the survey of 1,000 feet of Linear Induction Motor Research Vehicle (LIMRV) reaction rail at the Department of Transportation Test Center in Pueblo, Colo., and a comparison of experimental data from test runs of the LIMRV LIM guidance system with theoretical predictions using the survey data as an input to a mathematical model. While some deviations from predicted values were observed, in general the correspondence between experimental data and predictions was excellent.

Muhlenberg, JD
Mitre Corporation, Federal Railroad Administration Tech. Rpt. MTR-6618, FRA/ORD-76/25, Oct. 1975, 52 pp

Contract DOT-FR-30015

ACKNOWLEDGMENT: NTIS, FRA
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PB-261921/1ST, DOTL NTIS

11 168021
ADVANCED SYSTEMS AND ADVANCED TECHNOLOGY
This summary of information presented in Report FRA/ORD-77/27 traces the decade of development of unconventional high-speed ground transportation vehicles. The section on Advanced Systems discusses system engineering, tracked air cushion vehicles, tube vehicles, suspended vehicles and multimodal concepts involving passenger service. The section on Advanced Technology describes work with linear electric motors, guideways, power

conditioning, controls, obstacle detection and communications. An Appendix explains current FRA advanced systems and advanced technology research programs.

A summary of Ten Years of Advanced Research and Development by the Federal Railroad Administration.

Federal Railroad Administration FRA/ORD-77/27, Oct. 1977, 33 pp, 15 Fig., 1 App.

ACKNOWLEDGMENT: FRA
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11 168985
COMPARISON OF EXPERIMENTAL AND THEORETICAL REACTION RAIL CURRENTS, RAIL VOLTAGES, AND AIRGAP FIELDS FOR THE LINEAR INDUCTION MOTOR RESEARCH VEHICLE

Measurements of reaction rail currents, reaction rail voltages, and airgap magnetic fields in tests of the Linear Induction Motor Research Vehicle (LIMRV) were compared with theoretical calculations from the mesh/matrix theory. It was found that the rail currents and magnetic fields predicted by the theory are within 20 percent of the measured currents and fields at most motor locations in most of the runs, but differ by as much as a factor of two in some cases. The most consistent difference is a higher experimental than theoretical magnetic field near the entrance of the motor, and a lower experimental than theoretical magnetic field near the exit. The observed differences between the theoretical and experimental magnetic fields and currents do not account for the differences of as much as 26 percent between the theoretical and experimental thrusts. (Color illustrations reproduced in black and white)

Elliott, DG
Jet Propulsion Laboratory, National Aeronautics and Space Administration, Federal Railroad Administration Final Rpt. FRA-/ORD-77/33, 77-36, July 1977, 84 pp

Contract NAS7-100

ACKNOWLEDGMENT: NTIS, FRA
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PB-274039/7ST

11 179123
COMPARISON OF LINEAR INDUCTION MOTOR THEORIES FOR THE LIMRV AND TLRV MOTORS

The Oberretl, Yamamura, and Mosebach theories of the linear induction motor are described and also applied to predict performance characteristics of the TLRV & LIMRV linear induction motors. The effect of finite motor width and length on performance predictions is examined for each theory. The edge and end effects are shown to play a dominant role in determining motor performance. The LIM thrusts predicted by the Oberretl, Yamamura, and Mosebach computer models are in reasonable agreement over most of the LIM speed range. The Oberretl theory tends to predict somewhat lower thrust values than the Yamamura and Mosebach theories; possible causes for the divergent thrust predictions are discussed. Computer listings for the Oberretl and Yamamura linear induction motor theories are presented in the appendix.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Stickler, JJ
Transportation Systems Center Final Rpt. DOT-TSC-FRA-77-21, FRA/ORD-77/68, Jan. 1978, 132 pp, 39 Fig., 21 Tab., 8 Ref., 1 App.

ACKNOWLEDGMENT: FRA, NTIS
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PB-292654/1ST, DOTL RP

11 179282
TLV STATUS REPORT

The worldwide status of Tracked Levitated Vehicle (TLV) technology and an assessment of its development, sponsored by the Advanced Technology Program within the Office of Research and Development in FRA, is presented here. This report along with a TLV Technology Workshop sponsored by the Office of University Research represent a continuing and coordinated effort by the Department of Transportation to keep abreast of the state of worldwide developments in this technology. The first chapter, entitled "An Overview of Worldwide Research Programs of Noncontacting Suspensions for Ground Transportation Vehicles", describes various maglev and air cushion suspension test facilities in use throughout the world. The second chapter, entitled "TLV Technology Status Report" discusses the status of the overall technology, in the judgment of MITRE/METREK. The purpose of this report is to place the worldwide research efforts in perspective as they address the outstanding technical problems as a whole. This will provide the reader with a tool for assessing target areas for future research which complement the ongoing worldwide efforts. This report uses the SI (metric) units.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Katz, R
Mitre Corporation Tech Rpt. FRA/ORD-78/01, MTR-7599, Oct. 1977, 142 pp, 52 Fig., 37 Ref.

Contract DOT-FR-54090

ACKNOWLEDGMENT: FRA
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PB-279845/AS, DOTL NTIS, DOTL RP

11 179284
PHASE IIIC--TEST & DEMONSTRATION PROTOTYPE TRACKED AIR CUSHION VEHICLE (PTACV)

A six year multi-phased program for design, development and test of a prototype tracked air cushion vehicle was culminated in a six month test and demonstration under Phase IIIC. Descriptions of the various major sub-systems are presented with design and operational performance data. Technical data covering test objectives, descriptions and results are furnished on a wide variety of functional assemblies, subsystems and performance conditions. Physical characteristics were measured for accelerations, braking, aerodynamic drag, ride comfort, acoustical quality, reliability and maintainability performance. System description and proposed system applications were surveyed and presented to selected government representatives.

Prepared for U.S. Department of Transportation, Federal Railroad Administration. Related information in report deliverables under Phases I through IIIB of contracts DOT-UT-10031; and DOT-FR-40022.

Smith, AK Dallas, J Dynes, R Stott, R Samusson, L
Rohr Industries, Incorporated Final Rpt. FRA/ORD-78/03, Nov. 1977, 215 pp, Figs., Tabs., 15 Ref., 2 App.

Contract DOT-FR-54089

ACKNOWLEDGMENT: FRA
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PB-279970/AS, DOTL NTIS, DOTL RP

11 319061
EFFECT OF MACHINE LENGTH ON THE PERFORMANCE OF LINEAR INDUCTION MOTORS: AN EXPERIMENTAL INVESTIGATION

This report describes the full-scale testing of a 10-pole, double-sided linear induction motor, modified to permit excitation of 9, 5, 4, or 2 poles in addition to full 10-pole excitation. Testing in reduced-pole configurations enabled the effect of a discontinuous excitation at the front and rear of the motor to be investigated, as well as the validity of certain mathematical models that assume infinite primary iron extending in the forward and reverse directions. A mathematical model of the motor is also presented that shows good correlation with test results. The motor had a peak thrust capability of 15.3 kN at 60 m/s at an excitation current of 2000 A.

Bevan, RJA
AiResearch Manufacturing Company, Federal Railroad Administration Final Rpt. FRA/ORD-79/07, 77-14572, Jan. 1979, 247 p., Figs., Tabs., 17 Ref., 12 App.

Contract DOT-FR-64226

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PB80-156243, DOTL NTIS, DOTL RP

11 325720
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 1

A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with lami-

nated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap and machine, and forces in all six axes. The machine was tested under nominal conditions and with perturbations in five degrees of freedom: air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficients were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-1, SRD-78-102, Sept. 1980, 115p, Figs., 5 Tab., 1 App.

Contract DOT-FR-64147

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11 325721
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 2
A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with Laminated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap and machine, and forces in all six axes. The machine was tested under nominal conditions and with perturbations in five degrees of freedom: air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficients were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-2, SRD-78-102, Sept. 1980, 352p, 1 App.

Contract DOT-FR-64147

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11 325722
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 3
A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with laminated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficients were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-3, SRD-78-102, Sept. 1980, 324p, 1 App.

Contract DOT-FR-64147

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11 325723
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 4
A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with laminated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap and machine, and forces in all six axes. The machine was tested under nominal conditions and with perturbations in five degrees of freedom: air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficients were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-4, SRD-78-102, Sept. 1980, 242p, 1 App.

Contract DOT-FR-64147

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11 325724
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 5
A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with laminated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap and machine, and forces in all six axes. The machine was tested under nominal conditions and with perturbations in five degrees of freedom: air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficients were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-5, SRD-78-102, Sept. 1980, 298p, 1 App.

Contract DOT-FR-64147

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DOTL RP

11 325725
PERFORMANCE OF A LINEAR SYNCHRONOUS MOTOR WITH LAMINATED TRACK POLES AND WITH VARIOUS MISALIGNMENTS. PHASE I-VOLUME 6
A test facility was designed and built to measure the performance of a single-sided high speed homopolar Linear Synchronous Motor with laminated pole pieces over a wide range of frequency and excitation levels. The facility was instrumented to measure performance at the machine terminals, flux density in the air gap and machine, and forces in all six axes. The machine was tested under nominal conditions and with perturbations in five degrees of freedom: air gap, lateral, pitch, roll, and yaw. Equivalent circuit parameters and flux form coefficents were measured and compared to design values. Poor correlation forced a revision of the design programs. The modeling of the finite interpolar gap and interpolar leakage flux led to good agreement between test and revised design values. The test data show a high power factor, the absence of end effects, and a strong tendency of the machine to remain properly aligned relative to the track, with the exception of a destabilizing pitch torque.

Mischler, WR Nondahl, TA
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/52-6, SRD-78-102, Sept. 1980, 236 p, 1 App.

Contract DOT-FR-64147

ORDER FROM: FRA/ORD

DOTL RP

11 325726
PERFORMANCE OF A SINGLE-SIDED LINEAR INDUCTION MOTOR WITH SOLID BACK IRON AND WITH VARIOUS MISALIGNMENTS. PHASE II- VOLUME 1

A test facility was designed and built to measure all aspects of the performance of a single-sided high-speed linear induction motor with solid back iron over a wide range of frequency, speed, and excitation. The facility was equipped and instrumented to measure all the usual performance parameters plus all of the six-axis forces in normal operation and, when displaced, in the remaining five degrees of freedom (air gap, lateral, pitch, roll, and yaw). Performance in the normal position was compared to the mesh/matrix prediction. Generally good agreement was obtained between measured and predicted values of thrust and efficiency. Differences between predicted and measured thrust (especially at high slips) were related to the solid back iron and skin saturation. Agreement between predicted and measured normal forces was not satisfactory. The six-axis force measuring system was thoroughly analyzed to determine the range of validity of the measurements and the errors inherent in using a sector motor to simulate a flat linear motor.

Kliman, GB Mischler, WR Oney, WR
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/53-1, SRD-78-069, Sept. 1980, 103p, Figs., 8 Tab., 2 App.

Contract DOT-FR-64147

ORDER FROM: NTIS

PB81-119463, DOTL NTIS, DOTL RP

11 325727
PERFORMANCE OF A SINGLE-SIDED LINEAR INDUCTION MOTOR WITH SOLID BACK IRON AND WITH VARIOUS MISALIGNMENTS. VOLUME 2- APPENDIX B-PART 1

A test facility was designed and built to measure all aspects of the performance of a single-sided high-speed linear induction motor with solid back iron over a wide range of frequency, speed, and excitation. The facility was equipped and instrumented to measure all the usual performance parameters plus all of the six-axis forces in normal operation and, when displaced, in the remaining five degrees of freedom (air gap, lateral, pitch, roll, and yaw). Performance in the normal position was compared to the mesh/matrix prediction. Generally good agreement was obtained between measured and predicted values of thrust and efficiency. Differences between predicted and measured thrust (especially at high slips) were related to the solid back iron and skin saturation. Agreement between predicted and measured normal forces was not satisfactory. The six-axis force measuring system was thoroughly analyzed to determine the range of validity of the measurements and the errors inherent in using a sector motor to simulate a flat linear motor.

Kliman, GB Mischler, WR Oney, WR
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/53-2-1, SRD-78-069, Sept. 1980, 289p

Contract DOT-FR-64147

ORDER FROM: FRA/ORD

DOTL RP

11 325728
PERFORMANCE OF A SINGLE-SIDED LINEAR INDUCTION MOTOR WITH SOLID BACK IRON AND WITH VARIOUS MISALIGNMENTS. VOLUME 2- APPENDIX B-PART 2

A test facility was designed and built to measure all aspects of the performance of a single-sided high-speed linear induction motor with solid back iron over a wide range of frequency, speed, and excitation. The facility was equipped and instrumented to measure all the usual performance parameters plus all of the six-axis forces in normal operation and, when displaced, in the remaining five degrees of freedom (air gap, lateral, pitch, roll, and yaw). Performance in the normal position was compared to the mesh/matrix prediction. Generally good agreement was obtained between measured and predicted values of thrust and efficiency. Differences between predicted and measured thrust (especially at high slips) were related to the solid back iron and skin saturation. Agreement between predicted and measured normal forces was not satisfactory. The six-axis force measuring system was thoroughly analyzed to determine the range of validity of the measurements and the errors inherent in using a sector motor to simulate a flat linear motor.

Kliman, GB Mischler, WR Oney, WR
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/53-2-2, SRD-78-069, Sept. 1980, 272p

Contract DOT-FR-64147

ORDER FROM: FRA/ORD

DOTL RP

11 325729
COMPARISONS BETWEEN DESIGNS FOR SINGLE-SIDED LINEAR ELECTRIC MOTORS: HOMOPOLAR SYNCHRONOUS AND INDUCTION. PHASE III

A design study of two types of single-sided (with a passive rail) linear electric machine designs, namely homopolar linear synchronous machines (LSM's) and linear induction machines (LIM's), is described. It is assumed the machines provide tractive effort for several types of light rail vehicles and locomotives. These vehicles are wheel supported and require tractive powers ranging from 200 kW to 3735 kW and top speeds ranging from 112 km/hr to 400 km/hr. All designs are made according to specified magnetic and thermal criteria. The LSM advantages are a higher power factor, much greater restoring forces for track misalignments, and less track heating. The LIM advantages are no need to synchronize the excitation frequency precisely to vehicle speed, simpler machine construction, and a more easily anchored track structure. The relative weights of the two machine types vary with excitation frequency and speed; low frequencies and low speeds favor the LSM. The effect of variations in several LSM design parameters are shown to illustrate trends in machine dimensions, track weight, and commutating reactance. The details of the LSM design programs are described and a Fortran IV listing of the programs is provided.

Nondahl, TA Richter, E
General Electric Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/54, Sept. 1980, 121p, Figs., Tabs., 10 App.

Contract DOT-FR-64147

ORDER FROM: NTIS

PB81-116188, DOTL NTIS, DOTL RP

12 091319
DEVELOPMENT OF A COMPUTER PROGRAM FOR MODELING THE HEAT EFFECTS ON A RAILROAD TANK CAR
A mathematical model has been programmed in FORTRAN IV that represents the response to a fire environment of a railroad tank car laden with a volatile, flammable fluid. Inputs to the program include total mass of lading per foot of tank length, tank length, number and flow area of relief valves, their opening and closing pressure, thickness and thermal conductivity of exterior insulation, and array of the thermodynamic properites of the lading, its initial condition, and heat transfer coefficient and fire temperature at various points on the tank. Output includes tank pressure, temperatures of the liquid and vapor, temperatures of the interior surface of the shell, mass of liquid remaining, and location of the liquid level. These are printed for the end of every computing interval, thus indicating the history of each.

Study sponsored by the U.S. Department of Transportation, Federal Railroad Administration, Washington, D.C.

Graves, KW
Calspan Corporation, Federal Railroad Administration, (CALSPAN-YE-5176-D-1) Final Rpt. FRA-OR&D 75-33, Jan. 1973, 101 pp

Contract DOT-AR-20036

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241365/6ST, DOTL NTIS

12 095870
RAILROAD TANK CAR FIRE TEST: TEST NO. 7
A fire test was conducted on a one-fifth scale model pressurized railroad tank car on 7 February 1973. The test, designated as Test Number 7, was conducted by the Ballistic Research Laboratories for the Federal Railroad Administration of the United States Department of Transportation at the White Sands Missile Range. The tank car model has a thermal insulation of four inches (10.16 cm) of polyurethane encased in a 0.125 inch (0.318 cm) steel jacket. The model was loaded with propane and then engulfed in a JP-4 jet fuel fire.

Anderson, C Townsend, W Zook, J Wright, W Cowgill, G
Department of the Army Final Rpt. FRA-OR&D 75-37, Dec. 1973, 154 p.

Contract DOT-AR-30026

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241145/AS, DOTL NTIS

12 129150
DEVELOPMENT OF ANALYTIC FIRE MODELS
The hydrodynamic equations which include a turbulence model based on the work by Spalding's group have been derived along with the associated boundary and initial conditions. They have also been put into finite difference form, coded, and are currently being debugged. The soot chemical model has been determined and is included in the above formulation. A radiation code based on the long characteristics method has been prepared for inclusion into the code as a subroutine as has an equation of state package.

Sponsorship was from Federal Railroad Administration, DOT.

Schalit, L Schneyer, G Toor, J Laird, D
Systems, Science, and Software, (SSS-R-74-2436) Prog. Rpt. FRA-OR&D 75-53, Oct. 1974, 66 pp, Figs., 50 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: FRA/ORD

12 129151
COMPUTER SIMULATION OF TANK CAR HEAD PUNCTURE MECHANISMS. CLASSIFICATION YARD ACCIDENTS
A number of railroad accidents have been aggravated by couplers puncturing the shell head of hazardous material tank cars. Development of means for identifying possible puncture mechanisms and quantifying the coupler forces involved is the subject of this report. A mathematical model, capable of simulating train action in the vertical plane, has been developed and used for simulation of three classification yard accidents. A detailed description of the model and the results of simulation are presented. The conclusions of this report must be considered tentative until the results of verification studies become available.

Sponsorship was from the Federal Railroad Administration, DOT.
Hohenemser, KH Diboll, WB Yin, SK Szabo, BA
Washington University, St Louis, (64274) Prelim Rpt FRA-ORD&D-75-23, Feb. 1975, 74 pp, Figs.

Contract DOT-OS-40106

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250409/0ST, DOTL NTIS

12 141582
AN OPERATIONAL DEMONSTRATION OF TRAILING END VISIBILITY ENHANCEMENT DEVICES FOR COMMUTER RAILROAD TRAINS
This report describes the demonstration which compared under actual operating conditions various means of enhancing the visibility of commuter train ends. The visibility enhancement devices included in the demonstration were: 1) Xenon strobe lights; 2) Large and small red market lights; 3) Amber flashing beacons and 4) Various patterns of brightly colored paints and fluorescent/reflective tapes on car ends. Data concerning the visibility and other attributes of the above devices was collected by means of a series of questionnaires directed at groups of people considered to be significantly impacted by the devices. The groups surveyed were: 1) Train crew members; 2) Independent observers; 3) Residents along various rail rights-of-way; 4) Commuters and 5) Motorists. The survey results are discussed and the conclusions arrived at are used to make recomendations regarding which devices are most appropriate for inclusion in a regulation to govern the visibility enhancement of passnger train ends. In addition, performance specifications and guidelines for the use of these devices are given.

This demonstration was conducted by the Illinois DOT with the support and cooperation of the Federal Railroad Administration and three Chicago area commuter railroads: Burlington Northern, Chicago & Northwestern, Illinois Central Gulf.

Englund, DB
Illinois Department of Transportation Final Rpt. FRA-ORD-76-292, June 1976, 129 pp, 12 Fig., 5 Tab., 11 Ref., 1 App.

ACKNOWLEDGMENT: Illinois Department of Transportation, NTIS
ORDER FROM: NTIS
PB-259901/7ST, DOTL NTIS, DOTL RP

12 144090
LOCOMOTIVE/CABOOSE CRASHWORTINESS
This report presents the results of the Phase I study of the locomotive/-caboose crashworthiness program and the proposed work for the Phase II investigation. The results of the Phase I study include the mechanics of train impact that lead to override, recommended action to control override and means of protection for locomotives and cabooses.

Sponsorship was provided by Federal Railroad Administration, Office of Research and Development, DOT.

Tong, P
Transportation Systems Center, (DOT-TSC-FRA-76-18) Final Rpt. FRA-OR&D-76-289, Oct. 1976, 26 pp, 5 Fig.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-261110/1ST, DOTL NTIS

12 145541
MECHANICS OF TRAIN COLLISION
A simple and a more detailed mathematical model for the simulation of train collisions are presented. The study presents considerable insight as to the causes and consequences of train motions on impact. Comparison of model predictions with two full scale train-to-train impact tests shows good correlation. Methods for controlling train motion and kinetic energy dissipation for the minimization of train collision induced damage are suggested.
(PC A04/MF A01)

Tong, P
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-76-5, FRA/ORD-76/246, Apr. 1976, 74 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-258993/5ST, DOTL NTIS

12 157508
WAYSIDE DERAILMENT INSPECTION REQUIREMENTS STUDY FOR RAILROAD VEHICLE EQUIPMENT
An analysis of the causes of the railroad equipment-caused derailments was made. Data reported to the FRA was the primary source of derailment information; however, data from other sources were also available. Individual cause codes were consolidated into groups that had a common characteristic that might be used to detect the presence of the defect. Seven consolidated cause code groupings were identified that accounted for over 80 percent of the cost of equipment-caused derailments. Existing wayside inspection systems were evaluated. Developmental wayside inspection systems were identified. A method was developed that assigns a purchase cost number for possible wayside detection schemes that is based on the cost of derailment and effectiveness of the system. A recommendation is made that FRA set up Wayside Inspection Station(s) as a means of evaluating improvement to present systems and new wayside inspection methods.

Sponsored by the FRA/U.S. DOT through the Transportation Systems Center, Cambridge, Massachusetts.

Frarey, JL Smith, RL Krauter, AI
Shaker Research Corporation, (DOT-TSC-FRA-77-5) Final Rpt. FRA-/ORD-77/18, May 1977, 150 pp, Figs., Tabs., 16 Ref.

Contract DOT/TSC-1029

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-271244/AS, DOTL NTIS, DOTL RP

12 163786
KEYNOTE ADDRESS. 13TH RAILROAD ENGINEERING CONFERENCE, OPENING SESSION
Comments and illustrations are given about the effects of traffic density, inflation and other factors on the apparently increasing trends for railroad accidents and casualties. The need for improved reporting systems and the role for cooperative safety programs involving government, industry and labor are discussed.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, and included in the Conference Proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Harris, WJ, Jr (Association of American Railroads)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 1-6, 13 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-272948/AS, DOTL NTIS

12 190536
RAIL SAFETY/EQUIPMENT CRASHWORTHINESS. VOLUME I. A SYSTEMS ANALYSIS OF INJURY MINIMIZATION IN RAIL SYSTEMS
The Department of Transportation, Transportation Systems Center (TSC), is providing technical assistance to the Federal Railroad Administration (FRA) in a program to improve railroad safety and efficiency by providing a technological basis for improvement and possible regulation in rail vehicle crashworthiness, inspection and surveillance of equipment, and other areas. As part of this program, TSC is conducting technical analyses of passenger railcar collisions, derailments, and other accidents, directed towards minimizing occupant injuries. The document, the first of four volumes, reports on the collection of data for a representative accident sample, the analysis of the data to identify injury types, locations, and, when possible, injury causal factors. Vehicle interior design details are also considered in conjunction with the accident data to compile a list of potential improvements in occupant protection.

See also Volume 2, PB-289148. Also available in set of 4 reports PC E06, PB-289 146-SET.

Reilly, MJ Jines, RH Tanner, AE
Boeing Vertol Company, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-77/73.I, DOT-TSC/FRA-77-15-1, July 1978, 265 p.

Contract DOT-TSC-821-1

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-289147/1ST, DOTL NTIS

12 190537
RAIL SAFETY/EQUIPMENT CRASHWORTHINESS. VOLUME II. DESIGN GUIDE
The second of four volumes, has been prepared to assist design engineers in understanding the basic problems associated with the development of crashworthy interiors of locomotives, cabooses and passenger railcars. Rail vehicle accident conditions are presented with the resulting interactions that can occur between one car and another. Types of injuries to the occupants of the cars, and the mechanism causing the injury, are discussed.

See also Volume 1, PB-289147, and Volume 3, PB-289149. Also available in set of 4 reports PC E06, PB-289 146-SET.

Reilly, MJ Shefrin, J Patrick, LM
Boeing Vertol Company, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-77/73. II, DOT-TSC/FRA-77-15-2, July 1978, 99 p.

Contract DOT-TSC-821-2

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-289148/9ST, DOTL NTIS

12 190538
RAIL SAFETY/EQUIPMENT CRASHWORTHINESS. VOLUME III. PROPOSED ENGINEERING STANDARDS
The document, the third of four volumes, contains recommended Engineering Standards prepared in the format of the standards published in the Code of Federal Regulations (Title 49, Transportation, Parts 200). The standards proposed provide improved occupant protection in the secondary impact situation associated with railroad accidents.

See also Volume 2, PB-289148, and Volume 4, PB-289150. Also available in set of 4 reports PC E06, PB-289 146-SET.

Reilly, MJ
Boeing Vertol Company, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-77/73. III, DOT-TSC/FRA-77-15-3, July 1978, 70 p.

Contract DOT-TSC-821-3

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-289149/7ST, DOTL NTIS

12 190539
RAIL SAFETY/EQUIPMENT CRASHWORTHINESS. VOLUME IV. EXECUTIVE SUMMARY
The document, the fourth of four volumes, summarizes the activities and documentation conducted under this contract. The analysis of the accident data highlighted areas where improvements could be made to improve the occupant protection of passenger rail vehicles. Design criteria were determined and some suitable design changes proposed. For the proposed areas of change, typical Federal Standards documentation were prepared.

See also Volume 3, PB-289149. Also available in set of 4 reports PC E06, PB-289 146-SET.

Reilly, MJ
Boeing Vertol Company, Transportation Systems Center, Federal Railroad Administration Intrm Rpt. FRA/ORD-77/73.IV, DOT-TSC/FRA-77-15-4, July 1978, 75 p.

Contract DOT-TSC-821-4

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-289150/5ST, DOTL NTIS

12 325734
A REPORT ON INVESTIGATIONS INTO RAIL PASSENGER SAFETY

Investigations are made into issues affecting rail passenger safety in intercity and commuter rail service. The objectives of the study were to identify important safety issues that need resolution, to describe means for resolving these issues, and to describe further research that is critically needed. Special attention was given to those issues highlighted by the National Transportation Safety Board (NTSB) in recent recommendations. The important safety issues identified are briefly described as communications, train control systems, vehicle crashworthiness, vehicle interior design, emergency regress and lighting, equipment maintenance and inspection, and employee training.

Mattison, PD Palmer, DW Nayak, PR
Little (Arthur D), Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/65, ADL-80589-30, Oct. 1980, 93p, Figs., 4 Tab., 4 App.

Contract DOT-FR-74261

ORDER FROM: NTIS

PB81-116196, DOTL NTIS, DOTL RP

13 143943
A PARAMETRIC COST STUDY OF AC-DC WAYSIDE POWER SYSTEMS
The wayside power system provides all the power requirements of an electric vehicle operating on a fixed guideway. For a given set of specifications there are numerous wayside power supply configurations which will be satisfactory from a technical standpoint. The purpose here is to determine among a set of technically feasible designs, the one which is most cost effective. The primary cost tradeoff used in this study is between power rails and substations. Included is a presentation of the major technical and cost characteristics of each and a means of parameterizing these quantities, a procedure for optimizing costs, identification of the principal characteristics of a cost effective solution, and a comparison of ac and dc wayside power systems. For purposes of illustration, numerical values and costs for the Tracked Levitated Research Vehicle and the wayside power rail at the High Speed Train Test Center at Pueblo, Colorado, are used.

Prepared by Kusko (Alexander), Inc., Needham Heights, Mass.

Rutishauser, H Kusko, A Barrett, M
Transportation Systems Center, Kusko (Alexander) Incorporated, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-75-20, FRA/ORD-76-24, Sept. 1975, 136 pp

Contract DOT-TSC-203

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-257744/3ST, DOTL NTIS

13 153067
SELECTED BIBLIOGRAPHY OF WORLD LITERATURE ON ELECTRIC TRACTION FOR RAILROADS. (1970-1975 PERIOD)
The purpose of this task was to review selected world literature on electric traction and railroad electrification of 1970-1975 period and prepare abstracts of the most important articles describing the status of foreign technology in selected areas of interest. This document lists all these abstracts. In addition, nine (9) volumes of photocopied original articles are filed with Mr. M. Guarino, Program Manager, Electrical Traction, FRA, RRD-21, Washington, D.C. 20590 for reference.

Compilation of this bibliography was sponsored by the FRA, Office of Research, Development and Demonstration, U.S. DOT.

Macie, TW
Jet Propulsion Laboratory Bibliog. FRA-OR&D 76-296, Nov. 1976, 85 pp

Contract DOT-AR-30006 Amend 4

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-265469/7ST, DOTL NTIS, DOTL RP

13 154009
TECHNICAL FEASIBILITY STUDY OF RAILROAD ELECTRIFICATION WITH HIGH VOLTAGE (10-50 KV) DIRECT CURRENT
High-voltage (10-50 kV), direct-current (HVDC) power distribution may prove to be an economically and technically attractive option for railroad electrification. There may be potential economic advantages in both wayside installation and operation, and in the propulsion equipment aboard the rolling stock. However, before an economic comparison with AC systems can be completed, the technical feasibility of DC systems must be determined, which was the purpose of this study. This study was directed toward the wayside equipment only. The problem of HVDC rolling stock was not considered. The preliminary analysis in this report shows no technical obstacle to the use of HVDC power distribution systems for application to the wayside portion of railroad electrification. Circuit breakers, which can be applied to these systems, are in various stages of development, and with reasonably directed research can meet the duty requirements. Likewise, rectifiers which can satisfy both current and voltage requirements are within the state of the art.

Uher, RA
Carnegie-Mellon University, Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-77/05, Sept. 1976, 75 pp

Contract DOT-TS-11702

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-265018/2ST, DOTL NTIS

13 179269
RAILROAD ELECTROMAGNETIC COMPATIBILITY. VOLUME I. ELECTRIFICATION BIBLIOGRAPHY
In an effort to provide a single source of referable material concerning electromagnetic interference/electromagnetic compatibility (EMI/EMC) associated with railroad electrification, a special document was prepared for the Federal Railroad Administration. This bibliography is the result of that effort and contains numerous abstracts of mixed foreign and domestic material. The abstracts are compiled from previous published bibliographies on related subjects, with special attention given to the Railroad Research Information Service File. The material in this document is categorized into the following subject topics: Catenary System, Electrification, Power Transmission Line, Signalling and Telecommunication, Substation, Track Circuit, Traction Control System and Miscellaneous.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. Project part of overall effort on railroad electromagnetic compatibility study-investigation according to research plan FRA/OR&D 77/44 addendum #1 dated September 1977. Volume II--Railroad Electromagnetic Compatibility; Assessment for Classification Yards and Electrification, FRA/ORD-77/77.II to be published.

Young, J O'Neill, D
Electromagnetic Compatibility Analysis Center Final Rpt. FRA/ORD-77/77.I, ECAC-CR-78-009, Mar. 1978, 122 pp

Contract AR 74311

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-281705/AS, DOTL NTIS, DOTL RP

13 179289
SELECTED BIBLIOGRAPHY OF WORLD LITERATURE ON ELECTRIC TRACTION FOR RAILROADS, 1970-1976
No Abstract.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C.

Macie, TW
Jet Propulsion Laboratory Bibliog. FRA/ORD-77/42, Aug. 1977, 146 pp

Contract DOT-AR-30006 Amend 5

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-284160/AS, DOTL NTIS, DOTL TF857.M13, DOTL RP

13 188690
FIXED INSTALLATIONS ON THE FRENCH 200 MPH RAILROAD. TRANSLATIONS
A new milestone in railroad transportation technology will have been achieved with the completion in 1981 of the new high speed rail line between Paris and Lyon, France, when high speed passenger trains will be traversing the 409 kilometers (255 miles) between Paris and Lyon at cruising speeds of about 260 kmph (160 mph). The French Railroad Administration (SNCF) has the responsibility for implementation of the project as well as for the development of the equipment and infrastructure. A great number of articles and pamphlets have been published in French on the subject. Four of these articles for the purpose of acquainting the American railroad community with the newer technology from abroad and to illustrate the potential benefits which might be derived by utilizing this particular technology in the North American operations were selected for translation at JPL, e.g.: Scope and implementation of tests on the high speed traction head Z7001, Senac, G.; The power supply of the French alternating current railways, Niekamp, K.; Supply of electrical energy to the new line, Laurenceau, J-N., and Fixed installations of electric traction and the collection of current, Boissonnade, P. and Dupont, R.

Macie, TW
Jet Propulsion Laboratory FRA/ORD-77/69, Aug. 1978, 79 p., Figs., Tabs.

Contract DOT-FRA AR-30006

ACKNOWLEDGMENT: FRA/ORD

ORDER FROM: NTIS

DOTL NTIS, DOTL RP

13 318972

PERSONNEL SAFETY ON ELECTRIFIED RAILROADS

Potential electrical hazards to fire, police, and rescue personnel responding to emergencies on electrified railways are examined. Data on descriptions of electrical facilities, types of accidents and danger to emergency personnel, and reviews of operating procedures have been obtained during a series of visits to electrified rail and transit systems. Programs to reduce electrical hazards to emergency personnel are proposed. These programs are evaluated by a cost-benefit comparison, and recommendations are selectively made. Joint development of emergency operating plans by rescue and railroad organizations, and installation of direct telephone lines to the power director are recommended as being most cost-effective.

Prepared in cooperation with Kusko (Alexander), Inc., Needham, MA.

Abbas, JD Phillips, WE, Jr Kusko, A King, CM

Transportation Systems Center, Federal Railroad Administration Final Rpt. FRA/ORD-80/36, DOT-TSC-FRA/80-14, June 1980, 60p

Contract DOT-TSC-1180

ACKNOWLEDGMENT: NTIS

ORDER FROM: NTIS

PB80-220858, DOTL NTIS

16 092310
RAILROADS AND THE ENVIRONMENT: ESTIMATION OF FUEL CONSUMPTION IN RAIL TRANSPORTATION. VOLUME I. ANALYTICAL MODEL
The report describes an analytical approach to estimation of fuel consumption in rail transportation, and provides sample computer calculations suggesting the sensitivity of fuel usage to various parameters. The model used is based upon careful delineation of the relevant physical machanisms of energy dissipation under steady-state conditions-rolling and aerodynamic resistance (using the Davis equations), braking, idling, and locomotive power generation and conversion losses. Both simple and more complex formulations are applied as appropriate. Several classes of service are considered: branch line freight, intercity freight, conventional and high-speed passenger, and commuter. Numerous graphs illustrate typical results for specific fuel consumption as a function of speed, grade, power/weight, load factor, weight per seat, etc.

Hopkins, JB
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-75-16-I, FRA/ORD-75/74.I, May 1975, 84 pp, Figs., Tabs., 22 Ref., Apps.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-244150/5ST, DOTL NTIS

16 131325
FUEL EFFICIENCY IMPROVEMENT IN RAIL FREIGHT TRANSPORTATION
Railroad diesel fuel conservation is becoming increasingly cost-effective. The price of diesel fuel has increased almost two and one-half times since the October 1973 Embargo. The estimated value of diesel fuel, if in short supply, is over 1 dollar a gallon. A comparison of the fuel performance of 10 selected railroads, before and after the Embargo, showed improvement in net-ton-miles hauled per gallon of diesel fuel. However, some roads used fuel less efficiently from an operating standpoint, as measured in gross-ton-miles per gallon. The most promising immediate avenue for conserving diesel fuel is designing train operating policies specifically to conserve fuel while continuing to provide desired schedule performance. Reducing horsepower-per-ton assignment to trains is a preferable strategy to that of reducing maximum allowable train operating speeds. The key to successful implementation is the appropriate short term regulation of the locomotive fleet. The basic diesel locomotive now used was designed during an era of plentiful fuel supply at a relatively low price. Many features can be improved to provide greater fuel efficiency. Corporate strategies need re-examination in the light of the high cost and uncertain supply of diesel fuel. The control of fuel must be improved and continencies for a fuel shortage should be planned.
Sponsored by the U.S. Department of transportation Federal Railroad Administration.

Cetinich, JN
Emerson Consultants, Incorporated, (DOT-TSC-FRA-75-26) Final Rpt. FRA-OR&D-76-136, Dec. 1975, 92 pp, 6 Fig., 5 Tab., 2 App.

Contract DOT-TSC-1105

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-250673/AS, DOTL NTIS

16 147579
THE IMPACT OF THE U.S. ENERGY SITUATION ON HIGH SPEED GROUND TRANSPORTATION
U.S. energy supply issues for the next few decades are summarized with a view toward their impact on high speed ground transportation (HSGT) modes. As background, the energy characteristics of intercity passenger modes, including 300 mph tracked levitated vehicle (TLV) systems, are presented and discussed. In the short and mid terms (through 1985 or 1990), energy shortages are seen to impact HSGT modes mainly through increased operating (fuel) costs; and the need for greater capacity flexibility. In the long term, HSGT modes may have to adapt to non-fossil fuels. Research topics for addressing energy impacts on HSGT are suggested.
Research sponsored by the FRA, Office of Research, Development and Demonstration.

Fraize, WE
Mitre Corporation, (MTR-6808) Tech. Rpt. FRA-OR&D-75-63, Dec. 1975, 41 pp, 14 Fig., 3 Tab., 17 Ref., 1 App.

Contract DOT-FR-30015
ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-261805/6ST, DOTL NTIS

16 167397
RAILROADS AND THE ENVIRONMENT: ESTIMATION OF FUEL CONSUMPTION IN RAIL TRANSPORTATION. VOLUME II. FREIGHT SERVICE MEASUREMENTS
Fuel consumption measurements have been carried out in cooperation with several railroads for a variety of types of revenue freight service. Intermodal operations have been emphasized, but this report also includes studies relating to branchline and general freight movements. The wide range of operating parameters examined includes train speed, weight, length, type, power-to-weight ratio, and terrain. In particular, this report describes the test conditions, operating parameters and fuel usage indices for 80 separate line-haul movements on six different railroads, covering 53,000 train miles. Trailer-On-Flatcar (TOFC) service predominates, but several manifest freights, two unit coal trains, and two COFC trains are included. Branchline service is also reported and analysed for six 174-mile round trips.
See also Volume 1 dated May 75, PB-244 150.

Hopkins, JB Newfell, AT
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FRA-77-11, FRA/ORD-75/74.II, Sept. 1977, 46 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-273277/4ST

16 188693
RAILROADS AND THE ENVIRONMENT: ESTIMATION OF FUEL CONSUMPTION IN RAIL TRANSPORTATION VOLUME III. COMPARISON OF COMPUTER SIMULATIONS WITH FIELD MEASUREMENTS
This report documents comparisons between extensive rail freight service measurements (previously presented in Volume II) and simulations of the same operations using a sophisticated train performance calculator computer program. The comparisons cover a variety of lengthy freight movements over a differing terrain, for TOFC, boxcar, and branchline operations. The simulation shows excellent agreement (within 2%) for aggregated data, although some specific runs or run segments show substantial deviations. Uncertainty is typically plus or minus 10% to 15%, a range equivalent to the scatter generally found within sets of measured data. The report also includes a full description of the simulation program and a general analysis of the major factors which bear upon the validity and accuracy of train performance calculations. Proposed modifications to conventional train resistance equations are suggested.
Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. Volume I, Analytical Model, has 90 pp. Volume II, Freight Surface Measurements, has 46 pp.

Hopkins, J Hazel, M McGrath, T
Transportation Systems Center Final Rpt. FRA/ORD-75-74.III, DOT-TSC-FRA-78-16III, Sept. 1978, 102 p., 8 Fig., 11 Tab., 10 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-288866/AS, DOTL NTIS, DOTL RP

16 313194

TECHNICAL PROCEEDINGS OF THE ENERGY MANAGEMENT WORKSHOP, HELD AT CHICAGO, IL ON NOVEMBER 8, 1979

A report on the technical proceedings of the Federal Railroad Administration's Energy Management Workshop is presented. This first Energy Workshop concentrated on the use and reliability of train performance simulators. A review of research conducted by DOT and DOE in the area of rail fuel efficiency is presented.

Prepared in cooperation with Department of Energy, Washington, DC., Transportation Systems Center, Cambridge, MA., and MITRE Corp., Bedford, MA.

Kearney (AT) and Company Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-80/18, Feb. 1980, 13 p.

Contract DOT-FR-9051

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-144975, DOTL NTIS

17 057738
INTRODUCTION TO THE APPLICATION OF THE DYNALIST COMPUTER PROGRAM TO THE ANALYSIS OF RAIL SYSTEMS DYNAMICS

DYNALIST, a computer program that extracts complex eigenvalues and eigenvectors for dynamic systems described in terms of matrix equations of motion, has been acquired and made operational at TSC. In this report, simple dynamic systems are used to define the DYNALIST terminology. Input parameters required to model a rail vehicle are described. Preparation of a card deck to run the program is detailed. The program output is examined in terms of an application to a hunting analysis of a rail vehicle.

Perlman, AB Lanza, JJ
Department of Transportation, (DOT-TSC-FRA-74-2) Intrm Rpt FRA-ORD&D-75-2, Aug. 1974, 46 pp, 5 Fig., 9 Tab., 4 Ref.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-235 361/AS, DOTL NTIS

17 071940
A COMPUTER PROGRAM FOR ESTIMATING COSTS OF TUNNELING (COSTUN)

A computer performs all logic and computations customarily done by hand in preparation of engineer's estimates or contractor's bid on tunnel-shaft systems. The program described is based on construction methods, work forces and equipment selections corresponding to the current state-of-the-art of tunnelling. The program contains logic to permit the estimate of costs of complicated tunnel-shaft systems. In any estimate, the program will accommodate a large number of values or changes in the values of the factors that affect costs, such as tunnel shape and size, shaft depth, ground characteristics, and construction method. To provide great flexibility, the user of the program is provided with the option of selecting lining type and thickness, profit and overhead margins, and other input data. Suggestions for selecting an appropriate value for these inputs are contained in the report. Portions of this document are not fully legible.

Wheby, FT Cikanek, EM
Harza Engineering Company Final Rpt. FRA-ORD/D-74-16, Oct. 1973, 566 pp

Contract DOT-FR-20007

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-228740/7, DOTL NTIS

17 193773
LOCOMOTIVE DATA ACQUISITION PACKAGE. PHASE I, FINAL REPORT, OCTOBER 1977-JULY 1978

A preliminary examination of the problems associated with railroad locomotive data acquisition is presented. An approach toward the design of a microprocessor-based locomotive data recorder is also presented. Special attention is placed on determining the functional characteristics and environmental specifications required for the system. The system described consists of a magnetic tape digital data recorder, an ensemble of transducers, and analysis software. The system described is to be used as a research tool.

Kirsten, FA Abbott, RK Mullen, DR Turner, DB
California University, Berkeley, Department of Energy Sept. 1978, 122 p.

Contract W-7405-ENG-48. FRA/ORD-78/68

ACKNOWLEDGMENT: Energy Research Abstracts, NTIS
ORDER FROM: NTIS
LBL-7945

17 304797
INTERMODAL MANAGEMENT INFORMATION SYSTEM (IMIS). PHASE III, TASK 1: BASELINE SPECIFICATION

The document presents the system design of the IMIS. To assist the potential user in assessing system capabilities, it describes what the system will do and what a user must provide. The document is also a tool for the application analyst/programmer to use in developing detailed specifications and computer programs. A top-down design was accomplished, utilizing structured design techniques to describe the system in terms of its logical functional components. The system is modular and includes those functions considered critical to effective management and control of intermodal activities. It is a composite of three systems which can be used together or individually. These are (1) an intermodal equipment control system, (2) a repetitive waybilling and rating system, and (3) a profit analysis system. Each system functions independently of the others and may be used to interface with relevant information systems that already exist or are planned for the railroad. A major system objective is to supply a foundation or baseline from which the railroad may draw those features desired for its own situation. The design is constructed to permit supplemental functions to be readily incorporated by a railroad, if desired.

Prepared in cooperation with Norfolk and Western Railway Co., VA.

Peternick, J Fredrickson, V Pflugrad, A Rynders, B Dillenback, D
PRC Systems Sciences Company, Federal Railroad Administration Final Rpt. FRA/ORD-79/21, PRC/SCC-C02936, Sept. 1979, 267 p.

Contract DOT-FR-741-5157

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB80-107022, DOTL NTIS

17 319051
EVALUATION AND SUMMARY REPORT--INTERMODAL MANAGEMENT INFORMATION SYSTEM

An executive summary, that includes project history, scope, objectives and approach, and project conclusions/findings/recommendations of the FRA/PRC development of an Intermodal Management Information System. (Prior reports-IMIS-State-of-the-Art Survey, April 1978/IMIS-Phase II, Task 2, Interim Report, April 1978/IMIS-Baseline Specification, Phase II, Task 1, September 1979). Also lists IMIS products available from the FRA. Post-Audit Evaluation of the four month demonstration of the IMIS on the Norfolk & Western Railway, outlining the performance of the Intermodal Equipment Control Systems (IMECS), Repetitive Waybilling and Rating System (RWRS), and the Profitability Analysis System (PAS). Includes performance evaluaton of system initialization, implementation, maintenance, accountability, and hardware/software.

Peternick, J Pflugrad, A Holland, R Bergman, D
PRC Information Sciences Company, Federal Railroad Administration Final Rpt. FRA/ORD-80/26, Dec. 1979, v.p., 4 Fig.

Contract DOT-FR-741-5157

ORDER FROM: NTIS
PB80-158686, DOTL NTIS, DOTL RP

18 091314
COST/BENEFIT ANALYSIS OF HEAD SHIELDS FOR 112A/114A SERIES TANK CARS
A cost/benefit analysis of head shields installed on new and existing 112A/114A series pressure tank cars was performed based on a redistribution of accident dollar losses. Head shields are designed to prevent puncture of a tank car head during an accident with resulting loss of lading and possibly extensive fire damage. The design of the head shields and data for the analysis were obtained from Railway Progress Institute (RPI)-Association of American Railroads (AAR) cooperative research program reports. The RPI/AAR considered accident data for the years 1965-1970 and assigned accident dollar losses during that period according to the tank element that failed. Supporting evidence is presented indicating that dollar losses are strongly related to puncture distribution for a more extensive set of data including all classes of tank cars.

Study sponsored by the U.S. Department of Transportation, Federal Railroad Administration, Washington, D.C.

Adams, DE Bullerdiek, WA Pattern, JS Vassalo, FA
Calspan Corporation, Federal Railroad Administration, (CALSPAN-ZL-5226-D-1) Final Rpt. FRA-OR&D 75-34, Mar. 1974, 15 pp

Contract DOT-FR-20069

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-241298/9ST, DOTL NTIS

18 129261
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. METHODOLOGY FOR A COMPREHENSIVE STUDY OF TRUCK ECONOMICS
As a part of the Federal Railroad Administration's Truck Design Optimization Project (TDOP) a determination of the economics associated with particular freight car truck designs is needed. Although TDOP centers around the development of performance and testing specifications for rail freight car trucks the metnodology for evaluating the economic benefits to be derived from efficient truck designs is not at hand. Accordingly, it has been necessary to develop a systematic approach to identifying the cost elements associated with truck ownership. A methodology is proposed for developing the necessary truck economic data first through a pilot study and subsequently through the collection and verification of the data from a wide base of sources. A subsequent report is to outline the findings of this research.

Sponsorship was from Federal Railroad Administration, DOT.

April, D
Southern Pacific Transportation Company, (TDOP 75-1) Tech Rpt. FRA-OR&D 75-58, TDOP-75-1, Apr. 1975, 27 pp, 2 App.

Contract DOT FR-40023

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-248832/8ST, DOTL NTIS

18 131621
FREIGHT CAR TRUCK OPTIMIZATION: TRUCK ECONOMIC DATA COLLECTION AND ANALYSIS
A first interim report covering the development of the TDOP economic methodology was published by the Federal Railroad Administration in April 1975. It contains the truck investment economic evaluation procedures intended for the use of the railroad industry and their suppliers. The primary objective of the Truck Economic Data Collection and Analysis Program is to test the procedures for establishing the significant actual operating costs of existing Type I general purpose trucks. This second interim report covers the progress of the program. A generalized truck cost information system was designed for the collection and integration of truck economic data. The collection of test data for off-line truck maintenance costs was completed. Test data collection was initiated for on-line truck maintenance and other associated costs and operating conditions. Preparatory work was begun to develop the appropriate data analysis guidelines. A preliminary analysis of some of the test data clearly revealed the truck's reported off-line wear and failure cost performance. Railroad companies and their suppliers are encouraged to consider adopting the tested procedures of the TDOP economic methodology. A progressive implementation of this methodology will provide them with the timely opportunity to develop a truck economic evaluation capability of their own.

Sponsored by the Federal Railroad Administration.

April, D
Southern Pacific Transportation Company, Federal Railroad Administration, (TDOP 75-2) Tech Rpt. FRA-OR&D 75-58A, Mar. 1976, 86 pp

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-251400/AS, DOTL NTIS

18 132973
ECONOMIC FACTORS INFLUENCING THE DECISION TO USE JUMBO RAIL CARS
For over 40 years engineers have concluded that very heavy axle loading lends to a disportionate degree of track wear. Economists see the important question being why management continues to purchase and use jumbo cars in the face of very pervasive evidence provided by engineers. Management lives in a world of demand functions, cost functions, accounting principles and regulation. Decision making in this maze of variables, constraints and uncertainties must be made on the basis of the best information at its disposal and given the nature of railroading. ICC costing and regulatory restraints have encouraged large cars. Economics of scale seem to justify large cars. Long term economic costs, including those associated with track deterioration, may paradoxically be the wrong basis for rate making. Inability to compete in the short run may make the long run irrelevant. Short run profit maximization may be maximum use of assets.

Proceedings of the 12th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958,

Selzer, LJ
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 130-132

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

18 144089
FREIGHT CAR TRUCK DESIGN OPTIMIZATION. ECONOMIC ANALYSIS REPORT--PHASE I
This report summarizes the truck economic research accomplished during Phase I of the Federal Railroad Administration's three-phase Truck Design Optimization Project (TDOP). In this phase: A truck economic methodology was developed with the cooperation of representatives from the railroad industry and their suppliers. The methodology is for industry use to help establish the cost performance of the individual railroads' existing trucks and evaluate investments in proposed truck improvements. The economic data elements were identified and procedures were developed at various levels of specification to collect the information. An overall truck cost information system was designed. The system will provide a user with the processing capability to establish the integrated truck economic data base and present the data for evaluation. Economic data analysis guidelines was developed to establish and evaluate the cash flows of investments in proposed improvements to existing trucks. The approach to evaluating the operating cost performance of existing trucks through the exploitation of the economic data base was developed. The report recommends that the railroad industry adapt the TDOP methodology developed thus far to their individual company environments and begin to establish working procedures for the economic selection of existing trucks and proposed improved truck designs. Suggested further economic research is also identified.

See also: FRA-OR&D-75-58, April 1975 (NTIS Accession Number PB-248832) Methodology for a Comprehensive Study of Truck Economics, and FRA-OR&D-75-58A, February 1976 (NTIS Accession Number PB-251400) Truck Economic Data Collection and Analysis.

Southern Pacific Transportation Company, (TDOP 76-3) Tech. Rpt. FRA/ORD-76/287.I, July 1976, 6 pp, 1 Fig., 6 Tab., 2 App.

Contract DOT-FR-40023

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-259366, DOTL NTIS

18 182113
SYSTEMS ENGINEERING FOR INTERMODAL FREIGHT SYSTEMS. PHASE I. EXPLORATORY PLANNING. VOLUME IV. TASK RESULTS

Volume IV documents analysis of current intermodal system and equipment characteristics; identification of institutional, regulatory, and operational constraints to intermodal freight service; discussion of problems and opportunities; and identification of appropriate goals and objectives for an improved intermodal system; development of an evaluation methodology to compare alternative systems: selection of appropriate evaluation factors and criteria, and recommendation of relative weights to be assigned to each evaluation factor and criteria; identification of improved and innovative technological components for intermodal freight movement, technological assessment of each component, synthesis of components into subsystems (pick-up and delivery, terminal, and line-haul), analysis at the subsystem level, and development of technologically compatible systems; and, final evaluation of alternative technological systems with respect to economics, service, operational impact, technological considerations, and social implications.

Prepared in cooperation with Battelle Columbus Labs., OH., Banks (R. L.) and Associates, Inc., Washington, DC. and Boeing Computer Services, Inc., Arlington, VA. See also PB-282370 and PB-286036.

Hill, D Leilich, R Elliff, A Morice, W Edsforth, J
Peat, Marwick, Mitchell and Company, Battelle Columbus Laboratories, Banks (RL) and Associates, Incorporated, Boeing Computer Services Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-78/24.IV, 289-53177-VOL-4, July 1978, 468 p.

Contract DOT-FR-749-4273

ACKNOWLEDGMENT: NTIS
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PB-286035/1ST, DOTL NTIS

18 182114
SYSTEMS ENGINEERING FOR INTERMODAL FREIGHT SYSTEMS. PHASE I. EXPLORATORY PLANNING. VOLUME V. TASK RESULTS: APPENDICES

Appendix A documents the Intermodal Cost Calculator, which is the model used to perform the economic evaluation. Appendix B documents the technological assessment of component alternatives analyzed by the study team. Appendix C lists the parameters describing each technological alternative in terms of cost, performance, and other factors. Appendix D documents the formulae used in the life cycle cost model developed by the study team to calculate cost of ownership and terminal tie/untie costs. Appendix E presents the input data values and detailed results of the economic evaluation.

Prepared in cooperation with Boeing Computer Services, Arlington, VA. Battelle Columbus Labs., OH. and Banks (R. L.) and Associates, Inc., Washington, DC. See also PB-286035.

Hill, D Leilich, R Elliff, A Morice, W Edsforth, J
Peat, Marwick, Mitchell and Company, Boeing Computer Services Incorporated, Battelle Columbus Laboratories, Banks (RL) and Associates, Incorporated, Federal Railroad Administration Final Rpt. FRA/ORD-78/24.V, 289-53177-VOL-5, July 1978, 272 p.

Contract DOT-FR-749-4273

ACKNOWLEDGMENT: NTIS
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PB-286036/9ST, DOTL NTIS

21 093563
OPERATION OF HIGH SPEED PASSENGER TRAINS IN RAIL FREIGHT CORRIDORS

A preliminary examination of the problems associated with mixed-traffic operations-conventional freight and high speed passenger trains-is presented. Approaches based upon a modest upgrading of existing signal systems are described. Potential costs to the operating railroads, impact on railroad efficiency, and safety of passengers and train crews are considered. Special attention is given to analysis of stopping distance for various conditions and rolling stock. Basic conclusions are that speeds above 125 MPH are likely to require substantial signal system modification and that freight service capacity will be severely degraded by large numbers of HSPT's; further analysis is required to determine well-founded control-system guidelines.

Abbott, RK
Transportation Systems Center, Federal Railroad Administration Final Rpt. DOT-TSC-FHA-75-14, FRA/ORD-76-07, Sept. 1975, 82 pp

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-247055/7ST, DOTL/NTIS

21 127705
RAILROAD CLASSIFICATION YARD TECHNOLOGY: AN INTRODUCTORY ANALYSIS OF FUNCTIONS AND OPERATIONS

A review of the basic operating characteristics and functions of railroad classification yards is presented. Introductory descriptions of terms, concepts, and problems of railroad operations involving classification yards are included in an attempt to provide a "primer" on railroad yards. The report describes certain railroad operating practices and identifies problems that inhibit the efficient operation of railroad yards and the rail system of which they are a part. An extensive bibliography has been provided.

This project was sponsored by Federal Railroad Administration, DOT.

Troup, KF, III
Transportation Systems Center, (DOT-TSC-FRA-75-19) Final Rpt. FRA-OR&D-75-55, May 1975, 134 pp, 12 Fig., 3 Tab., 1 App.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS, REpr. PC, Microfiche
PB-246724/9ST, DOTL NTIS

21 151748
RAILROAD CLASSIFICATION YARD TECHNOLOGY. A SURVEY AND ASSESSMENT

This report documents a survey and assessment of the current state of the art in rail freight-car classification yard technology. The major objective was the identification of research and development necessary for technological improvements in railroad classification yards. This involved a projection of future classification yard needs and a comparison of these requirements of existing technology. Separate tasks included a description of the hardware, costs, performance characteristics, and operational practices of existing yards; formulation of general yard-network interaction concepts; collection of in-depth background information concerning the yard population in the United States (categorized by type, technology, and function); estimation of the demands likely to be placed on the nation's network of freight-car terminals during the foreseeable future; and an assessment and prioritization of those areas of terminal operations that warrant further research or development.

See also RRIS 21 127705.

Petracek, SJ Moon, AE Kiang, RL Siddigee, MW
Stanford Research Institute, Transportation Systems Center, Federal Railroad Administration, (SRI-3983) Final Rpt. DOT-TSC-FRA-76-35, Jan. 1977, 343 pp. FRA/ORD-76/304

Contract DOT-TSC-968

ACKNOWLEDGMENT: NTIS
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PB-264051/4ST, DOTL NTIS

21 178212
SYSTEMS ENGINEERING FOR INTERMODAL FREIGHT SYSTEMS--PHASE I, EXPLORATORY PLANNING VOLUME I--EXECUTIVE SUMMARIES

An overview of the findings of the initial phase of the Federal Railroad Administration's (FRA) Intermodal Systems Engineering Program is presented. The work reported presents one segment of FRA sponsored research and development directed to the improvement and viability of rail freight service. Phase I, Exploratory Planning, Systems Engineering for Intermodal Freight Systems, briefly stated, included: (1) characterization of present intermodal equipment and operations; (2) identification of problems or opportunities where technology could be utilized to improve service, efficiency and return on investment; (3) identification of improved equipment, subsystem, facility concepts having potential future application; (4) synthesis of alternate systems comprised of improved equipment in various combinations, (5) development of a methodology for assessment of the relative merit of system alternatives in quantitative terms under various operating scenarios; and (6) evaluation of synthesized systems and identification of most promising alternatives. The work reported was performed by two contractor teams working independently, each using slightly different approaches. Each contractor interacted with intermodal committees of the Association of American Railroads, the Transportation Research Board, and the National Industrial Traffic League. The findings from Phase I will be used in a more in-depth examination of the most promising alternatives during Phase II, Development Planning.

Kearney (AT) and Company Incorporated, Peat, Marwick, Mitchell and Company, Federal Railroad Administration Final Rpt. FRA/ORD-78/24.I, Apr. 1978, 77 pp

Contract DOT-FR-748-4336

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-282370/AS, DOTL NTIS, DOTL RP

21 192213
SYSTEMS ENGINEERING FOR INTERMODAL FREIGHT SYSTEMS. PHASE I, EXPLORATORY PLANNING. VOLUME II. TASK RESULTS

Volume II is a documentation of current intermodal system and equipment characteristics; identification of institutional, regulatory, and operational constraints to intermodal freight service; discussion of problems and opportunities; and identification of appropriate goals and objectives for an improved intermodal system; development of an evaluation methodology to compare alternative systems; selection of appropriate evaluation factors and criteria; identification of improved and innovative technological components for intermodal freight movement, technological assessment of each component, synthesis of components into subsystems (pick-up and delivery, terminal, and line-haul), analysis at the subsystems level, and development of technologically compatible systems; and final evaluation of alternative technological systems with respect to economics, service, operational impact, technological considerations and social implications.

See also Volume 1, PB-282 370. Prepared in cooperation with Whitten (Herbert O.) and Associates, Washington, DC., and General Motors Technical Center, Warren, MI. GM Transportation Systems Div.

Kearney (AT) and Company, Incorporated, Whitten (Herbert O) and Associates, General Motors Technical Center, Federal Railroad Administration Final Rpt. FRA/ORD-78/24.II, Aug. 1978, 822 p.

Contract DOT-FR-748-4336

ACKNOWLEDGMENT: NTIS
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PB-297395/6ST, DOTL NTIS

21 196982
SYSTEMS ENGINEERING FOR INTERMODAL FREIGHT SYSTEMS. PHASE I-EXPLORATORY PLANNING--VOLUME III-TASK RESULTS; APPENDICES

One of five reports documenting the results of a study entitled "Systems Engineering for Intermodal Freight Systems-Phase I, Exploratory Planning" sponsored by the Federal Railroad Administration. Volume III is comprised of three sections which constitute a statistical appendix to the Study Team's Phase I analysis report. The sections contain the detailed computer listings for all computer simulations of alternatives to the present intermodal system which were carried out as a part of the task entitled: Evaluation, Selection, and Recommendation of Alternatives. Part 1 contains those listings which deal with the analysis of trailer terminal alternatives, Part 2 with container terminal alternatives and Part 3 with line-haul and pickup/delivery alternatives. Each part is indexed on the rear cover of this volume.

Nyquist Heuer Kluk Markham Kloss DeClaire Hood Britt L-ipman
Kearney (AT) and Company, Incorporated, Federal Railroad Administration, Whitten (Herbert O) and Associates, General Motors Corporation Final Rpt. FRA/ORD-78.24. III, Aug. 1978, 1510 p., Figs., Tabs.

Contract DOT-FR-748-4336

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PB-297395/AS, DOTL NTIS

21 314441
RAILROAD CLASSIFICATION YARD TECHNOLOGY. DESIGN METHODOLOGY STUDY
The report documents the first phase of a three-phase effort to develop a railroad classification yard design methodology. Topics discussed include: site selection, hump grade profile design, sub-yard capacity requirements, trim-end conflict resolution, yard geometry and layout, yard hardware systems, and yard computer systems.

Wong, PJ Elliott, CV Kiang, RL Sakasita, M Stock, WA
SRI International, Transportation Systems Center, Federal Railroad Administration, (SRI-6364) Intrm Rpt. FRA/ORD-78/67, Sept. 1978, 50p

Contract DOT-TSC-1337

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-190481, DOTL NTIS

21 326368
INTERMODAL FREIGHT PROGRAM-PHASE II, DEMONSTRATION MANAGEMENT
The Intermodal Freight Program was established to develop and demonstrate profitable improved rail intermodal service (the movement of highway trailers and/or containers on rail flatcars). Emphasis was placed on developing the use of multiple frequency dedicated trains in intermediate distance markets (200-600 miles) dominated by trucks. Railroads operating demonstrations approved under the program were eligible for federal assistance covering 40 to 60 percent of operating losses during periods required to attain profitability. From June, 1978, through May, 1980, the Milwaukee Road operated a demonstration between Chicago and the Twin Cities (Minneapolis/St. Paul). The demonstration involved four dedicated intermodal trains each way each weekday in the corridor. Labor cooperation produced improved productivity in the service and improved capital utilization was attained through rapid equipment turns. A highly reliable service was developed. Milwaukee intermodal traffic in the corridor doubled from predemonstration levels with the additional business being attracted primarily from the highway. Profitability was attained during peak volume periods and possibilities for profit enhancement were identified. The experience gained during the demonstration should be of value to carriers considering similar services.

Yardley, CF
Association of American Railroads, Federal Railroad Administration Final Rpt. FRA/ORD-80/69, July 1980, 131p, 17 Fig., 12 Tab., 5 App.

Contract DOT-FR-708-5169

ACKNOWLEDGMENT: NTIS
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PB81-106510, DOTL NTIS, DOTL RP

23 056898
HSB: STUDY OF A HIGH SPEED INTERCITY SURFACE TRANSPORTATION SYSTEM FOR GERMANY. VOLUME I. SYSTEM ANALYSIS AND RESULTS
Volume one of a six volume study of rapid intercity ground transportation planning in West Germany presents a general systems analysis survey involving transit models, operations management, structural designs, tariffs, and cost engineering.

Technical trans. of Hochleistungs-Schnellbahn Studiengesellschaft mbH, Ottobrunn. Report (West Germany). Paper copy also available from NTIS PB-230 457-T-SET.

Neuber, HD Pennekamp, A Rothermel, VH
Federal Railroad Administration Rpt FRA-ORD/D-74-26A, 1972, 140p

ACKNOWLEDGMENT: NTIS (PB-230458-T)
ORDER FROM: NTIS, Repr PC, Microfiche
PB-230458-T, DOTL NTIS

23 056899
HSB: STUDY OF A HIGH SPEED INTERCITY SURFACE TRANSPORTATION SYSTEM FOR GERMANY. VOLUME II. ATTACHMENTS 1-6
Volume two of a six volume study of high speed interurban rail transportation in West Germany discusses operational modes, traveling behavior of trains, line capacities, schedule modeling, mathematical analysis of transport assignment problems, and computer aided management.

Technical trans. of Hochleistungs-Schnellbahn Studiengesellschaft mbH, Ottobrunn. Report (West Germany). Paper copy also available from NTIS PB-230 457-T-SET.

Neuber, HD Pennekamp, A Rothermel, VH
Federal Railroad Administration Rpt FRA-ORD/D-74-26B, 1972, 194p

ACKNOWLEDGMENT: NTIS (PB-230459-T)
ORDER FROM: NTIS, Repr PC, Microfiche
PB-230459-T, DOTL NTIS

23 056900
HSB: STUDY OF HIGH SPEED INTERCITY SURFACE TRANSPORTATION SYSTEM FOR GERMANY. VOLUME III. ATTACHMENT 7
Volume three of a six volume study of rapid transit planning for West German intercity rail systems deals with wheel rail interactions, passenger comfort, magnetic carrying and guidance or suspension systems, pneumatic supporting and guidance systems, dynamics of air cushion suspensions, gas turbines, diesel motors, power transmission, electrical energy supply and transmission, rotating electrical drives, brakes, and aerodynamic propulsion.

Technical trans. of Hochleistungs-Schnellbahn Studiengesellschaft mbH, Ottobrunn. Report (West Germany). Paper copy also available from NTIS PB-230 457-T-SET.

Neuber, HD Pennekamp, A Rothermel, VH
Federal Railroad Administration Rpt FRA-ORD/D-74-26C, 1972, 436p

ACKNOWLEDGMENT: NTIS (PB-230460-T)
ORDER FROM: NTIS, Repr PC, Microfiche
PB-230460-T, DOTL NTIS

23 056901
HSB: STUDY OF A HIGH SPEED INTERCITY SURFACE TRANSPORTATION SYSTEM FOR GERMANY. VOLUME IV. ATTACHMENTS 8-13
The fourth volume in a six volume series on West German high speed ground transportation planning for intercity service contains materials on station design, both motor vehicle and rail, track elements, structures such as bridges and tunnels, information systems, and maintenance methods and concepts.

Technical trans. of Hochleistungs-Schnellbahn Studiengesellschaft mbH, Ottobrunn. Report (West Germany). Paper copy also available from NTIS PB-230 457-T-SET.

Neuber, HD Pennekamp, A Rothermel, VH
Federal Railroad Administration Rpt FRA-ORD/D-74-26D, 1972, 170p

ACKNOWLEDGMENT: NTIS (PB-230461-T)
ORDER FROM: NTIS, Repr PC, Microfiche
PB-230461-T, DOTL NTIS

23 071937
NORTHEAST CORRIDOR TRAVEL SURVEY, 1968-1971
The Northeast Corridor Travel Survey was conducted by the U.S. Census Bureau for the Federal Railroad Administration to determine the impact of High Speed Rail Demonstration Projects operated between Washington-New York and New York-Boston. This report publishes data from the Survey on travel by members of households residing in the Northeast Corridor for the years 1968-1971. Profiles and indices were prepared which compare person-trip information within the Northcast Corridor. Specific travel markets within the Corridor were analyzed for growth trends and shifts resulting from the improved high speed rail transportation. Data are summarized, analyzed, and displayed in appropriate tables within this report.

Whitten, HO
Whitten (Herbert O) and Associates, (DOT-TS-FRA-73-14) Final Rpt. FRA-ORD/D-74-31, Jan. 1974, 234 pp

Contract DOT-TSC-725

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-229668/9, DOTL NTIS

23 148587
PERFORMANCE MODEL OF INTERCITY GROUND PASSENGER TRANSPORTATION SYSTEMS
A preliminary examination of the problems associated with mixed-traffic operations-conventional freight and high speed passenger trains-is presented. Approaches based upon a modest upgrading of existing signal systems are described. Potential costs to the operating railroads, impact on railroad efficiency, and safety of passengers and train crews are considered. Special attention is given to analysis of stopping distance for various conditions and rolling stock. Basic conclusions are that speeds above 125 mph are likely to require substantial signal system modification and that freight service capacity will be severely degraded by large numbers of HSPT's; further analysis is required to determine well-founded control-system guidelines.

Research was sponsored by the Federal Railroad Administration, DOT.

Shladover, SE
Transportation Systems Center, (DOT-TSC-FRA-75-13) Final Rpt. FRA-OR&D-76-08, Aug. 1975, 134 pp

ACKNOWLEDGMENT: FRA
ORDER FROM: FRA/ORD

23 148591
PERFORMANCE ANALYSES OF INTERCITY GROUND PASSENGER TRANSPORTATION SYSTEMS
This report documents the development of analytical techniques and their use for investigating the performance of intercity ground passenger transportation systems. The purpose of the study is twofold: (1) to provide a capability of evaluating new passenger train systems and (2) to provide information that assists in the formulation of development policies for new systems, thus, investigations evaluate the physical performance (average velocity, system capacity, mode split) of train systems with various design characteristics operating in a range of application conditions. Based on these analyses, conclusions are made regarding the potential performance effectivenss of train systems. The analyses cover design cruise speed, acceleration and braking rates, train length, seat density and lateral acceleration limits. Application characteristics considered include station spacing, dwell time, curve length, spacing and speed, switch concepts and train control strategies.

The Federal Railroad Administration, DOT, sponsored this research.

Hitz, JS
Transportation Systems Center, (DOT-TSC-FRA-75-25) Final Rpt. FRA-OR&D-76-248, Apr. 1976, 192 pp

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-262925/1ST, DOTL NTIS

23 178942
IMPROVED PASSENGER SERVICE FOR THREE CORRIDORS
The study identifies and estimates the cost of right-of-way facility improvements necessary to provide for improved passenger trains operating at maximum speeds of 120-150 mph in three transportation corridors; Chicago-Detroit, Portland-Seattle, and Los Angeles-San Diego. An examination was made of the existing track condition and alignment, curve elevations and spiral lengths, bridge conditions and fencing requirements for safety, in order to identify the necessary system changes necessary to permit a high speed rail operation. A train interference analysis indicated facility modifications were required to relieve the congestion caused by the improved passenger service at specified frequencies. In the Chicago-Detroit Corridor the total cost of modifications is $64 million; in the Portland-Seattle Corridor the total cost of modifications is about $27 million; and in the Los Angeles-San Diego Corridor the total cost of modifications is $26 million.

Pan-Technology Consulting Corporation Final Rpt. FRA-ORD/D-74-4, Apr. 1973, 56 pp, 13 Fig.

Contract DOT-FR-20080

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS

PB-227070/0, DOTL NTIS

23 308721
IMPROVED PASSENGER SERVICE FOR THE NORTHEAST CORRIDOR
The study evaluates the costs of additional improvements of the current northeast corridor (Boston to Washington) metroliner service, employing improved facilities on existing rights-of-way and improved passenger equipment capable of maximum speeds of 150 mph. An examination was made of the existing track condition and alignment, curve elevations and spiral lengths, bridge conditions, and fencing requirements for safety, in order to identify the necessary system changes necessary to permit a high speed operation. The costs of these modifications were estimated to be about $300 million. A train interference analysis indicated that an investment of approximately $90 million is needed to relieve the congestion caused by the improved passenger service at the specified frequencies. In addition, about $160 million is required to improve stations, yards, maintenance shops and traction power systems.

Pan-Technology Consulting Corporation Final Rpt. FRA/ORD/D-74-3, Apr. 1973, 84 p.

Contract DOT-FR-20080

ACKNOWLEDGMENT: NTIS
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PB-227069/2, DOTL NTIS

24 071965
AN ANALYSIS OF THE JOB OF RAILROAD TRAIN DISPATCHER
The report constitutes a detailed study of the job of railroad train dispatcher, conducted to provide a data base for the derivation of job knowledge, skills and training consonant with safe operations. Documentation was reviewed: specialists were consulted, and selected dispatching operations were observed in detail. The report describes the responsibilities and duties of train dispatchers, their workplaces and job aids, the principal functions they perform, and the records they must maintain. Special characteristics of the job, such as workload, stress, inadequacies in aids, and trends toward improvements are discussed, and estimates are made of the physical and psychological attributes, job knowledge and skills basic to safe operations and possible approaches to assurance of safety through selection, placement and training.

Devoe, DV
Transportation Systems Center, (DOT- TSC- FRA-73-13) Final Rpt. FRA-OR&D-74-37, Apr. 1974, 263 pp

ACKNOWLEDGMENT: FRA (PB-233 597/4)
ORDER FROM: NTIS, Repr. PC, Microfiche
PB-233 597/4, DOTL NTIS

24 132970
ORE ORGANIZATION AND ITS STUDIES IN TRACK, SUSPENSION AND TRACK/TRAIN INTERFACE
The procedures and facilities utilized by the office for Research and Experiments of the International Union of Railways are described. The studies on conventional and on concrete slab track are described. The investigations of train/track interraction and of derailments are then discussed, as well as axle loading as a function of speed and wheel diameter. It is concluded that in Europe the ballasted conventional track is nearly optimized and much study is being made of concrete slab track. Studies of car suspension systems have only involved two-axle cars. Recommendations on improving the riding stability and quidance of locomotives have been formulated and of maximum loadings for axles and bridges are being progressed.

Proceedings of the 12 th Annual Railroad Engineering Conference held at Pueblo, Colorado, October 23-24, 1975. The complete volume is RRIS 02 132958.

Schrotberger, K (International Union of Railways)
Federal Railroad Administration FRA OR&D 76-243, Oct. 1975, pp 93-102, 17 Fig.

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-252968/AS, DOTL NTIS, DOTL RP

24 163785
13TH ANNUAL RAILROAD ENGINEERING CONFERENCE PROCEEDINGS: "RAILROAD CHALLENGES IN AMERICS'S THIRD CENTURY--IMPROVED RELIABILITY AND SAFETY"
This report constitutes the proceedings of a two-day railroad engineering conference held at Pueblo, Colorado on October 12 and 13, 1976. The conference theme was the reliability and safety aspects of railroad operations. Technical papers were presented during three sessions relating to the following topics: operations/crew, track maintenance, and train and equipment. A visit to the DOT's Transportation Test Center was included in the conference program for the observation of test operations at the newly completed Facility for Accelerated Service Testing (FAST).

Conference and report sponsored by the FRA/U.S. DOT, Office of Research and Development.

Federal Railroad Administration Proceeding FRA/ORD-77/13, July 1977, 152 pp

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS
PB-272948/AS, DOTL NTIS

24 163789
PUTTING RESEARCH TO WORK FOR A SAFER RAILROAD
The organization and utilization of a systemwide Track Train Dynamics Program by Southern Pacific Transportation Company is described. Interdepartmental committees on System and Division levels are carrying out the objectives of SP's TTD application program. The general goal is safe, efficient and economical train operation by reduction of derailments and of component failures in equipment, track and lading to improve reliability for shippers and greater net profit.

Presented at the 13th Annual Railroad Engineering Conference, Pueblo, Colorado, October 12-13, 1976, and included in the Conference proceedings, "Railroading Challenges in America's Third Century--Improved Reliability and Safety," sponsored by the FRA's Office of Research and Development, U.S. DOT.

Lind, EF (Southern Pacific Transportation Company)
Federal Railroad Administration Conf Paper FRA/ORD-77/13, July 1977, pp 24-32

ACKNOWLEDGMENT: FRA
ORDER FROM: NTIS
PB-272948/AS, DOTL, NTIS

24 181428
PROCEEDINGS OF THE ANNUAL RAILROAD ENGINEERING CONFERENCE (14TH). R AND D RAILROADING: 1977. HELD AT THE UNIVERSITY OF SOUTHERN COLORADO, PUEBLO, COLORADO ON OCTOBER 18-20, 1977
This report constitutes the proceedings of the three day railroad engineering conference held at the University of Southern Colorado on October 18-20, 1977. Conference papers were presented from the Federal Railroad Administration, Office of Research and Development, the railroad industry, and the Association of American Railroads. Generally, the papers covered a review of the R&D activities in the railroad industry during 1977. A tour of the Transportation Test Center Facilities was also included.

Federal Railroad Administration FRA/ORD-78/42, Mar. 1978, 416 p.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS
PB-283785/4ST, DOTL NTIS

24 188686
TEST TRAIN PROGRAM NINTH PROGRESS REPORT
This report describes progress on the Engineering and Test Support Services for Railroad Instrumentation, Data Acquisition, Processing and Evaluation Program from 1 July 1976 through 30 June 1977. The report covers operation of the FRA track geometry measurement and data acquistion fleet, track survey operations and vehicle dynamic tests on lightweight flat cars, DOD cars, passenger cars and locomotives. Also, the report describes test activities on the Facility for Accelerated Service Testing, aerodynamic validation, track structures, vehicle vibration and ride quality, trailer-on-a-flat-car combinations; and investigations of the automated wayside inspection station concept.

Prepared for U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington, D.C. This report is intended for use by management and technical personnel concerned with accomplishments in railroad engineering.

ENSCO, Incorporated FRA/ORD-78/23, DOT-FR-78-06, Oct. 1977, 110 p., 37 Fig., 3 Tab., 2 App.

Contract DOT-FR-64113

ACKNOWLEDGMENT: FRA
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PB-289690/AS, DOTL NTIS, DOTL RP

24 319054
15TH RAILROAD ENGINEERING CONFERENCE PROCEEDINGS, RAILROAD R&D CHALLENGES OF THE 80'S: OPPORTUNITIES & OBSTACLES

This report constitutes the proceedings of the 15th Railroad Engineering Conference held at TSC on October 21-23, 1979. Conference papers were delivered by various industry and Government officials and centered on three topic areas: The Status of the Northeast Corridor Improvement Project and Passenger R&D; An Overview of Freight Technology Advancements, Obstacles, and Future Opportunities; and Major R&D Opportunities of the 80's. A tour of the Santa Fe-San-Vel concrete crosstie plant in Littleton, Massachusetts, was included as part of the conference program.

Transportation Systems Center, Federal Railroad Administration Proceeding FRA/ORD-80/35, DOT-TSC-FRA-80-10, June 1980, 128 p., Figs., Tabs., Refs.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS

PB80-205206, DOTL NTIS, DOTL RP

25 050140
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965
The report accounts for High Speed Ground Transportation activities and covers the period ending 30 September 1972. Previous reports of the former Office of High Speed Ground Transportation have served as a source book on the HSGT Program for Congressional Committees, other DOT organizations, prospective contractors, academicians, and others wanting to know about HSGT program content, accomplishments, or future direction. HSGT activities are now a portion of the work of the Office of Research, Development, and Demonstrations in the reorganized Federal Railroad Administration. This Sixth Report will serve the same purpose as previous reports and reflect the more recent emphasis of the activities at the High Speed Ground Test Center in Colorado, expanding hardware development programs, and maturing demonstration programs.

See also Annual rept. no. 5, PB-212 694.

Federal Railroad Administration Ann Rpt No. 6, FRA-ORD/D-74-8, Sept. 1972, 145 pp

ACKNOWLEDGMENT: NTIS (PB-222261/0)
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PB-222261/0, DOTL NTIS

25 093609
REPORT ON THE RAILROAD TECHNOLOGY PROGRAM (8TH), FEDERAL RAILROAD ADMINISTRATION 1974
The Secretary of Transportation is required to report at least annually to the President and the Congress on the activities carried out under the High Speed Ground Transportation (HSGT) Act of 1965 as amended and extended. This Eighth Report covers not only HSGT-fund research, development and demonstrations programs administered by the Office of Research, Development and Demonstration (ORD&D) of the Federal Railroad Administration (FRA) in accordance with section 10(a) of the Act, but also encompasses related work performed under appropriations for advancing railroad technology and safety.

See also report dated 1973, PB-233 064.

Federal Railroad Administration Annual Rpt FRA-ORD/D-76-127, 1974, 88 pp

ACKNOWLEDGMENT: NTIS
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PB-247206/6ST, DOTL NTIS

25 138087
NINTH REPORT ON THE RAILROAD TECHNOLOGY PROGRAM
A report on the Federal Railroad Administration's activities carried out under the High Speed Ground Transportation (HSGT) Act of 1965 as amended and extended, for the Secretary of Transportation to report annually to the President and the Congress on activities performed under the Act. This report covers the HSGT-funded research, development and demonstrations programs administered by the Office of Research and Development (OR&D) and the Transportation Test Center (TTC) of the Federal Railroad Administration (FRA) in accordance with Section 10(a) of th Act and also encompasses related work performed under appropriations for advancing railroad technology and safety including the activities of the Transportation Test Center. The report covers program activities for the period October 1, 1974, to September 30, 1975. The report is designed to serve as a source of information for those having an interest in FRA's research, development and demonstration activities. A limited number of copies are made available to Committees of Congress, other Department of Transportation (DOT) organizations, academicians, prospective contractors, industry organizations and others who have an interest in FRA's R&D results.

Federal Railroad Administration FRA-OR&D 76-245, Apr. 1976, 74 pp, 42 Fig., 1App.

ACKNOWLEDGMENT: FRA, NTIS
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PB-253197/AS, DOTL NTIS

25 157219
TENTH AND FINAL REPORT ON THE HIGH SPEED GROUND TRANSPORTATION ACT OF 1965
This is the tenth and final report to the Congress on research, development, and demonstrations activities authorized by the HSGT Act of 1965. The activities are evaluated, accomplishments described, recommendations presented, and the history of the HSGT Program consolidated into one document. More than 400 reports were produced on railroad and advanced systems since the Act was signed in 1965. Major accomplishments of the program include: (a) creation of continuing Federal R&D in railroad technology, (b) establishment of the Transportation Test Center, (c) demonstration that quality rail passenger service will be used in this country, (d) system performance and cost estimates for the Northeast Corridor multi-modal regional transportation study, (e) development of data processing of rail passenger statistics now used by Amtrak, (f) conception of Auto Train, (g) initiation of railroad track dynamics research (the first scientific investigation of track in over 30 years), (h) construction of the Rail Dynamics Laboratory, (i) Development of automated track geometry inspection, (j) advancement of linear electric motor technology, (k) expansion of knowledge of magnetic levitation, (l) analysis of the dynamics of air cushion levitation, and (m) exploration of the ram air cushion. DOT should continue to follow research on tracked levitated vehicles and other advanced technology as an option for high-density short-haul routes as future needs may develop for intercity passenger systems.

A report to the President and the Congress by the Secretary of Transportation.

Federal Railroad Administration Cong. Rpt. FRA/ORD-77/27, May 1977, 120 pp, 31 Fig., 17 Ref., 2 App.

ACKNOWLEDGMENT: FRA, NTIS
ORDER FROM: NTIS

PB-271508/AS, DOTL NTIS, DOTL RP

26 044571
RAILROAD RESEARCH BULLETIN. DEVELOPMENTAL ISSUE. AUTUMN 1973
This publication contains 1,297 abstracts of journal articles and research reports selected by RRIS from current railroad literature and 150 summaries of ongoing research activities in the railroad field. The material covers the entire range of railroading from technology to management, economics, government regulation, and operations. The material is arranged according to the RRIS classification scheme in two separate sections, one for the abstracts and one for the summaries. The book also contains subject term, author, and source indexes.

Transportation Research Board, (RRIS-7301) Bibliog. FRA-ORD&D-74-2, Sept. 1973, 374 pp, 1447 Ref.

Contract DOT-OS-00035

ORDER FROM: NTIS

PB-226784/AS, DOTL JC

26 056897
PUBLISHED RESEARCH REPORTS--FEDERAL RAILROAD ADMINISTRATION
The bibliography presents and abstracts major research reports published by the Office of Research, Development and Demonstrations (ORD and D) in the Federal Railroad Administration, U.S. Department of Transportation. Also included are selected reports of other Department of Transportation agencies that relate to ORD and D activities. These reports represent results of contracted research, development, demonstrations, systems engineering, technology assessment, transportation surveys, and mathematical model developments, along with intramural research reports and program and project summaries. The abstracts are arranged according to technical categories under Rail Technology and Advanced Systems. (Author)

Prepared by National Technical Information Service, Springfield, Va. Supersedes PB-213047.

Federal Railroad Administration Bibliog FRA-ORD/D-74-23, Oct. 1973, 103 pp

ACKNOWLEDGMENT: NTIS (PB-230007/7)
ORDER FROM: NTIS, Repr. PC, Microfiche

PB-230007/7, DOTL NTIS

26 057887
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965 AND THE RAILROAD TECHNOLOGY PROGRAM 1973
The report presents studies on rail technology, such as improved passenger and freight service, safety research, improved track, rail and vehicle dynamics. The study evaluates the Washington-New York Metroliner and the Boston-New York Turbotrain Demonstration including ridership and mileage. The report also presents research on advanced systems such as tracked levitated, magnetically levitated, and tracked air cushion vehicle systems along with supporting technology, such as propulsion, communications and control, guideways and tunneling.

See also report dated Sep 72, PB-222 261.

Federal Railroad Administration, (FRA-ORD/D-74/54) Annual Rpt No. 7, 1973, 205p

ACKNOWLEDGMENT: NTIS (PB-233064/5)
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PB-233064/5, DOTL NTIS

26 080112
RAILROAD RESEARCH BULLETIN VOLUME 1, NUMBER 1, SPRING 1974
Th publication contains 1,841 abstracts of journal articles and research reports selected by Railroad Research Information Service (RRIS) from current railroad literature and 160 summaries of ongoing research activities in the railroad field. The material covers the entire range of railroading from technology to management, economics, government regulation, and operations. The material is arranged according to the RRIS classification scheme in two separate sections, one for the abstracts and one for the summaries. The publication also contains subject term, author, and source indexes.

Transportation Research Board, (RRIS-7401) Bibliog. FRA/ORD/D-74-34, Apr. 1974, 470 pp

Contract DOT-OS-00035

ACKNOWLEDGMENT: FRA
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PB-233880/4GA, DOTL NTIS

26 080113
RAILROAD RESEARCH BULLETIN, VOLUME 1, NUMBER 2, AUTUMN 1974
This publication contains 1,647 abstracts of journal ariticles and research reports selected by RRIS from current railroad literature and 160 summaries of ongoing research activities in the railroad field. The material covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS classification scheme in two separate sections, one for abstracts and one for summaries. The book also contains subject term, author and source indexes.

Outside the United States add 10% to the cost of the publication. Previous editions have the following NTIS accession numbers: PB-220220, PB-226484, PB-233880.

Transportation Research Board, (RRIS-7402) Bibliog. FRA-ORD&D-75-13, Sept. 1974, 448 pp

Contract DOT-OS-40022

ACKNOWLEDGMENT: FRA
ORDER FROM: TRB

PB-241042, DOTL NTIS

26 093543
RAILROAD RESEARCH BULLETIN, AUTUMN 1975. VOLUME 2, NUMBER 2
The publication contains 1,106 abstracts of journal articles and research reports selected by RRIS from current railroad literature, 93 descriptions of computer programs, and 404 summaries of ongoing research activities in the railroad field. This material covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS classification scheme in two separate sections, one for journal and report abstracts and computer program descriptions, and one for ongoing project summaries. The book also contains subject term, author, and source indexes. It supplements the material contained in the five prior Railroad Research Bulletins which should be retained for a complele file of RRIS data.

See also PB-242 353. Also pub. as ISSN-0097-0042.

Transportation Research Board, Federal Railroad Administration, (RRIS-7502) Bibliog. FRA/ORD-76-26, 1975, 327p

Contract DOT-OS-40022

ACKNOWLEDGMENT: NTIS
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PB-246648/0ST, DOTL/NTIS

26 094495
RAILROAD RESEARCH BULLETIN, CUMULATIVE SUBJECT INDEX, 1973-1975
This Index marks completion of the developmental phase of the Railroad Research Information Service. It lists alphabetically all the subject terms which have been utilized in the indexing of journal articles, reports and computer programs for which abstracts and descriptions have been entered in the RRIS magnetic tape file and reproduced in the six issues of the Railroad Research Bulletin and RRIS Special Bibliography published between 1973 and 1975. Listed alphabetically under each subject term are the titles of the pertinent journal articles, reports and/or computer programs, followed by a guide to make it possible to locate the abstract and bibliographic data in a specific RRIS publication. The publications covered by this index are the following, all available from National Technical Information Service: RRIS Special Bibliography, March 1973, PB-220 220; Railroad Research Bulletin 7301, Autumn 1973, PB-226 784; Railroad Research Bulletin 7401, Spring 1974, PB-233 880; Railroad Research Bulletin 7402, Autumn 1974, PB-241 042; Railroad Research Bulletin 7501, Spring 1975, PB-242 353; Railroad Research Bulletin 7502, Autumn 1975, PB-246 648.

See also PB-246 648. Also pub. as ISSN-0097-0042.

Transportation Research Board, National Academy of Sciences-Natl Research Council, Federal Railroad Administration, (RRIS-75C1) Bibliog. FRA/ORD-76-134, Jan. 1976, 684 pp

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ACKNOWLEDGMENT: NTIS
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PB-249716/2ST, DOTL NTIS

26 099189
RAILROAD RESEARCH BULLETIN. VOLUME 2, NUMBER 1. SPRING 1975

This publication contains 1,176 abstracts of journal articles and research reports selected by RRIS from current railroad literature and 235 summaries of ongoing research activities in the railroad field. This material covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS classification scheme in two separate sections, one for journal and report abstracts and one for ongoing project summaries. The book also contains subject term, author, and source indexes. It supplements the material contained in the four prior Railroad Research Bulletins which should be retained for a complete file of RRIS data.

The publication is available on a regular subscription basis from Railroad Research Information Service, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. Batch-mode computerized and manual file searches of specific subject areas are available directly from RRIS. Bulletin is published twice yearly, each edition containing accessions of the Railroad Research Information Service over a six-month period. Bulletins form a cumulative library reference. Previous editions bear following NTIS Accession Numbers: PB-220220, PB-226784, PB-233880, PB-241042.

Transportation Research Board, (RRIS-7501) Bibliog. FRA-OR&D-75-42, Mar. 1975, 272 pp

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PB-242353/AS, DOTL NTIS

26 133324
RAILROAD RESEARCH BULLETIN, SPRING 1976. VOLUME 3, NUMBER 1

The publication contains 1,110 abstracts of journal articles and research reports from current railroad literature and 418 summaries of ongoing research activities in the railroad field. The material covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS (Railroad Research Information Service) classification scheme in two separate sections, one for journal and report abstracts and computer program descriptions, and one for ongoing project summaries. This publication supplements material in the six prior Railroad Research Bulletins which should be retained for a complete file of RRIS data. The material in the six previous Bulletins can be searched through the RRIS Cumulative Subject Index, 1973-1975, PB-249 716, which also gives information about the individual publications.

Also pub. as ISSN-0097-0042. See also PB-246 648.

Transportation Research Board, Federal Railroad Administration, (RRIS-7601) Bibliog. FRA/ORD-76-144, 1976, 323 pp, Refs.

ACKNOWLEDGMENT: NTIS
ORDER FROM: NTIS, Railroad Research Information Service, 2101 Constitution Avenue, NW, Washington, D.C., 20418

PB-252014/6ST, DOTL NTIS

26 143989
RAILROAD SAFETY RESEARCH

This Special Bibliography prepared from the magnetic-tape files of the Railroad Research Information Service, contains selections which were accessioned between 1973 and 1976. Although the literature in a few cases dates back three decades, all listings are considered pertinent to contemporary railroad safety problems. The volume is divided into three main categories: Improved track structures research; Rail vehicle safety research; and Improved inspection, detection and testing research. There are 4,368 listings, involving 3,131 abstracts of research reports and journal articles, and descriptions of computer programs with some individual citations. The categories are based on the functional responsibilities of the groups comprising the staff of the FRA Office of Rail Safety Research.

Prepared for Annual Railroad Engineering Conference (13th) Held at Pueblo, Colorado in October 1976. See also report dated, Oct 75, PB-252 968.

Transportation Research Board, Federal Railroad Administration, (RRIS-76S1) Bibliog. FRA/ORD-76-280, Dec. 1976, 686 pp

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PB-258066/0ST, DOTL NTIS

26 157692
RAILROAD RESEARCH BULLETIN--SPRING 1977. VOLUME 4, NUMBER 1

This publication contains 1,474 abstracts of journal articles and research reports and descriptions of computer programs and magnetic data tapes. It also has 515 summaries of ongoing research activities in the railroad field. The material, selected from current railroad literature and other contemporary sources, covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS classification scheme in two separate sections, one for the abstracts and descriptions and the other for ongoing project summaries. This publication supplements material in the eight prior Railroad Research Bulletins which should be retained for a complete file of RRIS data.

Sponsorship provided by the Federal Railroad Administration, U.S. Department of Transportation, Office of Research and Development.

Railroad Research Information Service, (RRIS-7701) Bibliog. Vol. 4 No. 1, FRA/ORD-77/23, Mar. 1977, 436 pp, 1989 Ref.

ORDER FROM: Railroad Research Information Service, 2101 Constitution Avenue, NW, Washington, D.C., 20418

26 158179
SPECIAL BIBLIOGRAPHY. RAILROAD TECHNICAL DOCUMENTS RECEIVED THROUGH U.S. BILATERAL AGREEMENTS

This Special Bibliography contains 153 abstracts of foreign documents. These documents have been received by the Federal Railroad Administration through its bilateral agreements with the USSR Ministry of Railway Transport and the Ministry of Transport, Federal Republic of Germany. the abstracts are compiled from the magnetic tape files of the Railroad Research Information Service. The material in this volume is categorized in the following 17 of the 26 RRIS categories: Right-of-Way, Track, Rail Vehicles and Components, Propulsion Systems, Signals, Control and Communications, Human Factors, Rail-Highway Grade Crossings, Materials Science, Safety, Electrification, Information Systems, Economics, Freight Operations, Passenger Operations, Industry Structures and company Management, and Bibliographies and Documentation.

Prepared for the International Railroad Technology Transfer Seminar, New Orleans, Louisiana, January 14, 1976, under the sponsorship of the Office of Research and Development, FRA/U.S. DOT.

Railroad Research Information Service, (RRIS-77S1) Bibliog. FRA-/ORD-77/01, Jan. 1977, 56 pp, 153 Ref.

Contract DOT-OS-40022

ORDER FROM: Railroad Research Information Service, 2101 Constitution Avenue, NW, Washington, D.C., 20418

26 158191
RAILROAD RESEARCH BULLETIN, AUTUMN 1976. VOLUME 3, NUMBER 2

This publication contains 1,492 abstracts of journal articles and research reports and descriptions of computer programs and magnetic data tapes. It also has 563 summaries of ongoing research activities in the railroad field. The material, selected from current railroad literature and other contemporary sources, covers the entire range of railroading from technology to operations, management, economics and government involvement. Literature sources are worldwide. The material is arranged according to the RRIS classification scheme in two separate sections, one for the abstracts and descriptions and the other for ongoing project summaries. This publication supplements material in the seven prior Railroad Research Bulletins which should be retained for a complete file of RRIS data. This publication is available on a regular subscription basis from Railroad Research Information Service, Transportation Research Board, 2101 Constitution Avenue

N.W., Washington, D.C. 20418. Batch-mode computerized file searchs are avilable directly from RRIS.

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