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A BIBLIOGRAPHY ON THE DESIGN AND PERFORMANCE OF RAIL TRACK STRUCTURES

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FINAL REPORT

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URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Research and Development
Washington DC 20590

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16. Abstract

This bibliography was prepared as part of the Rail Supporting Technology Program being sponsored by the Rail Programs Branch of the Urban Mass Transportation Administration. It is based on the reference material that was used to evaluate the technical factors which govern the design and performance of at-grade track structures for urban rail systems. While most of the reference material that has been included is directly related to track used for railroad, rail rapid transit and light rail transportation, there are some additional references on related topics such as rail vehicle dynamics, soil mechanics, stress analysis, etc. However, this bibliography does not include a comprehensive review of these related topics.

This survey includes much of the published literature on track design, track loading, ballast, wood and concrete cross ties, rail and rail fasteners. It also includes considerable material on track problems such as rail wear and corrugation, rail defects, rail joints and track degradation.

The formal literature search for this bibliography covered the time period from about 1963 to 1973. The principal sources were the National Technical Information Service (NTIS) file of government reports, Engineering Index, and the Applied Science and Technology Index. Earlier references were identified from the Railroad Research Information Service (RRIS) computerized data base and bibliographies prepared by the RRIS and the Association of American Railroads.

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PREFACE

The Office of Research and Development Rail Programs Branch of the Urban Mass Transportation Administration is conducting an Urban Rail Supporting Technology Program. This bibliography has been prepared by Battelle's Columbus Laboratories as a part of Contract DOT-TSC-563 for the Transportation Systems Center (TSC), the Systems Manager for this Program. The overall objective of this contract was to evaluate the technical factors which govern the design and performance of at-grade rail track structures. The results from this program are reported in two volumes. Volume I, Report No. UMTA-MA-06-0025-74-3 (PB 233016/AS) , describes the design and performance of tie-ballast track, and Volume II, Report No. UMTA-MA-06-0025-74-4 (PB 233017/AS), is an evaluation of the requirements for designing concrete slab track. The work covered by these reports was conducted under the technical direction of Dr. Leonard Kurzweil, Code 612, at the Transportation Systems Center.

This bibliography is based on the reference material that was obtained and organized in support of the technical program on rail track structures discussed above. It includes much of the published literature on track design, track loading, ballast, wood and concrete cross ties, rail and rail fasteners. It also includes considerable material on track problems such as rail wear and corrugation, rail defects, rail joints, and track degradation. While most of the reference material that has been included is directly related to track used for railroad, rail rapid transit and light rail transportation, there are some additional references on related topics such as rail vehicle dynamics, soil mechanics, stress analysis, etc. However, this bibliography does not include a comprehensive review of these related topics.

The formal literature search for this bibliography covered the time period from about 1963 to 1973. The principal sources were the National Technical Information Service (NTIS) file of government reports, Engineering Index, and the Applied Science and Technology Index. Earlier references were identified from the Railroad Research Information Service (RRIS) computerized data base and bibliographies prepared by the RRIS and the Association of American Railroads.

This bibliography contains references to over 1300 reports, journal articles, and conference papers. About half of the references contain an abstract, varying in length and subject matter from a brief annotation to a long, informative abstract. Each citation is organized so that the title appears in capital letters immediately below the citation number to allow rapid

scanning of the titles. The publication data for journal articles are organized as follows: authors, author affiliation, publication, volume and issue identification, date and pagination. The publication data for reports are organized as follows: authors, corporate author, sponsor when known, report numbers, date, pagination, contract number and public availability number. Reports cited as being available from NTIS are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22151, by using the availability number identified in the citation.

The references in the bibliography are listed in numerical order using an arbitrarily assigned citation number. A subject index, an author/source index, and a foreign sources index follow the bibliography and refer to the particular references by the citation number. The subject index is based on the subject terms which were used to organize the literature for evaluating track structure design and performance. This index uses key words which were selected from the RRIS Thesaurus. The author/source index is based on the first author for each reference, followed by the pertinent citation numbers. When a reference does not cite an author, the corporate source or publication name or publisher is listed in the index. Foreign publications are listed in the foreign sources index according to their country of publication. Two or more terms in the indexes can be coordinated to locate references of particular interest.

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BIBLIOGRAPHY

0001
THE INFLUENCE OF BALLAST BED THICKNESS AND TIE SIZE AND SPACING ON SUB-STRUCTURE LOADING
Eisenbahntechnische Rundschau - The Railway Technical Review, Vol. 19, No. 8, pp 309-317

The steady increase in axle loading of railway vehicles and in train speeds not only cause greater stressing of the rails, but also higher loading of the substructure. Test results and theoretical considerations show the influence that the size, shape and spacing of the ties, the thickness of the ballast bed and depth of the formation, have on the loading of the substructure. Conclusions included the following: a ballast bed over a bad substructure that will carry 20 tons axle load, when over a good substructure, cannot carry more than 25 tons axle load. For axle loads of 30 tons, a protective layer over the substructure and a deepening of the ballast bed are necessary. With regard to the stresses on the ballast bed from an axle load of 25 ton to 30 tons, the tie spacing must be made smaller and with longer ties, the depth of the ballast bed and the thickness of the protective layer over the road can be kept to lesser limits.

0002
LATERAL OSCILLATIONS OF RAIL VEHICLES
Transactions of the ASME, Paper No. RR-57-A, Dec. 1935, pp 481-493

The authors point out in this paper that lateral oscillations, which either do not occur or are negligible at slow train speeds, are of vital importance at the high train speeds now demanded by the railroads. Aside from collisions and broken rails, practically all railroad accidents result from lateral derailments. Lateral derailments are caused by laterial pressure of wheel flanges against the rail. Therefore, the prevention of laterial derailments requires a knowledge of both the conditions which cause high laterial forces and of the conditions which must prevail in order to keep the lateral forces below some indicated safe value. The essential difference between the previous studies and the present one is that the previous ones discussed forced oscillations the life of which depended upon the application of some periodic force, such as that from cylinder action or rail joints, whereas the present discussion describes and explains a type of oscillation which, after an initial disturbance, even though a minor one, may build up to dangerous proportions and sustain itself indefinitely on absolutely perfect track. This type of oscillation is frequently encountered and is commonly known as "nosing". It is only one phase of the whole problem, but it represents the most serious menace to the safe operation of rail vehicles at high speed.

0003
A.R.E.A. MANUAL OF RECOMMENDED PRACTICE, VOL. 1 & 11
American Railway Engineering Association, Chicago, Illinois

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American Railway Engineering Association, Chicago, Illinois

0005
NEW PRODUCTION TAMPER TESTED ON PENN CENTRAL
Railway Track & Structures, Vol. 66, No. 12, Dec. 1970, pp 20-22

0006
"WELDED" BALLAST. NEW CONCEPT IN TRACK STABILIZATION
Railway Track & Structures, Vol. 66, No. 11, Nov. 1970, pp 21-23

0007
EFFECT OF BALLAST CONDITIONS ON TRACK STABILITY
Railway Gazette, Vol. 126, 1970, p 349

Installation of long-welded rail on Europe's principal trunk routes has created problems of track stability caused by the presence of thermal stresses in the track, affected by local climatic conditions. These investigations have led to the development of track stabilizers which follow closely behind the tamping machine. With this treatment the compacting effect which results from traffic is partly achieved in advance. Relationships between lateral resistance and deformation obtained from the tests carried out on a length of track are shown.

0008
INFLUENCE OF DYNAMIC-LOAD CHARACTERISTICS AND OF BALLAST FOUNDATION ON VIBRATION PARAMETERS OF LOADING BODY (ZALEZNOSC PARAMETROW DRGAN ELEMENTU OBCIAZAJACEGO WARSTWE KRUSZYWA OD CHARAKTERYSTYKI IMPULSU WYMUSZAJACEGO I PODLOZA)
Mazur, S., and Szafran, J., Arch Inzynierii Ladcwej, Vol. 16, No. 3, 1970, pp 495-504

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Rostler, F. S., and White, R. M., Materials Research and Development Inc., Final Report, to FRA Office of High Speed Ground Transportation, Dec. 8, 1966, p 219, Contract C352-66, Available: NTIS, PB 179466

0010
SUMMARY OF METROLINER TEST RESULTS
Herring, J. M., Jr., Budd Co., Fort Washington, Pa., Technical Center, Feb. 10, 1972, 272 p, Contract DOT-FR-1-0035, Available: NTIS, PB 208284

Laboratory dynamic test results are presented for Metroliner railroad car. Power spectra of road test is also included. Track geometry power spectra of roadbed input are also documented.

0011
SOUTHERN RAILWAY SYSTEM'S USE OF SLIDING JOINTS
Beaver, J. F., Office of Chief Engineer, Southern Railway System, Atlanta, Ga.

0012
BUTYL RUBBER FOR RAPID TRANSIT RAIL-PADS
Beiner, R. S., Synthetic Rubber Division, Enjay Chemical Company, Cranford, N. J.

0013
STUDY OF NEW TRACK STRUCTURES DESIGN
Bhatia, G. S., Report submitted to U. S. Department of Transportation by Transportation Research Institute, Carnegie-Mellon University, Mar. 1968

0014
VIBRATION MEASUREMENTS ON THE BUTYL RUBBER RAIL SEATS AND STANDARD WOODEN TIE TRACK INSTALLATION OF TRACKS 4 AND 3 OF THE SHUTTLE AT GRAND CENTRAL STATION, NEW YORK CITY
Bolt, Beranek and Newman, Inc., New York, Report No. 1281, Aug. 5, 1966

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CONCRETE CROSSTIES ON THE FLORIDA EAST COAST RAILROAD
Bolton, N. A., and Howard, J. Y., General Railway Signal Co., Rochester, N.Y., Sept. 15, 1967

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STUDY OF NEW TRACK STRUCTURE DESIGNS
Bhata, G. S., and Romualdi, J. P., Carnegie-Mellon University, Pittsburgh, Pennsylvania, Mar. 1968, 103 p

The effect of an abrupt change of elastic foundation properties upon the motion of a high speed vehicle is investigated in detail in this study. Limiting allowable accelerations are chosen as the criteria for riding quality. The study indicates that there is a likelihood of encountering a variety of elastic soil combinations which can seriously deteriorate the riding qualities of a rail vehicle on conventional track. As remedial measures, two alternatives are considered to improve the quality of ride; one by improving the rigidity of the track structure by means of providing a track structure utilizing narrow vertical walls embedded in the subsoil, and the other by carefully compacting the foundation soil to minimize local variations. A study is also made to evaluate the relative economics of the alternatives.

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DYNAMIC CHARACTERISTICS OF RAIL FOUNDATION
B & O-C & O Research Services Planning Department, B & O-C & O Rwy., Baltimore, Md.

0018
RAIL SUPPORT & ATTACHMENT DEVICES
Battelle Memorial Institute, Columbus, Ohio, Summary Report on Study of New Track Structures

0019
SOME PROBLEMS ABOUT TRACK AND MAINTENANCE OF WAY UNDER HIGH-SPEED TRAIN OPERATION
Ban, Y., Murayama, H., and Satou, Y., International Railway Congress Association, High-Speeds Symposium, Vienna, Austria, 1968

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B & O-C & O Railway Company, Baltimore, Md.

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Birmann, F., Proceedings of the Institute of Mechanical Engineers, Vol. 180, Pt. 3F, Paper 5, 1965-66

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Bethlehem Steel Company, Bethlehem, Pa., Two Company Reports, Feb. 14, 1968, and Sept. 16, 1959

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b) THE RAILROAD RAIL
Bethlehem Steel Company, Bethlehem, Pa., a) Catalog 379, 1954, b) unknown

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Baker, S.

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DETERMINATION OF VEHICLE RIDING PROPERTIES - 1
Batchelor, G. H., Railway Gazette, London, England, July 20, 1962

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PERMANENT WAY STANDARDIZATION AND MAINTENANCE
Butland, A. N., The Engineer, Jan. 31, 1964

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Blessin, F., Signal Und Schiene, Dresden, Germany, Dec. 1965, pp 518-520

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Burmister, D. M., Highway Research Board Proceedings, New York, Vol. 35, 1956

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SURVEY OF EUROPEAN CONCRETE CROSSTIES
Kunze, W. E., Journal of the Structural Division, Proceedings of A.S.C.E., New York, Vol. 88, No. ST 2, Apr. 1962

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Nelson, H. E., American Concrete Institute Journal, Vol. 67, Jan. 1970, pp 1-5

0032
NEW ASPECTS OF CONCRETE-TIE TRACK
Way, G. H.; Railway Track & Structures, Dec. 1971, p 22

Responsibilities of a special commission are discussed, which has been created with the object of preparing a technical specification and of establishing a method of manufacturing monoblock sleepers. The inspection tests are divided into two parts, one covering quality, and the other technology, which enables the parts of the sleeper pads to be inspected in the different positions in which they are used.

0033
LABORATORY METHODS OF INVESTIGATION PRE-STRESSED CONCRETE SLEEPERS
Mazur, S., Deutsche Eisenbahntechnik, No. 12, 1971, p 578

Describes test laboratory measurements to be made of the deformation of sleepers under varying loads and on layers of ballast. Results of these measurements are shown and several conclusions are drawn.

0034
REINFORCED CONCRETE PREFABRICATED PARTS FOR ALL KINDS OF TRACK INSTALLATIONS
Hagedorn, H. P., Eisenbahning, July 1971, pp 171-174

Reinforced concrete blocks of various types are made for holding railway tracks. An account is made of the design of these blocks and laying them.

0035
HIGH SPEED RAIL SYSTEMS (6/5) GUIDEWAY SYSTEMS
See 0350

0036
EXPERIMENTS ON ARITA RIVER RAILWAY BRIDGE WITH CONCRETE BED
Warizawa, Y., Railway Research Rept. No. 3, Sept. 1970, pp 146-148

Experiments using four kinds of track structures are described. Two of them use concrete short sleepers or wooden short sleepers on a PC bridge and the other two use steel plates with holes or slabs for fastening rails without sleepers on a RC rigid frame.

0037
INCREASING THE CARRYING CAPACITY OF RAILWAY ROUTES BY STRESSED CONCRETE BLOCKS
Tyc, P., Deutsche Eisenbahntechnick, Dec. 1970, pp 571-574

0038
FRENCH RAILWAYS' TRACK. (VI) LAYING RAILS DIRECTLY ON CONCRETE BLOCKS
Prud'Homme, A., Eisenbahning, May 1969, pp 144-145

Two types of permanent way have been developed: 1) a heavy type for the heaviest traffic stressing when taking curves with small radii has given excellent service, requiring no maintenance whatever, and 2) lighter permanent way for straight tracks and curves of large radius. Illustrations show a track laid on concrete blocks, and the rail fastenings in tunnels.

0039
DEVELOPMENTS IN TRACKS WITH CONCRETE FOUNDATIONS
Sulger-Buel, A., Wirschaftl. & Techn. Schriftenr, No. 9, 1969, pp 47-50

Ninety nine percent of the track in the streets of Zurich are laid on concrete slabs. There are 3 rather serious defects in this method, the track is now laid only on an asphalt course. The method using concrete slabs and the asphalt course method are described.

0040
EXPERIMENTAL CONCRETE TRACK BED AT RADCLIFFE
Lucas, J. C., Railway Gazette, No. 14, July 18, 1969, pp 547-549

BR has laid a trial length of concrete slab foundation on which six kinds of fastenings are being tried out. The Pandrol 401 clip is being used.

0041
FRENCH RAILWAYS' TRACK. (V). THE CONCRETE SLEEPER AND ITS RAIL FASTENING
Prud'Homme, A., Eisenbahning, May 1969, pp 143-144. In German.

Describes the VW, RS and Vagneux types of track. The VW type is a monobloc stressed concrete sleeper. In the RS and Vagneus types there are two mixed sleepers of concrete and steel with two reinforced concrete blocks joined together by a rail steel stay. The spring fastenings are the same for all three kinds of sleepers.

0042
INCREASING THE STRENGTH OF FERROCONCRETE SLEEPERS
Malyshev, V. G., Putj i Putevoe Hoziaistvo, Aug. 1968, pp 13-15. In Russian.

Describes various types of ferroconcrete sleepers (C-56, CZK-2-57 and CA-56). Measurement of the stress in the steel reinforecement of sleepers of different types are given.

0043
PERMANENT WAY STRESSING-THE SLEEPERS ESPECIALLY
Eisenmann, J., Holzschwelle, No. 62, Aug. 1969, pp 6-24. In German.

The effect of the track framework is described (vertical load, the calculated course of stress in the ballast and subsoil in the sleeper axis and horizontal stress). From laboratory tests,

the principle of the scissors leaver vibrator for determining the efficiency of rail fastenings and sleepers is given.

0044
CONTINUOUS STRESSING TESTS ON PRESTRESSED CONCRETE SLABS
Eisenmann, J., Beton, May 1966, pp 189-199. In German.

0045
ADJUSTMENTS MADE EASY WITH NEW CONCRETE ROADBED
Railway Track and Structures, Mar. 1968, pp 30-31

A major characteristics of the Fist-T system is that each rail is supported on a concrete block using a Fist clip in conjunction with a supporting assembly that has features that are designed to facilitate the making of vertical and lateral adjustments in the rails. This assembly is placed on the block in a recess, located diagonally with the rail.

0046
STRESSING RAILWAY PERMANENT WAY AND ITS FURTHER DEVELOPMENT FOR HIGHER SPEEDS AND AXLE LOADS. HIGH SPEED RAILWAYS. (II & III). THE CONCRETE BLOCK PERMANENT WAY AND RAIL FASTENINGS
Eisenmann, J., Eisenbrahnt. Rundschau., Mar. 1968, pp 192-194. In German.

0047
SOME PROBLEMS ABOUT TRACK AND MAINTENANCE OF WAY UNDER HIGH-SPEED TRAIN OPERATION
Ban, Y., Murayama, H., and Satou, Y., International Railway Congress Association-Monthly Bulletin, Vol. 45, No. 2, Feb. 1968, pp 181-207

Various measures for high-speed operation on New Tokaido Line and their effects discussed include curve radius and allowable train speed, transition curve, vertical curve, allowable limit of track irregularities, dynamic effects of vehicles upon track, track inspection and measurement systems, expansion joint, turnout with movable nose crossing, actual result of maintenance work, and countermeasures against earthquake and snow; measures for raising maximum speed and new tracks structure suitable for high-speed operation are described.

0048
EXPERIMENTS WITH CONCRETE TRACK BED
Takahara, K., Railway Gazette, No. 7, Apr. 4, 1969, pp 260-262. Eisenbahnt. Rundschau., Mar. 1969, pp 109-110, or Eisenbahner (A&B), Apr. 1969, pp 145-146

0049
TIE/SLEEPER REPLACEMENT PROGRAM
Reiner, I. A., Railway Systems and Managment Association, Paper, Feb. 1969, pp 63-73

Analysis of concrete ties vs. wood tie alternatives is discussed.

0050
PS(PRE-STRESSED) CONCRETE TIES FOR SPECIAL SECTIONS
Iwasakj, I., Railway Technical Research Rept. No. 1, Mar. 1969, pp 10-13

Prototype sleepers to be laid in steep curved sections were tested near Tokyo. Test results are analyzed.

0051
STUDY OF NEW TRACK STRUCTURE DESIGNS
Bhatia, G. S., Romualdi, J. P., and Thiers, G. R., Carnegie-Mellon University. Pittsburgh, Pa., Transportation Research Institute, Mar. 1968, 103 p, Contract C-222-66, Available: NTIS, PB 179401

The effect of an abrupt change elastic foundation properties upon the motion of a high speed vehicle is investigated in detail in this study. Limiting allowable accelerations are chosen as the criteria for riding quality. The study indicates that there is a likelihood of encountering a variety of elastic soil combinations which can seriously deteriorate the riding qualities of a rail vehicle on conventional track. As remedial measures, two alternatives are considered to improve the quality of ride; one by improving the rigidity of the track structure by means of providing a track structure utilizing narrow vertical walls embedded in the subsoil, and the other by carefully compacting the foundation soil to minimize local variations. A study is also made to evaluate the relative economics of the alternatives.

0052
HIGH-SPEED GROUND TRANSPORTATION RESEARCH AND DEVELOPMENT: A PRELIMINARY APPRAISAL
Office of the Under Secretary for Transportation (Commerce), Washington, D. C., Transportation Research Staff, 1965, 69 p, Available: NTIS PB 168782

The study is concerned primarily with the technological progress of the railroad industry.

0053
CUSHIONED CONCRETE TIES FOR ULTRA-SMOOTH TRAINS
Chironis, N., Product Enginering, Vol. 40, Sept. 22, 1969, pp 102-103

0054
COUPLED DYNAMIC INTERACTIONS BETWEEN HIGH SPEED GROUND TRANSPORT VEHICLES AND DISCRETELY SUPPORTED GUIDEWAYS
Chiu, W. S., and Woormley, D. N., Massachusetts Institute of Technology, Cambridge, Engineering Projects Laboratory, Final Report, July 1970, 130 p

The coupled dynamic interactions between high speed ground transport vehicles and discretely supported guideways is investigated using modal analysis techniques to determine

the performance of vehicles traversing spans with distributed mass, flexibility and damping and which rest on rigid discrete supports. Results indicate that for typical advanced transportation systems span dynamic deflections at vehicle speeds of 100 - 300 mph may approach values which are twice the span static deflection due to the vehicle weight and that vehicle heave accelerations may substantially exceed the desired 0.05 g level unless very strong constraints are placed upon system parameters. Parametric design charts are presented which provide an initial basis for the selection of vehicle and guideway system parameters to meet a given specified limit on vehicle heave acceleration.

0055
TRACK LOADING FUNDAMENTALS, PARTS 1-7
Clarke, C. W., Railway Gazette, London, England, Vol. 106, 1957

Part 1 appears in the Jan. 11th issue, pp 45-48, and introduces the subject of track and wheel loading. Part 2 on the determination of rail sections appeared in the Jan. 25th issue, pp 103-107. Part 3 on ballast depth determination is in the Feb. 8th issue, pp 157-160, 163. Part 4, which disucsses curved track and lateral strength, is in the Feb. 22nd issue, pp 220-221. Part 5 on the effect of wheelbase on track stresses is in the March 8th issue, pp 274-278. Part 6 which relates track design to bridge loading appears in the March 22nd issue, pp 335-336. The last part presents various speed effect formulas and summarizes the principal formulas from all the articles in this series. This seventh part appears in the April 26th issue, pp 479-481.

0056
A METHOD OF CALCULATING THE MAXIMUM STRESS IN THE WEB OF RAIL DUE TO AN ECCENTRIC VERTICAL LOAD
Code, C. J., A.R.E.A. Proceedings, Chicago, Illinois, Vol. 48, 1947, pp 986-990

0057
FASTENING OF RAILWAY RAILS TO CONCRETE SLEEPERS WITH THE AID OF SUPERPOLYAMIDES
Cuperus, J.L.A., Bulletin of the International Railway Congress Association, London, England, No. 625, pp 143-145, Feb. & Mar. 1965

0058
NOTES ON TRACK - CONSTRUCTION AND MAINTENANCE
Camp, W. M., Chicago, Illinois, 1904, pp 94-99

0059
TRACKWORK STUDY. VOLUME I. TRACKWORK PRACTICES OF NORTH AMERICAN RAPID TRANSIT SYSTEMS
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0060
TRACKWORK STUDY. VOLUME II. RECOMMENDED TRACKWORK STANDARDS
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0061
HIGH SPEED GROUND TRANSPORTATION: NOISE SOURCES
Dietrich, C. W., and Bender, E. K., Bolt, Beranek and Newman, Inc., Cambridge, Massachusetts, Oct. 1968, 52 p

Analyzing the noise problem in high-speed ground transportation passenger spaces, this report identifies: (a) sources, (b) paths, and (c) receivers. It examines ways of establishing noise-level criteria for HSGT vehicles.

0062
TRACKWORK STUDY. VOL. 1
See 0266

0063
EVALUATION OF TRANSPORTATION EQUIPMENT TECHNOLOGY FOR USE IN THE BALTIMORE REGION RAPID TRANSIT SYSTEM
Daniel, Mann, Johnson, and Mendenhall, Los Angeles, California, June 1968, 186 p, Available: NTIS, PB 180093

The report reviews current and anticipated development in transit system operations equipments as they may particularly apply to the proposed rapid transit system for the Baltimore Region. The primary objective of this evaluation was to provide a realistic set of alternatives upon which to base decisions as to the inclusion of advanced techniques and equipment in the preliminary engineering of the transit system. New concepts and improvement of well-established techniques are examined. Recommendations are included for various system components and subsystems. (Author)

0064
COMPARISON OF NOISE AND VIBRATION LEVELS IN RAPID TRANSIT VEHICLE SYSTEMS
Davis, E. W., and Zubkoff, M. J., Operations Research, Incorporated, Silver Spring, Maryland, Apr. 1964, 187 p

This report presents the results of a study of rapid transit vehicle noise and ridability, undertaken to fulfill a need for basic data on these characteristics of existing rapid transit systems. The objective of this study was to obtain noise and ridability data which might be helpful in setting vehicle design criteria. A secondary objective was to determine the relative quietness and ride smoothness of rubber-tired and steel-wheeled rapid transit vehicles to assist in the comparison of these systems. Complete correlation of the vibration data collected (and of the noise data) with the design, construction, and maintenance factors

influencing them was beyond the scope of this study. However, an attempt is made to correlate some observed system conditions with measurement results. Enough information is presented herein to permit identification of these systems judged consistently best in all respects, so that the field has been narrowed to a small number for further investigation.

0065
HIGH SPEED PASSENGER TRANSPORTATION IN THE NORTHEAST CORRIDOR OF THE UNITED STATES OF AMERICA UTILIZING EXISTING FACILITIES
Diffenderfer, J. W., International Railway Congress Association, High-Speeds Symposium, Vienna, Austria, 1968

0066
FASTENING RAIL TO A CONCRETE DECK
See 0292

0067
A PRELIMINARY INVESTIGATION INTO 16-567C ENGINE MALFUNCTIONS BY ACOUSTICAL MEANS
Dalmo Victor Company, Final Report, No. R4443

Acoustic and vibration tests were made on an EMD-GP9 locomotive with a 16-567C engine under three conditions. Runs were made at various throttle settings with the engine, 1) "normal" (that is, in the state it was taken off its run); 2) with one cylinder injector blocked, and 3) with the same cylinder injector abnormally wide open. Data processing and analysis revealed marked differences in the final records between the three conditions. Thus there appears to be considerable hope that acoustic methods may be useful for diagnosis of engine malfunctions.

0068
TEST TRAIN PROGRAM. SYSTEM INSTRUMENTATION MANUAL
Gerhardt, C. L., and May, J. T., Ensco Inc., Springfield Va., Report No. DOT-FR-72-1, Annual Report, Jun-Dec. 1971, 168 p, Contract DOT-FR-00015, Available: NTIS, AD 748286 and PB 209709

The report describes current instrumentation installed aboard the Department of Transportation Test Train. The instrumentation is designed to gather research data on various rail research projects. The major discussion in this report covers the Track Geometry System aboard the test train, and the operation and calibration of this system.

0069
DOT TEST TRAIN PROGRAM SYSTEM INSTRUMENTATION MANUAL
Gerhardt, C. L., and May, J. T., Ensco, Inc., Springfield, Va., Report No. DOT-FR-72-1
See 0068

0070
DOT TEST TRAIN PROGRAM
Demuth, H., Gerhardt, C., May, J., and Trzaskoma, W., Ensco, Inc., Springfield, Va., Report No. DOT-FR-71-2, Progress Report No. 3, July 1970-June 1971, 119 p, Contract No. DOT-FR-00015, Available: NTIS, PB 209762

The progress report covers a 12-month activity period covering engineering and data management in conjunction with operation of rail research test cars, and discusses research and analysis work in fields associated with rail research. Developemtns include an operational prototype track geometry.

0071
SYSTEM INSTRUMENTATION MANUAL. DOT TEST TRAIN PROGRAM
Gerhardt, C. L., and May, J. T., Ensco, Inc., Springfield, Va., Report No. DOT-FR-71-1, Annual Report, June-Dec. 1970, 176 p, Available: NTIS, PB 203110

The report describes current instrumentation installed aboard the Department of Transportation Test Train. The instrumentation is designed to gather research data on various rail research projects. The major discussion in this report covers the Track Geometry System aboard the test train, and the operations and calibration of this system.

0072
FASTENING THE RAILS ON TRACKS FOR VERY HEAVY LOADS (SCHIENENBEFESTIGUNG FUER SCHWERSTBELASTETE GLEISE)
Eisenmann, J., Stahl und Eisen, Vol. 91, No. 22, Nov. 11, 1971, pp 1313-1818

On a special testing machine, which is described and illustrated, rail assemblies were fatigue tested under pulsating loads. The assemblies consisted of the rail, fastened by double shank spring spikes to a steel base plate separated from the tar-oil saturated beechwood tie by a layer of plastic material. The results, which are given in great detail, lead to the conclusion that such an assembly can be expected to have a long service life even in 300 to 500 m long curves, when the mean axle loads are 360 kN and loads occasionally increase to 450 kN. In German.

0073
TESTS OF RAIL FASTENERS
Engineering Research Division, A.A.R. Research Center, Chicago, Illinois, 1966

0074
TESTS OF RAIL FASTENERS
Engineering Research Division, A.A.R. Research Center, Chicago, Illinois, Report No. 31897, October 1966, pp 1-121

0075
TEST OF THE LANDIS INDUSTRIAL COMPANY RAIL FASTENER
Engineering Research Division, A.A.R. Research Center, Chicago, Illinois, Dec. 6, 1967

0076
ROLLING LOAD AND SLOW BEND TEST RESULTS OF BUTT WELDED RAIL JOINTS
Engineering Research Division, A.A.R. Research Center, Chicago, Illinois, 1966

0077
SUBWAY TRACK VIBRATION MEASUREMENTS
Edwards, A. T., The Hydro-Electric Power Commission of Ontario, Research Division, Report No. 66-175-P, May 27, 1966

0078
ST. LOUIS METROPOLITAN AREA RAPID TRANSIT FEASIBILITY STUDY. PHASE II REPORTS: ALTERNATIVE TRANSIT SYSTEMS
East-West Gateway Coordination Council, East St. Louis, Illinois, 1969, 113 p

The report is the second in a series to determine the feasibility of rapid transit in the St. Louis metropolitan area. The report discusses criteria suggested for use in further development of the study as well as several alternative transit system schemes. Basic to all schemes is the continuing use of busses either as feeders or as part of a collector system. A review of the current 'state of the art' of transit technology is also included.

0079
AN INVESTIGATION OF STEEL WHEEL-RAIL NOISE AND TECHNIQUES FOR ITS SUPPRESSION
Enright, J. J., Battelle Memorial Institute, Columbus Laboratories, Columbus, Ohio, Oct. 1967, 18 p

A potential limitation of systems using steel wheels on steel rails in urban transportation is the noise generated by the wheel-rail interaction. Various noise-reduction studies have been performed. As these have been independent studies, there has been a lack of unity in direction, purpose, and test conditions. Therefore, while the results are encouraging, they are mainly of qualitative value. A coordinated study to clearly define the exact mechanism of wheel-rail noise generation and the appropriate technique for suppressing this noise is needed. This will involve the integration of the results of independent studies together with a significant amount of basic research and development.

0080
MOTIVE POWER FOR HIGH SPEEDS
Die Bundesbahn - The Federal Railway, No. 7/8, pp 339-343

This article traces the growth of high speed operation engineering and planning on the German Railways from 1903. Projected plans call for even heavier and higher speed units of motive power, with 25 ton axle load and capable of 300 km/h. Further developments are in progress in motive power elements, as the asynchronous motor drive. Similar progress is evidenced in the application of computer techniques to train control and operation. The demands for faster travel speeds are being constantly considered by the German Federal Railway.

0081
FLANGE AND RAIL LUBRICATION
Fujinawa, I., Railway Gazette, London, England, Dec. 1967, pp 899-902

0082
ECONOMICS OF RAILWAY TRACK
Farrin, J. M., A.R.E.A. Proceedings, Chicago, Illinois, Vol. 28, 1927

0083
HIGH SPEED RUNNING AND RELATED TRACK PROBLEMS
French Railway Techniques, No. 2, pp 83-92

High-speed running does not set any track-make-up problems. The convention type is quite suitable. Strengthening the track is not a must, neither from the angle of safety nor that of fatigue. Strengthening, which could be useful on the lines carrying both dense fast traffic and numerous slow heavy trains, could be carried out simply at the time of the scheduled renewals. The layout problem is more difficult. On certain important lines on the S.N.C.F. there are sufficiently long sections where the radii are over the minima indicated above. Consequently, scheduled service traffic at 200 km/h could be envisaged on these sections in a not too far distant future.

0084
INITIAL TESTS OF THE TURMO III C TURBINE ENGINE
French Railway Techniques, No. 2, pp 75-90

Experiments began in July 1966, with a TURMO III C3 aircraft type turbine engine in a rail vehicle. The aim of the experiments is to determine the results as to soundproofing, operation with the fuels stocked by the S.N.C.F., the potentialities for traction, and the endurance with such a machine. From the initial tests, results are already satisfactory, both for soundproofing and for operating with the usual SNCF fuels. From the engine starting test results, it was decided to substitute an F3 type engine for the C3 type. The endurance test results are shown.

0085
DETAILS OF AN INITIAL EXPERIMENTAL GAS TURBINE RAILCAR SET
French Railway Techniques, No. 2, pp 67-74

For the prototype gas turbine set, a 330 kw diesel-powered railcar set was selected for starting. The original trucks were satisfactory for operation to 150 kmh, but were replaced with Y-214 trucks for greater speed capability. The

air intake and exhaust systems and the Soundproofing necessary for the installation of the 297 kg turbine motor are described. The transmission system is described and illustrated. The fire protection system, heating and air conditioning system, and the towing gear are briefly discussed.

0086
PLASMA TREATMENT OF RAILWAY RAILS TO IMPROVE TRACTION
Gifford, F. E., General Motors Corporation, Warren, Michigan, and Yoshino, R. T., Transactions of the ASME, Journal of Engineering for Industry, Vol. 93, Series B, No. 3, Aug. 1971, pp 867-872, Paper 70-WA/RR-1

0087
PRINCIPLES OF ENGINEERING ECONOMY
Grant, E. L., and Ireson, W. G., The Ronald Press Company, New York, New York, Fourth Edition, 1964

0088
TEST CONDUCTED BY GENERAL MOTORS PROVING GROUNDS NOISE AND VIBRATION LABORATORY, REPORT NO. 22050
General Motors Corporation, Report No. PG 22050, Test Report

The objective of this test was to obtain data during a typical tri-level shipment known to cause automobile frame damage. The rail car chosen was NIFX-13551 which was a split deck, low tri-pack car with side cushions. The top level, front auto position was chosen as the location for the automobile because of a high failure rate among autos shipped in this position. The "T" hook, was used and standard tie-down procedure was followed in securing the automobile to the rail car. The instrument car was coupled directly to the tri-level rail car containing the test automobile. Large strains were recorded on a number of gages immediately after tie-down. Strains greater than 1500 $\mu\epsilon$ generally result in yielding of the material for the type of steel used in automobile frames. The value was exceeded at each tie-down hole on initial tie-down.

0089
PUBLISHED REPORT BY THE OFFICE OF HIGH SPEED GROUND TRANSPORTATION
Office of High-Speed Ground Transportation, Washington, D. C., Nov. 1971, 59 p, Available: NTIS, PB 205937

The bibliography presents abstracts of 328 major research reports published by the Office of High Speed Ground Transportation in the Federal Railroad Administration, Department of Transportation. Also included are selected reports by the Office of Policy Planning, Federal Railroad Administration, and by the Northeast Corridor Transportation Project in the Office of the Assistant Secretary of Transportation for Policy and International Affairs. These reports represent results of contracted research and development, systems engineering, transportation surveys, and model development, along with intramural research reports and program summaries.

0090
PUBLISHED REPORTS BY THE OFFICE OF HIGH-SPEED GROUND TRANSPORTATION
Office of High Speed Ground Transportation, Washington, D.C., Nov. 1970, 46 p, Available: NTIS, PB 196348

The bibliography presents abstracts of 225 major research reports published by the Office of High Speed Ground Transportation in the Federal Railroad Administration, Department of Transportation. Also included are selected reports by the Office of Policy Planning, Federal Railroad Administration, and by the Northeast Corridor Transportation Project topics presented include: rapid transit railways, tracks, subways, monorail systems, tunnels, communication equipment, and safety.

0091
RAILWAY TRACK STRUCTURE FOR HIGH SPEED TRAIN OPERATION
Hojo, T., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Aug. 1964, pp 3-8

0092
TRACK STRUCTURE FOR HIGH SPEED RUNNING
Hoshino, Y., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Apr. 1960, pp 37-46

0093
TRACK STRUCTURE
Hoshino, Y., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Apr. 1960, pp 20-23

0094
RAILWAY TRACK STRUCTURE FOR HIGH SPEED TRAIN OPERATION
Hirakawa, T., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Nov. 1962, pp 2-4

0095
RAILWAY TRACK STRUCTURE FOR HIGH SPEED TRAIN
Hoshino, Y., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Nov. 1961, pp 4-14

0096
TRACK STRUCTURE FOR HIGH SPEED TRAFFIC
Hojo, T., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Special Issue, Oct. 1963, pp 2-6

0097
STRESSES BENEATH A RAILWAY TRACK
Heath, D. L., and Cottram, M., British Railways Research Department, Derby, England

0098
TEST OF THE LANDIS INDUSTRIAL COMPANY RAIL FASTENER
Hales Testing Laboratories, San Jose, California, Nov. 24, 1967

0099
RAILROAD RESEARCH FIELD TESTING PROGRAM
See 0128

0100
URBAN RAPID TRANSIT CONCEPTS AND EVALUATION
Hoel, L. A., and Lepper, R. L., Transportation Research Institute, Carnegie-Mellon University, Pittsburgh, Pennsylvania, 1968, 241 p

The several aspects of urban rapid transit systems are reviewed from the standpoint of developing them according to the dictates of population and employment distribution patterns, rather than by conventional, and uneconomical, restrictive grade and curvature criteria. Included in the discussion are vehicle design, guideway substructure and superstructure, and analysis of regional-local transit system transfer interfaces. Present technology capabilities are illustrated by examples of various types of urban and interurban systems.

0101
TESTS OF RAIL FASTENING SYSTEM
Hanson, N. W., Research and Development Division, Portland Cement Association, Skokie, Illinois, Report No. 31897, July 1966

0102
TRACK BED AND TRACK MAINTENANCE ON HIGH-SPEED TRACKS. EARLY EXPERIENCE FROM THE HIGH-SPEED RUNS BETWEEN MUNICH AND AUGSBURG AT THE TIME OF THE INTERNATIONAL TRANSPORT EXHIBITION
International Railway Congress Association, Bulletin Of The International Congress Association

Remarks concerning alignment, design and maintenance condition of the permanent way on the high-speed section between Munich and Augsburg are followed by a discussion of test run results, with special reference to the relationships between track bed faults and vehicle accelerations at high speeds.

The technical problems associated with high-speed tracks and their maintenance have been largely clarified.

0103
DESIGN AND MAINTENANCE OF HIGH-SPEED PERMANENT WAY IN THE U.S.S.R.
International Railway Congress Association, Bulletin Of The International Railway Congress Association, pp 837-853

The track on high-speed lines is subject to special criteria. A high level of design including the use of long welded rail sections, temperature-stressed concrete sleepers is required. Maintenance requirements are severe. Of vital importance is the control of track in the horizontal plane. The wear of rails and the permissible magnitude of corrugations, etc., are strictly limited. Great attention in the U.S.S.R. is paid to the increasing of speeds of trains since a comparatively small increase in maintenance gives a considerable economy in railway stock, reduces the cost of freight and passenger services, increases railway capacity. Experience, maintenance, design and labor problems are discussed.

0104
WORKING SESSION
International Railway Congress Association-Monthly Bulletin, pp 1018-1098

This discussion of rolling stock for high speed operation includes: a discussion of bogie-suspension systems, comparison of 4 wheel vs. bogie systems, locomotive design and relation ship to track for determining speed limits. Part II, which concerns fixed installations, discusses the theoretical and experimental solutions to the problems of track design for high speed operation. Note as these are records of working sessions, the papers are abstracted, and there are questions and discussion of many points raised in the meetings.

0105
SUBWAY ENVIRONMENTAL SURVEY, CHICAGO TRANSIT AUTHORITY SYSTEM
De Leuw, Cather and Company, Chicago, Illinois, Institute for Rapid Transit, Washington, D. C., Report Nos. UMTA-DC-MTD-7-71-7, and 2045-04, Available: NTIS, PB 201875

The report has been prepared under the Institute For Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems', and is one of many such reports leading to the final product, a 'Handbook for Subway Environmental Criteria, Analysis and Control'. The purpose of this particular report was to present all of the subway environmental information gathered in an extensive interview with the Chicago Transit Authority. The information represents the state-of-the-art under actual operating conditions, in the Chicago subway system of the various environmental areas included in the project-temperature, hunidity, velocity, pressure, environmental equipment, noise and vibration.

0106
PROVING GROUND FOR NEW IDEAS IN TRACK STRUCTURES - THE BARTD TEST TRACK
See 0729

0107
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN OPERATION
International Railway Congress Association,

Bulletin of the International Railway Congress Association, Mar. 1965

Discussion of factors related to track structure for high speed operation is given. Running tests include running stability over a ruptured rail, dynamic effects of wheel flat, dynamic stresses of prestressed concrete ties, behavior of embankments under high speed traffic loads, and measurements of train wind. Additionally, comp rative studies of welded rails, wooden sleepers, and a test vehicle to be used for high speed track inspection are discussed.

0108
THE STABILITY OF LONG WELDED RAILS
International Railway Congress Association, Bulletin of the International Railway Congress Association, Vol. 38, No. 10, pp 679-708

The British Railways testing is reported of long welded railroad track. Testing program determines the stability of welded rails by tests for buckling, torsional resistance, lateral moment of resistance and lateral ballast resistance. Conclusions are that track can buckle but factors controlling stability are torsional resistance of fastenings, sleeper spacing, and ballast resistance.

0109
SOME PROBLEMS OF WHEEL/RAIL INTERACTION ASSOCIATED WITH HIGH-SPEED TRAINS
International Railway Congress, Bulletin of the International Railway Congress Association, Sept. 1969, pp 513-542

The objective of this study was to identify and evaluate potential problems involving wheel-rail interaction which could limit the speed of a high speed rail (HSR) system. The study is based upon a survey of existing knowledge in the areas pertinent to wheel-rail interaction; no extensive analytical work is presented, but several approximate calculations are given. The results and discussion are concentrated in four main areas, namely: estimation of the dynamic loads; wheel behavior and structural integrity; rail dynamics and structural integrity; adhesion, hunting, and related problems.

0110
DETERMINATION OF THE SNAKING EFFORT IN TRACK LAID WITH LONG WELDED RAILS BY MEANS OF A NON-LINEAR CALCULATION
International Railway Congress Association, Bulletin of the International Railway Congress Association, Aug. 1965, pp 580-588

The author describes a method to ascertain, with the assistance of an electronic computer, the axial effort due to snaking in a track laid with long welded rails. In these calculations, the influence of the lateral resistance and that of the angular rigidity can be introduced in their true nonlinear form, so accurately that the stress under which snaking occurs can be determined exactly. It is necessary to establish by measurements the lateral resistance and the angular rigidity. After this has been done, the admissible value of the preliminary deformation, free of stress, of a track with long welded rails can be calculated fairly rapidly. Provisionally it is affirmed that the critical wave length will be considerably shorter than that obtained by the methods of calculation previously suggested.

0111
NEW TURNOUT DESIGN FOR HIGH-SPEED TRAIN IN CONVENTIONAL LINE
Kurokochi, H., Kagami, M., and Torigoe, S., Permanent Way, Vol. 13, No. 2, Sept. 1971, pp 1-10

A turnout which enables the train to run at a speed of 130 km/hr on the stock rail of the turnout of a narrow-gage track and which does not require a speed reduction on the turnout was developed. A flexible point is used. The tongue rail is shaved out of a 90S full-web section point rail. The 90S rail is designed so that it can be used mainly in a welded crossing, and also in a point for 60 kg rails and the tongue rail of an expansion joint.

0112
TRACK AND RUNNING GEAR AS SUPPORTING ELEMENTS IN WHEEL-RAIL SYSTEM (TRAG- UND FUEHRUNGSELEMENTE IM RAD-SCHIENE-SYSTEM)
Krugmann, H. L., Glasers Ann, Vol. 95, No. 5, May 1971, pp 107-111, 118

Outline of the properties and functions of the track and running gear as supporting elements is given to discuss the guidance of the vehicle by the wheel-rail system, concluding that this system can be applied also for speeds above 250 km/hr. In German.

0113
ESTIMATED COSTS OF CROSSTIES PRODUCED UNDER SEVERAL PROPOSED SPECIFICATIONS FOR B & O-C & O RAILWAYS
Koppers Company Incorporated, Baltimore, Md., Apr. 1964

0114
DYNAMICS OF INDEPENDENTLY ROTATING WHEEL SYSTEMS
Kaplan, A., and Short, S. A., TRW Systems, Redondo Beach, California, Final Report, July 1970, 74 p

The report presents the results of an analysis of the dynamics of individually rotating wheel systems for use on high speed rail systems such as the Tube Vehicle System (TVS). The objective of this system is to remove the hunting stability problems of conventional rail-wheel systems and thus improve the vehicle ride comfort and safety.

0115
ENGINEERING FEASIBILITY AND DEVELOPMENT STUDIES OF RAPID TRANSIT SYSTEM AND EQUIPMENT FOR THE NATIONAL CAPITAL REGION. VOLUME I

Kaiser Engineers, Los Angeles, California, July 1963,. 96 p

The report contains the Engineering Feasibility and Development Studies of Rapid Transit System and Equipment for the National Capital Region. The study consists of development of outline specifications and criteria as a basis for future design development and is divided into the following categories: alignment; construction methods; ventilation; electrification; train performance studies.

0116
ENGINEERING FEASIBILITY AND DEVELOPMENT STUDIES OF RAPID TRANSIT SYSTEM AND EQUIPMENT FOR THE NATIONAL CAPITAL REGION-APPENDIX, VOLUME II
Kaiser Engineers, Los Angeles, California, July 1963, 209 p

The volume is composed of a series of six separate interim reports which were submitted initially on the dates shown. The reports are included in the order listed. Investigation of electrical traction power system: substation size and spacing: methods of obtaining electrical power: realignment studies: ventilation: construction methods.

0117
RAIL FASTENERS AND TRACK STRUCTURES
Krammer, C. O., BART, San Francisco, California, Apr. 1967

0118
TRACK IRREGULARITIES
Kitaoka, H., Japanese Railway Engineering, Tokyo, Japan, Special Issue, Vol. 7, No. 3, Sept. 1966

0119
NEW TYPE PROFILES FOR BRITISH RAILWAYS
King, B. L., Railway Gazette, London, England, Jan. 19, 1968, pp 60-64

0120
SOME ASPECTS OF THE INTERACTION BETWEEN RAILWAY VEHICLE AND TRACK
Labuschagne, T. J., and Scheffel, H., South African Railways, Johannesburg, Civil Engineering in South African, Vol. 11, No. 10, Oct. 1969, pp 247-252

Paper describes aspects of experimental research on the South African Railways into the conditions affecting the riding quality of railroad vehicles. Parameters which influence the vertical riding quality of railway vehicles are given against the theory of forced vibrations. Results recorded during riding quality tests were found to be in good agreement with the theory. Method of simulating vertical oscillations of railway vehicles on a digital computer is outlined.

0121
DYNAMICS OF VEHICLE-STRUCTURE INTERACTION
Long, D. V., Bay Area Rapid Transit District, San Francisco, California

0122
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN OPERATION
Railway Technical Research Institute, Special Issue, pp 8-64

Discusses the results of testing of structure and materials for high speed operation. Tests of ruptured rail, effect of flat wheel on the track, stresses of PC ties, behavior of high embankment with high speed traffic are considered. Additionally, the testing of Japanese rail as welded by German and Grench methods and equipments. The use of wooden sleepers (ties) in the construction of the New Tokaido Line is also detailed. Finally, the design and use of a high speed track inspection car is discussed.

0123
VIBRATION DURING ACCELERATION THROUGH A CRITICAL SPEED
Lewis, F. M., ASME Transactions, New York, Vol. 54, 1932, pp 253-261

0124
DESIGN FOR COMFORT
Journal of the Institute of Locomotive Engineers, London, England, Vol. 57, No. 319, pp 428-508

The work done during the last ten years to improve passenger comfort has resulted in marked advances as far as riding, noise levels, heating and ventilation are concerned. Increasing speeds combined with road and air competition make it essential to ensure the development of still more effective coaches. The coaches should be lighter and they must be strong and energy-absorbing in accidents. Riding qualities have become less of a problem and running-gear maintenance requirements will be reduced. particularly by the use of rational tire profiles, but effective braking from high speeds will demand considerable attention. Heating and noise insulation will also demand further attention.

0125
BIBLIOGRAPHY OF HIGH SPEED GROUND TRANSPORT. PART IA.
Massachusetts Institute of Technology, Cambridge, Mass., Oct. 15, 1965, 86 p, Contract C-85-65, Available: NTIS, PB 170581

0126
TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT
Hansen, R. J., Massachusetts Institute of Technology, Cambridge, Mass., Summary Report, Dec. 31, 1967, Sept. 16, 1966-Nov. 15, 1967, 57 p, Contract C-85-65, Available: NTIS, PB 176923

This report contains highlights of research findings developed during the second year of research at Massachusetts Institute of Technology on the technology of high speed ground transport. The research topics are diverse but can be grouped roughly into areas relating to system operational performance, vehicles including suspension,

propulsion and control, and the problems of the intrastructure of an High Speed Ground Transport System. The research is aimed at establishing a basis for design of high speed ground transportation and often treats problems not previously studied for conventional transportation systems.

0127
STUDY OF METHODS OF STABILIZING CONVENTIONAL BALLAST USING POLYMERS
Rostler, F. S., and Newton, J. W., Materials Research and Development, Incorporated, Oakland, California, Final Report, July 1968, 47 p, Contract C-352-66, Available: NTIS, PB 179220

The report presents the results of the work performed in continuation of the research study on stabilized railroad ballast. The original study was to test the feasibility of the concept advanced that adapting existing ballast structures to accommodate high speed trains could be accomplished by converting conventional ballast, which is a collection of independent aggregate pieces, into a material which approaches a continuum. Dynamic tests simulating service conditions indicated that this improvement is of sufficient magnitude to make existing ballast or newly laid ballast of conventional design suitable as roadbeds for high speed trains. In this original study, the elastomeric cementing agent was applied in the form of a solution in organic solvents.

0128
RAILROAD RESEARCH FIELD TESTING PROGRAM
Hurley, F. J., Goeser, J. N., Koch, B. R., and McConnell, P. J., Melpar, Incorporated, Falls Church, Virginia, Progress Rept. No. 1, Dec. 1968, 215 p, Contract C-111-66, Available: NTIS, PB 182470

The primary purpose of this project is to assist in defining the operational characteristics and constraints of conventional rail systems at speeds of the order of 150 miles per hour. Four electric, multiple-unit commuter-type cars, modified to facilitate instrumentation and to achieve full-power balancing speed in excess of 150 miles per hour, were built and heavily instrumented. High-speed tests are being conducted on an improved 21 mile section of the Penn-Central Railroad between Trenton and New Brunswick, New Jersey, and track geometry measurements reflecting track conditions are being made between Washington, D.C., and Boston. Of particular interest are the evaluation of ride quality, truck and suspension performance and vibration, track geometry measurements, pantography performance, catenary profile and dynamic response, track-roadbed characteristics, and interaction between trains. An initial part of the original contract was the formulation of a general purpose mathematical model of car motion suitable for evaluating the performance of new or proposed vehicles or vehicle components in response to rail excitation at high speeds. The parameters and characteristics of the research cars and statistics of track geometry are being used to validate the mathematical model with actual measurements. This dynamic railcar simulation program will be subject of a separate comprehensive report. The purpose of this report is to present in summary form the progress achieved thus far on this program.

0129
RESEARCH REQUIREMENTS, SURVEY OF THE RAPID RAIL INDUSTRY
McGean, T. J., Mitre Corporation, McLean, Virginia, UMTA Report TRD-90-71, June 1971, 99 p, Available: NTIS, PB 204438

The major problems existing today in the rapid transit industry have been assessed by interviewing all properties in the United States and Canada and surveying major suppliers of transit equipment. The results of these surveys have been used to identify fruitful research areas for the Urban Mass Transportation Administration's rapid rail research program. The report includes complete survey results and rapid rail research recommendations. It also discusses the impact of present and planned research and development programs upon these problems.

0130
A 101 TYPE RAIL FASTENING DEVICE (THE NEW TOKAIDO LINE STANDARD TYPE) FOR P.S. CONCRETE SLEEPER
Minemura, Y., and Ichikawa, S., Japanese National Railways, Technical Research Institute-Quarterly Report, Vol. 5, No. 4, Dec. 1964, p 35

0131
INVESTIGATION OF LATERAL STRENGTH OF RAIL FASTENINGS ON TOKAIDO TRUNK LINE BETWEEN FUJIEDA AND SHIMADA BY LATERAL FORCE TESTING CAR
Minemura, Y., and Ichikawa, S., Japanese National Railways, Technical Research Institute-Quarterly Report, Vol. 5, No. 2, June 1964, p 50

0132
FEASIBILITY STUDY FOR A WHEEL-RAIL DYNAMICS RESEARCH FACILITY
Milenkovic, V., and Poczatek, J. J., General American Transportation Corporation, General American Research Division, Niles, Illinios, Dec. 1968, 180 p, Contract DT-7-35363, Available: NTIS, PB 182472

The principal objective of the program is to determine the most suitable form of laboratory apparatus required to significantly advance the current knowledge of wheel-rail dynamics, and to establish the safe upper-limit speed for those wheel-rail combinations which hold promise of achieving speeds up to 300 mph. What is sought here is a versatile piece of equipment or equipments capable of accommodating as many of the rail vehicles, suspension systems, mating tracks and/or models or components thereof, as might reasonably be of interst, and being able to evaluate their merits or deficiencies either in component fashion, in scale-model fashion, or in full-scale systems fashion. Such equipment must be both technically feasible and practical, and economically justifiable.

0133
RESEARCH REQUIREMENTS SURVEY OF THE RAPID RAIL INDUSTRY
See 0129

0134
HOW HIGH CAN TRAIN SPEED IN INCREASED - A REVIEW OF PRESENT AND FUTURE
Matsudaira, T., Railway Technical Research Institute, JNR, Tokyo, Japan

0135
HIGH PRIORITY RESEARCH TASKS FOR HIGH SPEED GROUND TRANSPORT, PART II
Massachusetts Institute of Technology, Cambridge, Mass., June 15, 1965, 73 p

Their purpose is to establish the current state of the art, to determine which lines of attack are technically promising, to ascertain the practical and theoretical feasibility of various design alternatives, and to extend the state of present knowledge to the point where the design of an HSGT system will be a practical possibility. The purpose of the design studies is to generate alternative ideas and proposals for network configuration, access methods, guideway structures, vehicle designs, propulsion, suspension, control, communication, and all other components of the system.

0136
SURVEY OF TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT, PART I
Massachusetts Institute of Technology, Cambridge, Mass., June 15, 1965, 484 p

This report presents the results of a research planning study initiated at MIT on Sept. 16, 1964, in support of the Northeast Corridor Transportation Project of the United States Department of Commerce. The objective of the Northeast Corridor Transportation Project is to determine the facilities that will be needed to transport passengers and freight in the region extending roughly from Boston, Massachusetts to Washington, D. C. in the era of 1980 and thereafter. This includes study of both technological and non-technological aspects of transportation; analysis of transportation needs and related demographic and economic forecasts for the region; and consideration of the interaction between transportation services and their impact on the development of the region as a whole and of its many urban centers.

0137
SECOND PROGRESS REPORT OF CO-OPERATIVE RESEARCH ON WOOD TIES OF THE RAILWAY TIE ASSOCIATION & THE AAR RESEARCH CENTER
Magee, G. M., AAR Research Center, Chicago, Illinois, 1966

0138
CALCULATION OF RAIL BENDING STRESS FOR 125 TON TANK CAR
Magee, G. M., AAR Research Center, Chicago, Illinois, Apr. 1965

The calculated bending stresses in shown in the base of rail at speeds up to 75 mph for six rail sections. Stresses for sections of other weights may be approximated by interpolation. The recommended acceptable working stress which should not result in rail bending or breakage is also shown on this chart for (a) light rail in branch lines where speeds will not exceed 35 mph; (b) jointed rail in main line; and (c) continuous welded rail in main line. It will be noted that no difficulty is anticipated with rail bending or breakage on branch lines at speeds up to 35 mph with rail of 80 lb. weight or heavier; or main line jointed rail at speeds up to 60 mph with 100 lb. rail or heavier; and on main line jointed rail at speeds up to 75 mph or continuous welded rail at speeds up to 70 mph with 115 rail or heavier. The above assumes a standard of maintenance of line and surface to accommodate such speeds. Establishment of the acceptable working stress is a matter of judgment and evaluation of the conditions on an individual railway.

0139
THIRD PROGRESS REPORT OF CO-OPERATIVE RESEARCH ON WOOD TIES OF THE RAILWAY TIE ASSOCATION & THE AAR RESEARCH CENTER
Magee, G. M., AAR Research Center, Chicago, Illinois, 1967

0140
STUDY OF NEW TRACK STRUCTURES DESIGN PHASE II
See 0365

0141
WELDED RAIL ON BRIDGES
Magee, G. M., AAR Research Center, Chicago, Ill., Railway Track & Structures, Nov. 1965, pp 24-26

In a quarter-mile length of welded rail movement due to changes in temperature is confined to the 8 rail lengths at each end, with no movement taking place in the 21 rails in the center section. The action of welded rail on bridges is probably not too much different than that of jointed rail because of the resistance to slippage of rail ends in the joint bars. Consequently, the anchorage being used for jointed rail may be useful as a guide. On ballasted deck bridges, welded rail could be used and anchored in the manner used for open track and no consideration need be given to locating the rail joints off the bridge. On open-deck viaduct spans, anchor every tie for 200 ft each side of any rail joint that falls on the span with two rail spring clips and elsewhere anchor alternate ties with two clips. On open-deck truss spans, box-anchor each tie in the open track for 200 ft at each end of the span. For spans up to 250 ft it would probably be satisfactory to use no anchors on the bridge except for perhaps two rail lengths at the fixed end and leave the span free to expand and contract at the expansion end. On open-deck bridges, the welded rail could be used on timber, concrete or steel-beam trestles for any length of bridge with the same anchor pattern as used on open track if the rail joints fall 200 ft off of the bridge.

0142
WHY THIS WHEEL WANTS TO CLIMB THE RAIL
Magee, G. M., Railway Age, New York, Mar. 6, 1967

0143
RESEARCH AND DEVELOPMENT OF CONTINUOUS WELDED RAIL
Magee, G. M., Welding Journal, Vol. 39, No. 9, Sept. 1960, pp 881-889

0144
WELDED RAIL JOINT FRACTURES AND THEIR EFFECT ON 200 KM/H OPERATION
Matsubara, K., Japan Railway Engineers Association, Tokyo, Japan, Japanese Railway Engineering, Vol. 5, No. 3, Sept. 1964

0145
PRACTICAL CONSIDERATIONS OF RAPID TRANSIT-A SUMMARY OF THE MANCHESTER STUDY
Millar, J., and Dean, J., High Speed Ground Transportation Journal, Vol. 2, No. 3, Sept. 1968, pp 409-422

The comparative feasibility study of transportation modes indicated that any rapid system for Manchester should be steel-on-steel duorail. A rail network evaluation is now being conducted. The value of an improved conurbation rail systems, upgraded, if necessary, to rapid transit standards, will be assessed in relation to potential passenger demand and the costs which may be involved. Studies are being conducted to ensure that sufficient attention is paid to the requirement of bus operation in the planning of redevelopment areas. It is concluded that in the field of public transport, the balancing of the three buchanan variables of environment, accessibility, and investment is just as relevant as ever.

0146
ROCKET TRAIN - CUSHION RAIL
Mechanical Engineering, Dec. 1971, p 40

Cushion rail is a module-carrying vehicle designed to use wheels at low speeds, with an airfoil design to provide a lifting factor at high speeds, using "slippers" at its cruising speeds of 400-450 mph. Never stopping to pick up passengers, cargo, or mail, it would slow down to 100 mph as it ties in with a series of shuttle systems utilizing small module-carrying vehicles, synchronized in speed, locked together, on parallel tracks. The vehicle will resemble an aircraft more than a rail car and will be built to aircraft standards. It will be "locked" into track slots by means of "feet" that resemble pontoons. Cushion rail requires only 5 percent consumption of fuel for takeoff purposes and uses electric motors in the cities. Sound deflectors attached to the track make the system an ideal one for high speeds at ground level.

0147
A MODEL STUDY FOR VERTICAL TRACK BUCKLING
Kerr, A. D., New York University, Department of Aeronautics and Astronautics, Report No. NYU-AA-71-31, Oct. 1971, 31 p, Contract DOT-FR-10019, Available: NTIS, PB 209614

The paper contains a study of two models which represent the mechanism of vertical buckling of a track when subjected to a mechanical or to a thermal compression force, respectively. The postbuckling equilibrium curves and their stability are discussed and a stability criterion is defined. The effect of various track model parameters upon the buckling load or buckling temperature, are shown. The nonlinear equilibrium equations were then linearized. It was found that the buckling loads, or temperatures, obtained from a linearized analysis have no relevance to the actual values obtained from a nonlinear analysis; the difference in results being substantial for buckling temperatures.

0148
SPECIAL STUDY OF PROPOSED TRACK SAFETY STANDARDS
Bureau of Surface Transportation Safety, National Transportation Safety Board, Washington, D.C., Aug. 26, 1971, 32 p

The report recommends that standards not be advanced unless they are objective, compatible with the system, and adaptable to circumstances, including changes in technology. Additional recommendations are directed at methods of strengthening the standards including such items as definitions, and the inclusion of standards for the promotion of saftey at grade crossings and reducing the incidence of rail failure.

0149
CONCRETE RAILWAY SLEEPERS
Neumann, B., The Cement Statistical and Technical Association, Malmo, Sweden, Trans. Cembureau, Aug. 1963, 79 pp

0150
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES). GENERAL PRINCIPLES TAKING INTO CONSIDERATION THE INCREASE IN SPEED AND AXLE LOADS
Office For Research and Experiments, UIC, Report No. 6, Question D72, Utrecht, Netherlands

The report summaries developments which have been published in the five preceding documents on this topic. Conclusions regarding the entire study are divided into three ranges of speed in relation to three criteria: security, comfort and maintenance: first: for V is less than km/h where security appears to be the most restrictive condition; second: for 40 is less than V is less than 160 km/h where comfort seems to be the most restrictive and which decides the limit of speed on a turnout according to the actual design of the switches; third: for V is greater than 160 km/h where maintenance and layout assume the greatest importance in proportion to the costs they involve in the general economy.

0151
ON DEVELOPMENT OF ELASTOMERIC TIE-PADS
Oliver Tire & Rubber Company, San Francisco, California, BART Report on Contract No. Z-434

0152
MAINTENANCE OF TRACK OF NEW TOKAIDO LINE
Oka, Y., Japan Railway Engineers' Association, Tokyo, Japan, Japanese Railway Engineering, Vol. 8, No. 1, Mar. 1967

0153
STRESSES IN THE RAILS, THE BALLAST & THE FORMATION RESULTING FROM TRAFFIC LOADS
Office for Research and Experiments, International Union of Railways, No. 18, Jan. 1964, Utrecht, Netherlands

0154
GO TRANSIT
Ontario Department of Highways, Downsview, Canada, Apr. 1968, 36 p

A semi-technical description is provided of the Government of Ontario transit rail commuter system, an experiment in the use of existing railway lines for rapid commuter operations, in order to reduce the rush-hour strain on the main highway arteries. Briefly, it describes: the formation of the trasportation study, the search for solutions, the crystallization of the commuter concept, the equipment, stations, fares and ticketing, scheduling, trackwork and signalling, and equipment servicing and maintenance.

0155
STANDARDIZATION OF TRACKWORK PLANS
American Railway Engineering Association, AREA Bulletin, Vol. 64, No. 577, pp 433-434

This committe submits the following report of progress in connection with the standardization of trackwork plans. Plans for five new standard turnouts were submitted and approved for recommended practice. Also published and issued for inclusion in the Manual were the various other AREA plans incorporating revisions in switch details. A study was made of the method used in calculating the recommended maximum speeds of trains through level turnouts. The AAR research staff made a study as a result of the investigation on standardization of turnouts. The formula developed by them used the angle of impingement at the point of switch, and a experimentally determined maximum lateral acceleration for comfortable riding, to develop the permissible speed through the switch. Speeds calculated by this method were compared to the recommended speeds now in the Manual and were found to be similar. Revisior of a plan covering switch stands was recommended.

0156
PERMANENT WAY WORK-A PROGRESS REPORT
A.R.E.A. Bulletin, Vol. 70, pp 814-822

Track maintenance techniques used by the British Railways are described and maintenance schedules are shown. Maintenances costs are shown as a function of track design, maximum speed, and number of trains per day.

0157
LETTER REPORT TO KENNETH LAWSON
Department of Transportation, Office of High Speed Ground Transportation, from Association of American Railroads, Oct. 23, 1968

0158
INVESTIGATION OF RAIL FASTENING ASSEMBLY
AAR, Chicago, Illinios, for Railroad Rubber Products, Inc., March-May 1966

0159
II FIELD TESTS FOR BATTER OF END-HARDENED RAILS IN SERVICE ON THE CHESAPEAKE AND OHIO RAILWAYS
A.R.E.A. Bulletin, Vol. 44, pp 611-621

A series of reports are presented for various aspects of rail, including field tests for batter of end-hardened rail, examination of rail for weeping cracks, control cooled rail with in-service failure and comparison of drop and bend tests.

0160
STABILIZED BALLAST INVESTIGATION
Magee, G. M., Association of American Railroads, Chicago, Illinois, Final Report, Aug. 1969, 89 p, Contract DOT-FR-3-0254, Available: NTIS, PB 192720

The purpose of the investigation was to evaluate the ability of a compound to enhance the load resistant characteristics of conventional stone ballast. This compound, an emulsion based on a new butadiene-styrene block copolymer, was sprayed on the stone ballast of a short section of railroad track. A second section of track, similar but untreated, provided the sample of conventional construction. In the conduct of the investigation pulsating, single point, vertical loads varying from 5000 lbs. to 50,000 lbs. (and to 75,000 lbs. in some cases) were applied to, first the untreated track and, then, the treated specimen in a uniform manner for 4,000,000 cycles. The treated ballast was finally subjected to 11,000,000 vertical stress cycles. Static lateral stress was also applied to each section. Comparisons established through this study are, conservatively stated, that the permanent settlement of ties supported on the untreated ballast was 10 times that recorded for the ties of the treated ballast test phase. Resistance to lateral displacement was, at least, five times greater for the treated specimen than for companion.

0161
COMPOSING SUBGRADE OF RAILROAD TRACK
American Railway Engineering Association, Chicago, Illinois, A.R.E.A. Proceedings, Vol. 13, 1912, pp 392-396

0162
SPECIAL REPORT ON FIELD TESTS ON CONTINUOUS WELDED RAIL ON GREAT NORTHERN RAILWAY
A.R.E.A. Bulletin, Vol. 60, No. 549, pp 642-653

The maximum stress developed in the rail due to temperature, bending and braking of the train

will be well below the yield strength of the rail steel. Its average yield strength is approximately 70,000 psi. The temperature stress measurements show the maximum compressive stress averages 13,300 psi at a rail temperature of 126 deg. This occurred with the rail temperature approximately 65 deg above the laying temperature. With the rail at 40 deg below zero the temperature stress would be approximately 20,000 psi tension. Adding to this a bending stress in the base of the rail of 27,300 psi and a longitudinal tensile stress of 3,120 psi developed in the rail under jackknifing locomotives, gives a maximum combined tensile stress of 50,400 psi. There are no experimental data available on the amount of compressive forces necessary to buckle a section of track. However, it appears that the buckling forces that were measured due to braking were very nominal.

0163
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES). FACTORS AFFECTING THE CONSTRUCTION OF COMMON AND OBTUSE CROSSINGS
Office for Research and Experiments, UIC, Interim Report, Question D72, Utrecht, Netherlands

The present document studies the choise of a geometry and a construction for common and obtuse crossings. The choice of geometry, for safety and for comfort, takes account of the incidence of high speeds and heavy axles on common and obtuse crossings, and the consequences, on obtuse crossings of a current tendency towards the reduction of wheel diameters. The choice of construction is of prime importance with speed and tonnage. Two methods of construction, one of which has the advantage of a long experience, are described with their respective characteristics.

0164
LATERAL STABILITY OF RAILS, ESPECIALLY OF LONG WELDED RAILS
Office for Research and Experiments, UIC, Interim Report, Question D14

This report discusses the results of a questionnaire to determine the state-of-the-art of welded rail. The report also includes discussion of the history of the uses of long welded rail, and tests to determine the characteristics of such rail under varying climatic conditions. The report also covers track buckling tests at Karlsrule and London in the late 1950's and includes a chapter on the characteristics of track incorporation long-welded rail. Various theories on the stability of long welded rails are covered briefly, and an extensive bibliography is included.

0165
THE DIESEL ENGINE AS NOISE SOURCE
ORE Publication, No. 28, pp 33-35

This report is the result of an investigation into the noise generated by a diesel engine. The various noise sources were located. The contribution to the overall noise level is described and suggestions are made to minimize these noises by engine redesign, which will surmount the portions producing the greater amounts of noise with sound-absorbent material.

0166
NOISE DEVELOPMENT IN STEEL RAILWAY BRIDGES
Office of Research and Experiments, UIC, Publication Report No. 24, Question E 82

Measurements were made at the following characteristic points: on the bridge, 2 m laterally from center of track 2 m above rail level; 25 m laterally from bridge, 1.6 m above ground; and below the bridge, 1.6 m above ground. The frequency spectra have been recorded. A survey is given of the noise levels emitted by 16 bridges, the latter being classified according to method of track laying. A outline of future tests is given. The track will be sound proofed before the tests are run.

0167
NOVEL FEATURES ON LINDENWOLD LINE
Pinkham, R. E., Port Authority Transit Corporation, Camden, New Jersey, ASCE Transportation Engineering Journal, Vol. 98, No. TE2, May 1972, Paper 8892, pp 367-385

The new Lindenwold high speed rapid transit line between Philadelphia, Pa and suburban Lindenwold, N.J. covers 14.5 miles and owns 75 new, high speed, automated cars. Parking facilities for over 8,600 autos are provided at suburban stations. All stations are unmanned, but are protected by closed circuit television. Tickets are sold by vendors and collected by electronic turnstiles. The right-of-way is fully grade separated, either on conventional fill or on reinforced concrete elevated structures. Running rails are 132 lb and are fully welded.

0168
ACOUSTICS STUDIES
Parsons Brinckerhoff-Tudor-Bechtel, San Francisco, California, June 1968, 105 p, Contract TR-8, Avaliable: NTIS, PB 179353

The report documents the noise and vibration studies for the Bay Area rapid transit District system. Several of the studies involved the investigation of new concepts of noise and vibration control, such as the use of sound barrier walls (often called sound barriers or parapets) along the right-of-way, wheel damping, rail damping, and the use of rail fasteners incorporating vibration-reduction and noise-reduction features. Considerable effort was expended in determining the rank order of the various important sources of noise produced by steel-wheel vehicles passing over steel rails.

0169
ADHESION CHARACTERISTICS
Parsons Brinckerhoff-Tudor-Bechtel San Francisco,

California, Final Technical Report, Aug. 1968, 183 p

The report discusses the phenomenon of adhesion as it applies to the theoretical and operational performance of railway wheels in contract with rail. The term adhesion refers to the tangential friction force developed at the wheel-to-rail contact area; this force is active during acceleration, deceleration, and maintenance of train speed. The ratio between the adhesion force and the normal load transmitted by the wheel to the rail is called the coefficient of adhesion (analogous to coefficient of friction). The objectives of the study were to establish the adhesion limits anticipated on the BART system, taking into consideration significant variables, and to provide a general source of adhesion data for the transit industry. As background for the second objective, a history of the laws and theories of friction and a summary of railway adhesion research are included.

0170
SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT DEMONSTRATION PROJECT, SUMMARY
Parsons Brinckerhoff-Tudor-Bechtel, San Francisco, California, Final Report, Jan. 1970, 73 p

The San Francisco Bay area rapid transit district demonstration project was conducted on a four and one-half mile test track. The purpose of the demonstration project was to test and evaluate new technical concepts in the field of rapid transit. These concepts included a variety of advanced hardware as well as completely automatic train control and automatic fare collection systems.

0171
AERIAL STRUCTURE AND RAIL SUPPORT METHODS
Parsons Brinckerhoff-Tudor-Bechtel, San Francisco, California, 1966, 45 p

The report describes a series of tests conducted as part of the development of the Bay Area Rapid Transit District (BARTD) system. The subject tests were performed primarily to evaluate rail fasteners and to determine their suitability for use on concrete aerial structures of advanced design. Specifically, the fasteners were evaluated in terms of their ability to maintain electrical isolation, reduce noise levels, and provide the safest and most economical system of hardware available. Upon completion of initial investigations, a totally new concept in the installation of rail fasteners and associated hardware on concrete aerial structures was tested. Additionally, several types of concrete tie were evaluated for performance under the conditions imposed by the selected BARTD system.

0172
TEST INSTRUMENTATION
Parsons Brinckerhoff-Tudor-Bechtel, San Francisco, California, Final Technical Report, May 1968, 70 p

The report describes the test instrumentation system and measuring devices used for testing and evaluating the various components of rapid transit hardware.

0173
CONCRETE FOR RAILWAYS
Portland Cement Association, Chicago, Illinois, PCA Bulletin No. 60, 1964

0174
THE EXPERIMENTAL DETERMINATION OF RAIL FASTENER DURABILITY UNDER CYCLIC LOADING
Prause, R. H., and Vorhees, J. E., Battelle, Columbus Laboratories, Columbus, Ohio

0175
DISCUSSION OF EUROPEAN CONCRETE CROSSTIES
Gomez-Perez, F., and Kunze, W. E., Journal of the Structural Division, New York, Proceedings of A.S.C.E., Vol. 88, No. ST 4, July 1962

0176
a) BUCKLING OF CURVED TRACK
b) MUD-PUMPING AND SETTLEMENT OF ROADBED
b) Nishiki, T., and Muromachi, T, a & b) Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Rpt. Nos. 1a and b

0177
WORK INTENSITY & RATIONALIZATION OF TRACK MAINTENANCE OPERATION
Hida, M., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Rpt. No. 3a

0178
ABRASION OF RAIL & TIRE HARDENED BY HIGH FREQUENCY INDUCTION IN DRY CONDITION
Yagi, A., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 3b

0179
ECONOMICAL LENGTH OF RAIL
Shinohara, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 3c

0180
STRESSES AT RAIL JOINTS AS INFLUENCED BY BOLT HOLES
Sasaki, N., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 6a

0181
LATERAL PRESSURE MEASURING CAR - YA-200
Tanahashi, H., and Shinoda, S., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 6c

0182
EXPANSION OF LONG RAIL OBSERVED IN FIELD
Hoshino, Y.; Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 7a

0183
SECTIONAL SHAPE OF RAIL AND ITS ABRASION
Sasaki, N., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 7b

0184
LOAD-FACTOR, STRUCTURE-FACTOR AND CONDITION-FACTOR OF RAILWAY TRACK
Satoh, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 7c

0185
ABRASION TEST OF HIGH MANGANESE TURNOUT
Yagi, A., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 12a

0186
ASPHALT PRECOATED CRUSHED STONE BALLAST
Satoh, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 12b

0187
HIGH SPEED TESTS FOR NEW TOKAIDO LINE
Tatematsu, T., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 12c

0188
LABORATORY INVESTIGATION OF RAILROAD BALLAST
See 0471

0189
ON THE RAIL CREEPAGE
See 1250

0190
JNR'S NEWLY DESIGNED RAIL SECTIONS
Sasaki, N., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 14a

0191
A VERY LONG RAIL LAID ON BRIDGE
Fukazawa, Y., and Onishi, A., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 14c

0192
HOW TO CHOOSE PROPER SURFACE SOILS FOR ROAD-BED
Nishiki, T., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 15a

0193
DROP TEST OF RAILS
Satoh, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 15b

0194
ON HIGH FREQUENCY VIBRATION OF TRACK
Sato, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 16a

0195
MAXIMUM VALUE OF TRACK IRREGULARITY
Hiroi, J., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 16b

0196
DESIGN OF RAIL FASTENINGS
Minemura, Y., Permanent Way Society of Japan, Vol. 6, No. 2, June 1963, pp 1-18

Fastening methods are described which are Japanese National Railroads and various designs of rail fastenings were manufactured and tested; strength and performance conditions of design were studied. Performance conditions of conducted in regard to resistivity of given fastening to creep of rail, vertical spring constant, lateral spring constant, break load, electric insulation, spring constant of rail pressing spring, deflection, distribuion of stress, strength of parts, ect. Relationships between lateral pressure of 3 tons and 6 tons and fatigue limit are shown.

0197
THE RIDING QUALITY OF A TRAIN PASSING A CURVE AS DETERMINED BY SUPERELEVATION AND CENTRIFUGAL FORCE
Koyama, M., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 17b

0198
RESIDUAL STRESSES IN THE RAIL
See 1017

0199
HOW TO PREVENT RAIL FAILURES WHICH CAUSE TRAFFIC DISTURBANCE
See 0731

0200
TESTS WITH REGARD TO IMPROVING THE INSULATION OF STRESSED CONCRETE SLEEPERS BY MEANS OF EPOXY RESIN
Deutsche Eisenbahntechnik, No. 5, May 1964, pp 226-228

0201
ON TEST OF PRESTRESSED CONCRETE SLEEPER FOR FROST-HEAVING SECTIONS
Miura, I., and Iwasaki, I., Permanent Way of Japan, Tokyo, Japan, Permanent Way, Report No. 28a

0202
RAIL FASTENING DEVICES FOR FROST-HEAVING SECTIONS
See 0680

0203
RAIL ANCHOR RESISTANCE IN TRACK
Pennsylvania Railroad, Test Report of Test 767, Oct. 1961, 17 p

Six panels of track were tested at two locations. Resistance to rail anchors was developed by applying a longitudinal load to the end of each rail in a panel of track; this load was transmitted through rail anchors and ties to ballast. The load

was applied by means of two hydraulic jacks and manually operated hydraulic pump. The panels at Lewistown having every tie anchored failed at a total load of 32,000 pounds while the panel having alternate ties anchored failed at 29,000 pounds. Panels at Parkersburg having every tie anchored failed at an average total load of 20,000 pounds while the panels having alternate ties anchored failed at an average total load of 18,000 pounds. Actual resistance to longitudinal movement, per panel, depends on type and quality of track structure.

0204
RAIL LAID WITHOUT EXPANSION ALLOWANCE VS. RAIL LAID WITH NORMAL EXPANSION ALLOWANCE
Pennsylvania Railroad, Progress Report, Test 510

The purpose of this test is to determine by service test the practicability and advantages of laying end hardened rail without expansion allowance and with joints "frozen", as a means of reducing rail end impact and noise, and rail end batter. The design and laying of the test track is described. Walking inspections and observations of the test during the recording of field data have indicated superior surface and rail end condition of the tight rail as compared with the standard. Riding the Aero Train, which was noticeabley noisy, showed a lower level of joint noise on the tight rail. The joints in the tight rail have lost less camber than those in the standard rail. During nine year's service it has been determined that rail laid without expansion offers reduction in joint bar wear and reduction in loss of joint camber as well as a better maintained track for equal expenditure.

0205
RUBBER TIE PADS UNDER CROSSING FROGS
Pennsylvania Railroad, Test Report , Test 628

The purpose of this test was to determine if rail abrasion pads applied between tie plates and crossing frogs and anchor seal pads applied between timber and tie plates in railroad crossings would result in reduction of noise, improved riding conditions, reduced maintenance, and increased life of frogs and timber foundations. The test locations are in heavy-tonnage tracks and in high speed territory. The frogs at Valparaiso developed considerable batter and tread wear after a very short period in track. Chipping and cracking of the castings was observed within six months. The pads were in long enough to determine that they did not have sufficient rigidity to withstand the large forces to which they were subjected. Both anchor seal and rail abrasion pads were deformed and torn. The crossings in both tracks at Orrville have given satisfactory service. There has been little difference in maintenance required for the crossings with and without pads. There was no significant reduction in noise to be realized from the use of pads. The use of tie pads will prevent tie plate penetration into crossing timbers.

0206
DESIGN OF NEOPRENE BRIDGE BEARING PADS
NEOPRENE STRUCTURAL BEARINGS & MOUNTING PADS
DuPont Company, Wilmington, Delaware, Reports dated 1953 and 1966, respectively

0207
THE EFFECT OF FORCES ON THE RAIL JOINTS, AND THE NOSE-SUSPENDED MOTOR DRIVES OF LOCOMOTIVES
Hendel, H., Deutsche Eisenbahntechnik (Berlin), Jan. 1972, p 31. In German.

With the help of an analogue computer, the author analyses the reciprocal effects in relation to the speed, the unevenness, and the resilience of the joints. It is concluded that there is close interdependence between the quality of the motor suspension and the reaction on the motor axle.

0208
INHERENT TENSIONS IN TYPE S49 RAIL-JOINT WELDS
Enken, H., Menz, K., and Vogel, H., Signal und Schiene, No. 11, 1971, p 396. In German.

0209
RAIL FASTENINGS FOIL TRACKS CARRYING HEAVY TRAFFIC
Eisenmann, J., Stahl und Eisen, Nov. 11, 1971, pp 1313

0210
DEVELOPMENT TRENDS IN TRACK CONSTRUCTION
Munch, W., Railway Technical Review, No. 12, Dec. 1970, pp 22, 24, 28, 30

Conventional to continuous welded track, normal-resistent steel for fish-plate jointing to advantageously weldable profiled heaviest rails, wooden and steel sleepers to concrete, resilient fastenings, and concrete deck are discussed.

0211
BALLASTED PERMANENT WAY WITH TIMBER SLEEPERS ON UNDERGROUND AND METRO RAILWAYS
Kuhn, F., Holzschwelle, No. 67, Apr. 1971, pp 27-39

A review of permanent way systems with sleepers and their various kinds of fastenings is presented.

0212
ELECTRICAL CORROSION OF FASTENINGS
Zibzibadze, S. E., Putj i Putevoe Hoziaistvo, Mar. 1968, pp 24-25. In Russian.

0213
AN IMPROVED TYPE OF K PERMANENT WAY FOR WOODEN, CONCRETE AND STEEL SLEEPERS BY USING A NEW RESILIENT ELEMENT
Baseler, W., Eisenbahning, Apr. 1969, pp 105-106. In German.

0214
STEEL SLEEPER PROGRESS
Railway Gazette, Vol. 125, No. 5, Mar. 7, 1969, pp 178-179

0215
PERFORMANCE OF LAMINATED RAIL-JOINT BEECH SLEEPERS
Shimizu, K., Railway Research Report No. 4, Dec. 1969, pp 198-200

0216
RAIL SEATINGS ON CONCRETE SLEEPERS
Schmitz, H., Eisenbahning, Dec. 1969, pp 353-356. In German.

Rail fastenings, rubber interlays, and a fastening for stressed concrete sleepers are discussed.

0217
COLOGNE'S MODERN PERMANENT WAY PROGRAM (II) COLOGNE
Braitsch, H., Verkehr & Technik, Sept. 1969, p 242-243, 246. In German.

0218
REHABILITATION OF STEEL SLEEPERS
Astley, H. T., Railway Gazette, No. 5, Mar. 7, 1969, p 176-177

Sleepers with worn rail seats reclaimed by welding on plates incorporating Pandrol fastenings are discussed.

0219
A NEW RAIL FASTENING ON REINFORCED CONCRETE SLEEPERS
Basiewicz, T., Signal and Schiene, Mar. 1969, pp 102-104. In German

A description is given of altered K type fixings: the dowel fastening; the fastening without dowels, the screw fastening, and the elastic S rail fastening. The principle is based on the adhesion of two U-shaped clips that actually fix the position of the rail.

0220
THE OPERATIONAL QUALITIES OF D-2 FASTENINGS
Gaidamaka, P. S., Putj i Putevoe Hoziaistvo, Aug. 1968, pp 8-9. In Russian.

0221
NEW TOKAIDO LINE
Fujii, M., Proceedings of IEEE, Vol. 56, No. 4, Apr. 1968, p 625

0222
BEAMS ON ELASTIC FOUNDATION
Hetenyi, M., University of Michigan Studies Scientific Series Volume XVI, The University of Michigan Press, Ann Arbor, Mich., 1946, pp 27-30

The theory of beams on elastic foundation was first used to calculate stresses and deflections of railroad tracks. In modern crosstie systems only the ties are continuously supported by the roadbed. Investigations have shown that an equivalent continuous elastic foundation can be substituted with good approximation for such supports, and in this way the theory can be applied to the analysis of the rails themselves. If such elastic supports are sufficiently closely spaced along the rail they can be replaced by a continuously distributed imaginary foundation, where the modulus $k = D/a$, a is the spacing of the ties and D is the spring constant to be determined experimentally. The moment diagram of a beam of unlimited length subjected to a single concentrated force is shown and analyzed, first, as resting on separated elastic supports and, secondly, as supported on an equivalent elastic foundation. The agreement between the deflection lines is close and the differences are insignificant. In the case of a railroad track the ballast and underlying subsoil represent a continuity between the deflection of neighboring points. If D is the same for every ties, wheel load $P = D\sum yi$. This value of D is about half the value obtained when only a single tie is loaded. Experiments carried out on normal track (length 8-9 ft., cross section 8 x 6-9 x 7 in., spacing 24-30 in. on centers; ballast of crushed stone of average depth 14 in.) gave D = 48,000 lbs./ in to 60,000 lbs./in., and k = 1400 lbs./in.^{2} to 2000 lbs./in.^{2} The k_0 modulus of the foundation of the ties equals 110 to 130 lbs./in^2/ in.

0223
REPORT OF STRAY CURRENT ANALYSIS
REPORT OF CORROSION SURVEY
MASS TRANSPORTATION SYSTEMS
The Hinchman Company, Detroit, Michigan, Reports dated Oct. 1966, Aug. 1967, and Oct. 1977, respectively

0224
EFFECTS OF PRODUCTION METHODS ON RESIDUAL STRESSES IN COMPLETELY QUENCHED RAILS
Konyukhov, A. D., Rabinovich, D. M., and Vinokurov, I. Y., Stal, No. 6, June 1969, pp 555-558

Complete quenching sets up high residual stresses in rails. Tempering lowers then while only slightly reducing rail hardness. Straightening after quenching and tempering again raises the residual stresses, making the rails prone to fracture along the neck. This is due to plastic deformation during straightening in the vertical plane, and to lower the residual stresses the maximum bending deflection should be limited. The increase in the residual stresses is then compensated by the high strength values of steel obtained by quenching.

0225
EFFECTIVENESS OF ALLOYING RAIL STEEL WITH CHROMIUM
Kazarnovskii, D. S., Shnaperman, L. Y., Kravtsova. Ravitskaya, T. M., Pavlenko, Y. P., Skvortsov, I. P., and Shvarts, Y. F., Stal, No. 9, Sept. 1969, pp 828-830

Service tests have proved that type R-50 railway rails made of steel containing 0.63 to 0.75% C and 0.7 to 1.0% Mn and alloyed with chromium (0.5 to 1.0%) have an increased (by a mean 25%) resistance to contact-fatigue defects, less wear per 100 million gross tons of freight, and less rippling of the surface after use than carbon steel rails of standard composition. These advantages are obtained if the total C and 1/4 Mn content of the steel is not lower than 0.88%.

0226
ELECTRIC CONDUCTIVITY OF ASPHALT LAYER IN RAILROADS CONSTRUCTION (ELEKTRISCHE LEITFAEHIGKEIT VON ASPHALTBELAEGEN FUER DEN EISENBAHBAU)
Kaegler, S. H., and Stever, F. W., Deutsche Shell AG. Hamburg, West Germany, Bitumen, Vol. 31, No. 5, 1969, pp 136-140

Electric actuation of railroad signals assumes existence of sufficient electric resistance between rails. Measurements of electric conductivity of asphalt-concrete and mastic asphalt have been carried out. Superiority of mastic asphalt has been ascertained. In German.

0227
CONTROL OF RAILROAD WHEEL SCREECH NOISE
Kirschner, F., International Congress on Acoustics, 6th, Tokyo, Japan-Reports, Vol. 4, Aug. 21-28 1968, Paper F-2-7, pp 61-64

Control of screech noise generated by railroad wheels on sharp curves has been attempted with many auxiliary treatment; efforts have been made in United States to apply newly developed, high efficiency, viscoelastic materials for suppression of screech noise, first on model wheels, then in laboratory experiments, and finally in field trials; results of study are reported in detail; in general, at least 24 db reduction in screech noise is described.

0228
TURNOUTS AND EXPANSION JOINTS FOR NEW SANYO LINE
Kurokochi, H., and Kagami, M., Permanent Way, Vol. 13, No. 2, Sept. 1971, pp 11-16

Report of the results of tests of a new turnout and expansion joint specially designed for use with 60 kg rails in New Tokaido and New Sanyo Lines. The new turnout and new expansion joint were installed and tested in the compound of New Tokaido Line Toyohashi Station.

0229
SURFACE-STRATUM FAILURE OF SANDY SLOPE
Kobashi, S., Imai, T., Imai, S., and Kusano, K., Railway Technical Research Institute-Quarterly Report, Vol. 12, No. 3, Sept. 1971, pp 121-124

The shallow surface stratum failures of a sandy slope are classified into a failure caused by the piping phenomenon and a kind of flow failure. There is a critical density to cause the flow failure of sandy soil. A new theory of the method to estimate the level of porewater pressure in the surface stratum under a given rainfall condition is presented.

0230
NEW TOKAIDO LINE TEST TRACK NEARS COMPLETION
Kato, I., Japanese Railway Engineering, Vol. 3, No. 1, Mar. 1972, p 30

0231
SCANNING ELECTRON MICROSCOPY OF EARTHQUAKE-INDUCED RAIL FRACTURES
Murr, L. E., Hodgkin, N. M., and Lowe, B. V., University of Southern California, Los Angeles, Metallography, Vol. 4, No. 6, Dec. 1971, pp 477-486

This investigation has as its purpose a somewhat systematic scanning electron fractography study of railroad-rail fracture resulting from stresses induced by earth movements associated with an earthquake measuring 6.6 on the Richter scale which struck the Los Angeles, Calif, area on Feb 9. 1971, having a primary shock duration ranging from 1 to 2 min.

0232
ELECTRICAL HEATING OF RAILWAY POINTS
Mawet, M. J., Copper, No. 5, 1971, pp 24-25

The heaters are attached by strips held in position by the existing permanent-way coach screws and small bolts through the rails. This form of heating can be readily fixed in position with considerable ease and the only precaution to observe is that the mating surfaces are thoroughly cleaned and the element attached as closely as possible to the rail.

0233
INVESTIGATION OF STRESS DISTRIBUTION IN RAILROAD TRACK FOUNDATION AS FUNCTION OF LOADING-BODY SURFACE (BADANIE ROZKLADU NACISKOW W PODLOZU W ZALEZNOSCI OD POWIERZCHNI NACISKAJACEGO BLOKU)
Mazur, S., Arch Inzynierii Ladowej, Vol. 16, No. 2, 1970, pp 333-342

The test results are reported on the subsidence and stress distribution in a layer of crushed stone ballast indented by blocks of various shapes-with rectangular cross-section and variable width, with T-shaped cross-section, and with curved bottom surface, both convex and concave. The blocks were loaded axially and excentrically. A special testing bench was used with a modeling foundation of Winkler type. Some interesting relationships have been found to hold. In Polish.

0234
STUDY OF NEW TRACK STRUCTURE DESIGN, PHASE I
See 0363

0235
DYNAMIC LOADING AT RAIL JOINTS
Nield, B. J., and Goodwin, W. H., Railway Gazette, Vol. 125, No. 16, Aug. 15, 1969, pp 616-619

Comparative tests carried out by British Railways research staff suggest that unsprung mass can have large but predictable effect on dynamic wheel load. Scope of work was confined to single pair of opposite rail joints selected in electrified line, each showing approximately 13 mm dip in unloaded condition. Two pairs of opposite rail joints, few rail lengths apart in same running line were selected

for instrumentation; analysis of interaction between rolling unsprung mass and dipped rail joint was carried out.

0236
ON THE EFFECTS OF THE TRACK PADS LAID IN THE RAILWAY TRACK ON SOLID BED
Ono, K., and Ito, Y., Proceedings of the Japan Society of Civil Engineers, No. 192, Aug. 1971, pp 99-110. In Japanese

0237
DEVELOPMENT OF A RAILROAD ROUGHNESS INDEXING AND SIMULATION PROCEDURE
Pursifull, L. J., and Prothro, B. E., U.S. Naval Research Laboratory-Shock & Vibration Bulletin, No. 39, pt. 6, Mar. 1969, pp 47-55

To simulate rail vehicle performance on an analog computer to study shock and vibration characteristics of various rail and cargo configurations, input must be provided representing the roughness characteristic of the rail surface. Methods for measuring and simulating rail surface roughness are described which resulted in a recommendation to use a white noise generator to provide the required inputs. Measured accelerations on cargo were found to approximate the characteristics of white noise.

0238
ADHESION CONTROL IN HIGH-SPEED WHEEL-RAIL INTERACTION
Paul, I. L., Massachusetts Institute of Technology, Cambridge, Mass., Joint ASCE-ASME Transportation Engineering Meeting, Seattle, Washington, July 26-28, 1971, 27 p

The paper presents experimental findings on a rolling contact apparatus and discusses a potential approach to improve the adhesion limits at high speeds by controlling the microvibrations in the contact area. Experiments were performed on the model rolling contact apparatus. The test wheel is driven by the 10-in. diam simulated track wheel. A braking torque can be applied to the test wheel by an air-brake through a timing belt pulley.

0239
ON THE RELATIONS BETWEEN SUPERELEVATION AND CAR ROLLING
Nakamura, I., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 14b

0240
DYNAMICS OF RAILWAY TRACK SYSTEMS AND THEIR ECONOMIC CONSEQUENCES
The Railway Gazette, Vol. 126, Jan. 1970, pp 19-24

British Railways has adopted concrete sleepers and continuous-welded rails as the best means to provide a high performance low annual cost track. Assessing the dynamic loading effect of different axles at different speeds on a less than perfect joint has been done and has produced a very close confirmation between field measurements and a previously calculated formula. Over 50 percent of the rail breaks occur in rails which are not more than ten year old, by which time none have reached the replacement stage due to loss of weight. Maximum bolt-hole stresses occur at the second running-on bolt, but rail-end failures start at the first bolt-hole. The joint consideration of the track and vehicle circumstances has resulted in the design of a three-axle bogie which not only increases the payload by 9 tons for a 2-ton increase in tare weight but reduces the axleload to 13-1/2 tons at an extra cost of less than 2,000 lb. a vehicle. While welded track requires higher installation costs the reduction in day-to-day attention is very marked. Taking 1969 prices, the costs per mile are: (i) long-welded rails on concrete sleepers, 29,000 lb; and (ii) jointed rails timber sleepers, 25,000 lb. But the "equalied" cost per annum is affetced by the relative lives and is considerably less for long-welded rails.

0241
REAL PROSPECTS FOR INCREASED SPEEDS ON THE RAILWAYS
Eisenbahntechnische Rundschau-The Railway Technical Review, Vol. 17, No. 3, pp 65-76

A comparison is made of door-to-door times for automobile, train and plane travel between cities separated by up to 200 Km, 200 to 400 Km, and 400 to 800 Km. The potential for the railways to offer service more competitive in elapsed time to that of air travel is explored. The increase in speed must take into account passenger comfort as well as safety. The closer spacing of ties will improve the riding qualities and provide more favorable stresses in the track structure. The use of curvature of 2400 m radius in switch turnouts to permit speeds up to 140 KM/H is possible. Signalling developments are also considered. The prospects for higher speeds in passenger service on the railways are necessary.

0242
TRACK FOUNDATION DESIGN
Railway Gazette, Vol. 124, Oct. 1968, pp 734-737

Procedure has been evolved for relating the depth between sleeper and sub-grade to the axle loading and traffic speed. This article describes the first phase of an investigation into the effects of cyclic loading upon the behavior of soils in general and London Clay in particular. Derivation of tentative design curves is illustrated relating speed, axleload and depth of track construction to the results obtained when a sample of the subsoil is deformed in a triaxial testing machine applying cyclic loadings.

0243
ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK
Sato, Y., Japanese Railway Engineering, Vol. 5, No. 1, Mar. 1964

0244
ACTION UNDER THE TIE OF A RAILROAD TRACK
Schubert, E., A.R.E.A. Proceedings, Chicago, Illinois, Vol. 7, 1906, pp 105-127

0245
THE EFFECT OF LONGITUDINAL FORCES ON CONTINUOUSLY WELDED TRACK & ON BALLAST
Siekmeier, E. W., Bulletin of the International Railway Congress Association, London, England, No. 625.14(01), July 1965

0246
SIMPLIFIED THREE MOMENT SOLUTION FOR BENDING OF RAILS
Storey, C., Bulletin of the International Railway Congress Association, London, England, Apr. 1957

0247
THE EFFECT OF LONGITUDINAL FORCES ON CONTINUOUSLY WELDED TRACK AND ON TRACK BALLAST
Stekmeter, E. W., Bulletin of the International Railway Congress Association, London, England, July 1965, p 447f

0248
THE LIMITS OF ADHESION
Steiner, B., Railway Gazette, London, England, Apr. 1967, pp 268-273

0249
RAIL DEFECT MANUAL
Sperry Rail Service, Danbury, Conn., Aug. 1966, 3rd Printing, 77 pp, Available: Sperry Rail Service Office

Sperry Rail Service has compiled this fifth edition of the Rail Defect Manual as a part of the technical service, in addition to actual rail testings, supplied to Sperry customers. It is designed to benefit railroad men concerned with track safety and maintenance of the right-of-way. The Sperry Rail Service staff, working with railroad men throughout the country, has spared no effort to make this manual a complete and accurate handbook of rail defects. The material which it contains represents the findings of over 40 years of experience by Sperry Rail Service in the field of rail testing. The manual discussed the following: making steel for rails; control-cooling; end hardening; fully heat treating rails; and testing. Transverse and longitudinal defects in the rail head; web defects, surface defects, base defects, and web defects in the joint area are described.

0250
MODES OF TRANSPORTATION
Solomon, R. J., and Silien, J. S., American Society of Civil Engineers, New York, Aug. 1968, 156 p

The document presents an inventory of modes of urban transportation classified by vehicle types, with subclasses by guideway where applicable. Over 100 vehicle systems which have been demonstrated, or are currently operated, are described and referenced. In addition, 124 proposed systems are listed. A background on vehicle performance and an extensive appendix on rail transit systems is included.

0251
INFLUENCE OF VEHICLE AND DISTRIBUTED GUIDEWAY PARAMETERS ON HIGH SPEED VEHICLE-GUIDEWAY DYNAMIC INTERACTIONS
Smith, R. G., and Wormley, D. N., Oct. 11-14, 1970, 10 p

Modal analysis techniques are used to study the dynamic interactions between a one-dimensional high speed ground transport vehicle model and a guideway consisting of multiple independent spans resting freely on rigid discrete supports. The study includes an evaluation of the effects of variations in the fundamental vehicle and guideways parameters on span maximum dynamic deflections and vehicle heave accelerations. Results of the study indicate that vehicle-guideway dynamic interactions strongly influence both vehicle suspension and guideway span design. System design guidelines are presented in the form of parametric plots in which values of vehicle and guideway parameters required to limit maximum vehicle heave accelerations and guideway dynamic deflections are specified.

0252
PERMANENT WAY TECHNIQUE AND PERMANENT WAY ECONOMY
Schramm, G., Otto Elsner Verlagsgesellschaft, Darmstadt, German, Translation, 1961

This publication deals primarily with standard gauge railways. The topics discussed are: essential features of the permanent way; shapes of rails, rail stresses, design of rail section, and corrugations and roaring rails; wooden, concrete, and steel cross ties, including a comparison of types and stresses in cross ties; ballast material, loads on ballast and formation, ballast profile, and track drainage; rail fastenings; alignment and permissible speeds for changes in gradient, given curvature and superelevation conditions; points and crossings rail joint welding; long-welded rail track; measuring and checking permanant way; and permanent way economy.

0253
TECHNICAL REPORT NUMBER 11, AERIAL STRUCTURE AND RAIL SUPPORT METHODS
San Francisco Bay Area Rapid Transit District, San Francisco, California, 1966

0254
DEFORMATION OF RAILWAY TRACK UNDER HIGH-SPEED TRAIN - MEASUREMENTS ON THE TEST-RUN SECTION OF THE NEW TOKAIDO LINE
Satoh, Y., Railway Technical Research Institute, JNR, Tokyo, Japan, Quarterly Report, Vol. 7, No. 2, 1966, pp. 20-23

0255
TECHNOLOGY FOR HIGH-SPEED GROUND TRANSPORT
Seifert, W. W., and Hansen, R. J., Massachusetts Institute of Technology, Cambridge, Dec. 31, 1966, 53 p

The report summarizes the research accomplished at the Massachusetts Institute of Technology during the period September 16, 1965, through September 15, 1966. The efforts were on networks and terminals, scheduling, vehicle flow control and switching problems, vehicle-suspension problems, propulsion problems, vehicle and tube aerodynamics, and guideway problems.

0256
SUMMARY OF RESEARCH AT MIT ON TECHNOLOGY FOR HSGT
Seifert, W. W., and Hansen, R. J., Prepared for U.S. Dept. of Commerce, Massachusetts Institute of Technology, Cambridge, Mass., 1966, Available: NTIS, PB 173658

0257
SUMMARY OF RESEARCH AT MIT ON TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT
Seifert, W. W., Massachusetts Institute of Technology, Cambridge, Mass., Aug. 31, 1970, 85 p

0258
BAY AREA RAPID TRANSIT
Stokes, B. R., Highway Research Board Special Reports, 1970, pp 3-5

Bay Area Rapid Transit district (BARTD) is a 75-mile dual-rail, rapid transit network with high-speed electric trains serving 33 regional stations in 15 communities. The system's light weight vehicles will be capable of top speeds of 80 mph and operating speeds of 50 mph, including station stops. Power to propel Bay Area Rapid Transit (BART) trains will be 1,000 volts of direct current, supplied to the vehicles from a trackside third rail. In order to insure high operating speeds and eliminate sway, bart tracks are spaced 5 ft. 6 in. apart. The tube is made up of 57 individual tube sections, concrete-lined, and floated into position over a trench dredged across the floor of San Francisco Bay. An automatic train control system, being installed at the Lake Merritt station in Oakland, will be responsible for the starting, stopping, speed levels, door movements, and proper spacing of trains. The computer can make as many as 6,000 command decisions every half second for the control of as many as 105 trains on the network at any one time. The automatic fare vending and collection system is described.

0259
DURABILITY OF ELASTIC RAIL FASTENING DEVICES
See 0846

0260
UNIVERSITY - BLOOR SUBWAY - VIBRATION ISOLATION OF TRACK
Edwards, A. T., Hydro-Electric Power Commission of Ontario, Research Division Report, Interim Report No. CON60-72, June 1960

0261
ST. LOUIS METROPOLITAN AREA RAPID TRANSIT FEASIBILITY STUDY LONG-RANGE PROGRAM. SUPPLEMENTAL REPORT, VOLUME II
East-West Gateway Coordination Council, St. Louis, Missouri, Final Report, Aug. 1971, 34 p

A supplementary report outlines, in some detail, the major components and characteristics of the proposed rapid transit system for the St. Louis metropolitan area, its general design criteria, construction methods, expected patronage, stations, operating characteristics, route descriptions, cost estimates, and the effects of inflation.

0262
ST. LOUIS METROPOLITAN AREA RAPID TRANSIT FEASIBILITY STUDY LONG-RANGE PROGRAM. VOLUME I
East-West Gateway Coordination Council, St. Louis, Missouri, Final Report, Aug. 1971, 130 p

The report represents a long range rapid transit feasibility study for the St. Louis metropolitan area. The purpose of the study was to determine the type of mass transit system or systems most appropriate for St. Louis in the future; to evaluate alternative system configurations and routings; and to provide the community's decision-makers with sufficient information concerning costs, benefits, and related factors to permit selection and early implementation of a plan to guide the development of the area's transit system.

0263
ST. LOUIS METROPOLITAN AREA RAPID TRANSIT FEASIBILITY STUDY: SUMMARY REPORT, ALTERNATIVE TRANSIT SYSTEMS
East-West Gateway Coordinating Council, East St. Louis, Illinois, July 1969, 30 p

The report is the summary of the study to determine the feasibility of rapid transit in the St. Louis metropolitan area. It discusses the criteria suggested for use in further development of the study as well as several alternative transit system schemes. A review of the current state of the art of transit technology is also included.

0264
FASTENING RAILS TO A CONCRETE DECK
Railway Gazette, Vol. 122, Mar. 1966, pp 230-236

Engineering design criteria for rubber-bonded cork pads on concrete are developed to account for geometry, the compression characteristics of the pads, axle loading and compression spring characteristics. An inspection coach, wagon and modern train with rubber spring wheels were run over the test track and vibrations in the rails and concrete slabs were measured. It was found that soft pads have better damping properties than hard pads for all frequencies, and ballasted track has less satisfactory damping properties than soft rubber-bonded cork pads. From sound level measurements, it was concluded that rubber-bonded cork also produces less sound at the most unfavorable measuring height. Compression spring tension was found to be critical

in eliminating a very noisy hammer effect caused by separation of the rail and pad.

0265
TRACKWORK STUDY. VOLUME II. RECOMMENDED TRACKWORK STANDARDS
Dunn, R. H., De Leuw, Cather and Company, Chicago, Illinois, Washington Metropolitan Area Transit Authority, Washington, D.C., WMATA-DCCO-TWS-2, July 1969, 331 p, Available: NTIS, PB 204213

The study provided the Washington Metropolitan Area Transit Authority with recommendations for trackwork design standards and criteria for use as a basic for the final design of trackwork for the entire METRO rail rapid transit system. The recommendations were based on analytical studies and the experiences reported by operating properties. Trackwork components were analyzed considering different combinations of components and varying physical parameters such as size, spacing, and estimated life of elements of the track structure. The report includes recommendations on rail weight, rail type, rail welding, fastener types and spacing, cross tie types and spacing, roadbed and ballast section, special trackwork, track appurtenances, track gauge and in-service test installations.

0266
TRACKWORK STUDY. VOLUME I. TRACKWORK PRACTICES OF NORTH AMERICAN RAPID TRANSIT SYSTEMS.
Dunn, R. H., De Leuw, Cather and Company, Chicago, Illinois, Washington Metropolitan Area Transit Authority, Washington, D.C., WMATA-DCCO-TWS-1, Nov. 1967, 149 p, Available: NTIS, PB 204212

The report is a summary of trackwork practices of seven North American rail transit properties; Boston, Chicago, Cleveland, New York, Philadelphia, San Francisco and Toronto. Responses to questionnaires sent to the properties covered construction standards for rail, rail welds, track gauge, rail fastenings, support spacing, rail anchorage, ties, roadbed and ballast sections, special trackwork and track appurtenances. The properties also reported their track maintenance criteria for rail wear, tie life, and ballast cleaning as well as test installations and recommendations for improving trackwork. The report contains a bibliography of over 100 publications on trackwork design, construction and maintenance.

0267
KEEPING THE TRACK IN ITS PLACE
Railway Gazette, Vol. 125, 1969, p 720

The lateral stability of track laid with continuous welded rail may be affected by unusually warm periods which cause trouble at points where insufficient care was taken in clamping at correct combination of rail temperature and stress. Adding ballast to the shoulders is only part of the answer. If the shoulders are to resist lateral movement they must be compacted after the track has been lined and levelled and the sleepers tamped. Machines are now available to do this work.

0268
NEW SANYO LINE 1. NEW SANYO LINE 2. THE ADJUSTABLE BALLASTLESS TRACK. APPENDIX TRACK FOR HIGH-SPEED RAILWAYS IN THE WORLD
Japan Railway Civil Engineering Association, Permanent Way

The publication discussed three major topics. First, the plan of the New Sanyo Line, its description, and aspects of the planning of the extension of the line are discussed in detail. The second section considers the design of an adjustable ballastless track which will be used on part of the New Sanyo is considered. The problems of design and engineering are discussed. The third part is a series of appendices which compare maintenance processes and controls of the railroads of the major countries of the world.

0269
TRACK STRUCTURE
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute-Quarterly Report, Special Issue, Apr. 1960, pp 2-23

Discusses the relationship between track structure, train speed, gross tonnage and the relationship to construction and maintenance. The cumulative effects of speed and weight to the destruction of the track is discussed and possible structural solutions and maintenance solutions are offered.

0270
DEVELOPMENT OF NEW RAILWAY TRACK STRUCTURES
Japanese National Railways, Tokyo, Japan Railway Technical Research Institute-Quarterly Report, Vol. 10, No. 2, June 1969, pp 62-70

In contrast to the existing standard track structure with ballast and cross-sleepers partially or wholly modified structures will here be called the new track structures. Ballasted track deflects and subsides under repeated passage of trains over it and loses the levelness of the running path. The volume of maintenance work increases in proportion to the speed-up and the frequency of train operation. The aim of first applying it to tunnel section and elevated track and ultimately extending the application to the common track sections, the concrete slab type track has been developed.

0271
THE BEAM ON DISCRETE ELASTIC SUPPORTS
Ellington, J. P., Bulletin of the International Railway Congress Association, London, England, English Edition, Vol. 34, No. 12, 1957

0272
RAIL TRACKS FOR JAPAN'S 130 MPH TRAINS
Matsubara, K., Civil Engineers, Vol. 39, Dec. 1969, pp 32-37

0273
DYNAMIC MEASUREMENT OF ABSOLUTE TRACK PROPERTIES
Cass, R., Journal of Engineering for Industry, Vol. 91, Aug. 1969, pp 855-860

0274
ANALYSING RAIL TRACK CHARACTERISTICS
Engineering, Vol. 209, Jan. 16, 1970, p 51

0275
EXPERIMENTAL CONCRETE TRACK-BED AT RADCLIFFE
Lucas, J. C., Lindsay, D., and Aitken, W. K., Railway Gazette, Vol. 125, No. 14, July 18, 1969, pp 547-549

0276
DEVELOPMENT OF NEW RAILWAY TRACK STRUCTURES
Satoh, Y., Quarterly Reports, Vol. 10, No. 2, 1969, pp 62-70

0277
TRACK FOR JAPAN'S 210 KM/H TRAINS
Matsubara, K., Permanent Way, No. 40/41, Apr. 1971, pp 1-67

0278
NEW BALLASTLESS TRACK STRUCTURES IN JAPAN
Satoh, Y., and Higuchi, Y., Japan Railway Civil Engineering Association, Permanent Way, No. 49, July 1972, pp 1-22

0279
EXPERIMENTAL RESULTS OBTAINED ON THE LATERAL PROBLEMS OF LONG WELDED RAIL CONTINUOUSLY LAID ON SEVERAL SPANS OF THE BRIDGE WITHOUT BALLAST
Sato, Y., and Nagata, M., Railway Technical Research Institute-Quarterly Report, Vol. 10, No. 1, Mar. 1969, pp 8-10

To study the characteristics of the lateral load to the bridge caused by the welded rail, an experiment was performed on the old Fuji river bridge on the Tokaido trunk line. The lateral forces acting between a rail and ties on the bridge, which was produced by longitudinally compressing the rail on the bridge with a jack were directly measured. Two cycles of test were performed for every alignment. One cycle consisted of the longitudinal loading and unloading of the rail up to 70 tons.

0280
OUTLOOK AND DEVELOPMENT OF CONCRETE BED TRACK
Takahara, K., Japanese Railway Engineering, Vol. 9, No. 1, Mar. 1968, p 12

0281
TRACKWORK STUDY. VOLUME I. TRACKWORK PRACTICES OF NORTH AMERICAN TRANSIT SYSTEMS
See 0266

0282
TRACKWORK STUDY. VOLUME II. RECOMMENDED TRACKWORK STANDARDS
See 0265

0283
STRENGTHENING OF TRACK STRUCTURES
Kitaoka, H., Japanese Railway Engineering, Vol. 8, No. 2, June 1967, p 36

0284
EXPERIMENTS ON RAILWAY TRACK WITH ASPHALT BALLAST
Washino, Y., Satoh, Y., Miyama, J., and Yamamoto, J., Report from Japanese National Railways translated by and available from the Asphalt Institute, College Park, Maryland.

0285
THE KANSAS TEST TRACK, NON-CONVENTIONAL TRACK STRUCTURES DESIGN REPORT
McLean, F. G., Williams, R. O., and Turnbell, R. C., Westenhoff and Novick, Inc., Chicago, Illinois, Sept. 1972, 161 pp, Available: NTIS, PB 212358

The non-conventional structures, which include a continuously reinforced concrete slab, twin cast-in-place concrete beams and twin precast concrete beams, are part of a research program to develop practical, low maintenence, high quality track structures for conventional and advanced rail vehicles. Included in this report are discussion of: basic structural concepts; design methods and models; and recommended construction, inspection and maintenance techniques.

0286
TRACK FOR NEW TOKAIDO LINE
Matsubara, K., Permanent Way, Vol. 1, Nos. 2-3, Sept. 1964, 1 p

0287
THE HUNTING BEHAVIOR OF CONVENTIONAL RAILWAY TRACKS
Cooperrider, N. K., Journal of Engineering for Industry, May 1972

0288
BRITISH RAILWAYS PROBLEM WITH WELDED TRACK
Simpson, C., Engineering, Vol. 209, Apr. 10, 1970, p 355

0289
THEORETICAL AND EXPERIMENTAL SOLUTIONS OF TRACK PROBLEMS FOR HIGH SPEEDS, ESPECIALLY IN REGARD TO THE DESIGN OF CURVES AND TRANSITION CURVES, TRACK LAYING AND MAINTENANCE TOLERANCES AS WELL AS DYNAMIC STABILITY. CONCLUSIONS AS REGARDS THE DESIGN OF TRACKS AND POINTS
International Railway Congress Association, High-Speeds Symposium Vienna, Austria, 1968

0290
THE DYNAMICS OF RAILWAY VEHICLES ON STRAIGHT TRACK, FUNDAMENTAL CONSIDERATION OF LATERAL STABILITY
Wickens, A. H., Proceedings of Institution of Mechanical Engineers, Vol. 180, Part 3F, 1965-1966, pp 29-44

0291
GERMAN FEDERAL RAILWAY EXPERIMENTS WITH CONCRETE TRACK BEDS
Birmann, F., Railway Gazette, Vol. 125, No. 8, Apr. 18, 1969, p 308

0292
FASTENING RAILS TO A CONCRETE DECK
Deenik, J., and Eisses, J., Railway Gazette, Vol. 122, No. 6, Mar. 18, 1966, 230 p

0293
THE MECHANICS OF A LOCOMOTIVE ON CURVED TRACK
Porter, S. R., Railway Engineer, July-Dec. 1934, Jan. 1935, and Railway Gazette, Feb.-Mar. 1935

0294
RAISING TRACK STANDARDS TO CATER FOR HIGH SPEEDS
Railway Gazette, Vol. 126, 1970, pp 225-228

The article discussed changes in track and traffic on the British Railways from 1959 to 1969. 1969. The necessity of changes in track maintenance and design to allow high speeds and heavier traffic is discussed. Details of changes in track, inspection method, as well as planning of maintenance and construction with the pressure of higher speeds, greater loads and frequency is also mentioned.

0295
HIGH-SPEED JUNCTIONS AND CROSSOVERS
Railway Gazette, Vol. 107, 1957, pp 333-334

British Railways has developed two new switches in 109-lb. f.b. rail. They are the "Curved F" and "G" switches and are both of the chamfered type, which, by the undercutting of the stock rail, permits the retention of sufficient metal in the switch rail to provide the robust section desirable at the near the switch toe when very fine entry angles are used. In the Southern Region a speed restriction of 50 mph is considered suitable for Curved F switches diverging from the straight. G switches will be used where higher speed restrictions up to 75 mph from straight are required and site conditions permit. Layout drawings for a double junction embodying G/24 turnouts have been completed. By the use of two-level baseplates and transition curves as necessary, a practically constant cant deficiency of just over 2-1/2 in. at 75 mph is possible.

0296
TOKAIDO LINE STANDARDS, TEST LENGTH AND TRIALS
Railway Gazette, Vol. 118, No. 11, Mar. 1963, pp 209-301

Various characteristics of the New Tokaido Line are presented, including track, tunnel and bridge construction, bogie design, and passenger and track inspection vehicles. Testing of rolling stock at 124 mph prior to the opening of the Line revealed wheel side thrust to be only 3-4 tonnes and lateral and vertical vibration accelerations of 0.2 g and 0.3 g respectively.

0297
SOLID-BED TRACK WITH NEOPRENE STRIP INSULATION
Railway Gazette 121, No. 3, Feb. 5, 1965, p 119

0298
REFURBISHING BRITISH RAILWAY TRACK FOR HIGH SPEEDS
Railway Gazette, Vol. 125, Nov. 21, 1969

0299
PERMANENT WAY TESTS AND PRACTICE ON THE L.M.S.R.-I
Railway Gazette, Vol. 77, 1942, pp 420-421

Track realignments necessary to accommodate the Coronation Scot, a 90 mph passenger train, are described. A total of 269 curves were eased for a single track mileage of 244. A test using various fastenings is described. Ten track locations, where lateral stress was high and traffic load varied, were selected. The test results are tabulated.

0300
THE KANSAS TEST TRACK
Federal Railroad Administration, Washington, D.C., Prepared in cooperation with The Atchison, Topeka and Santa Fe Railway Co., Progress Rept., Oct. 1971, FRA-A-RT-72-08, 33 p, Available: NTIS, PB 206622

The Federal Railroad Administration and the Atchison, Topeka and Santa Fe Railway Company are jointly sponsoring the construction of a test track as part of the railroad's heavy tonnage main line in Kansas. The objective of the project is a determination of the levels of increased train stability provided by 8 specimens of incrementally improved track support. A further objective is a definition of the cost-benefit relationship associated with each augmentation of stability. The various test segments are defined, associated instrumentation requirements are outlined, and progress to date described.

0301
EMBANKMENT SUPPORT FOR A RAILROAD TEST TRACK CONSTRUCTION REPORT
Shannon and Wilson, Inc., Burlingame, California, Final Rept., Aug. 1972, 221 p, FRA-RT-73-10, Available: NTIS, PB 212 783/5

The report discussed the construction of three non-conventional railroad track support structures. These structures are part of a program to develop practical, low maintenance, high quality track structures for conventional and advanced rail vehicles. The design of these test structures is discussed in a separate report, 'The Kansas Test Track, Non-Conventional Track Structures Design Report'. The report documents the construction phase of the Kansas Test Track. It includes drawings, field test data on the embankment and details of instrumentation. The information provided on instrumentation outlines the system configuration, components, shop drawings, installation details and calibration data. The field data obtained on the embankment during construction are summarized and interpreted.

0302
NON-CONVENTIONAL TRACK STRUCTURES-COMMITTE REPORT
Proceedings of the 83rd Annual Convention of the Road Masters and Maintenance of Way Association of America, Sept. 13-15, 1971, pp 67-75

0303
TRACK: CURRENT AND FUTURE REQUIREMENTS
Railway Track and Structures, Roadmaster's Committee Rpts, Standing Committee No. 2, Oct. 1967

0304
DESIGN REPORT, NON-CONVENTIONAL TRACK STRUCTURES FOR KANSAS TEST TRACK, AIKMAN AND CHELSEA, KANSAS
Westenhaff and Novick, Inc., June 1972

0305
THE EQUATIONS OF MOTION OF AN ELASTICALLY RESTRAINED WHEEL SET ON CURVED TRACK AND PRELIMINARY STUDY OF STEADY-STATE MOTION
Boocock, D., British Railways Research Department Rpt., WYN-35, 1966

0306
QUARTERLY REPORT OF THE RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 8 NUMBER 4 DECEMBER 1967
Japanese National Railways, Tokyo (Japan), Railway Technical Research Institute, 1967, 61 p, Available: NTIS, PB 180025

Reports are given on construction materials and methods, design and operation of equipment, and traffic considerations.

0307
QUARTERLY REPORT OF THE RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 9 NUMBER 1 MARCH 1968
Japanese National Railways, Tokyo (Japan), Railway Technical Research Institute, 1968, 63p, Available: NTIS, PB 180026

The document contains reports on materials, methods, communication, operation, and terrain.

0308
RECOMMENDATIONS FOR TRANSPORTATION IN THE NATIONAL CAPITAL REGION. APPENDIX. VOLUME II. USE OF RAILROAD FACILITIES
National Capital Transportation Agency, Washington, D. C., Rpt. to the Presient, Jan. 4, 1963, 257 p, Available: NTIS, PB 168299

This is an appendix to a report dated November 1, 1962. The report includes a study of commuter service using existing railroad facilities for Washington, D. C., by Louis T. Klauder and Associates, Philadelphia, Pa. Topics discussed include urban planning, railroad tracks, railroad cars, passenger vehicles, traffic, buildings, and maps.

0309
ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 15, No. 1, Mar. 1964, pp 29-32

Track destruction caused by lateral pressure takes place in three ways. These are horizontal track alignments sharply distorted, spikes pulled out of place or rail fastening devices fractured, and spikes laterally shifted or lateral supports of rail fastening devices fractured. Three kinds of tests were conducted: the first test was to measure the strength of spikes for sleepers sampled out of the test sections, the second test to measure pressure on several spikes under the lateral pressure and wheel load imparted to the rails by a lateral pressure test car, and the third test to measure the shift of spikes on all sleepers in the test sections after conducting a loading run by the lateral pressure test car. Based on the distribution of the lateral pressure caused by rolling stock and that of strength of spikes, the permissible limit of lateral force has been established at the level at which 1% of the spikes are streesed to their proportionality limits.

0310
TRACK GEOMETRY AND PERMANENT WAY CONSTRUCTION FOR HIGH SPEED LINES
Eisenbahntechnische Rundschau - The Railway Technical Review, Vol. 17, No. 12, pp 513-532

This article discusses the heavier demands imposed on the track structure by the maximum operating speeds on railways. The problems are presented and considered as determined by both theoretical studies and the results of field tests of 200Km/h operations. Consideration of the line construction and the alignment, superelevation and transition run-offs on curves is shown by actual data and charts, including theoretical studies of speeds up to 400Km/h. The stability of the track structure, horizontally and longitudinally, under different axle loads and spacings are considered, and the relations thereto of rail strength, type of fastening, the ballast bed and the underneath soil foundation. Switch, turnout and frog designs are dealt with. This article gives a comprehensive, detailed study of the requirements for track geometry and construction for high speed operations.

0311
HIGH-SPEED TRAVEL ON RAILS. 1) CRITICAL CONSIDERATION OF TRACK AND POINTS MAINTENANCE ENSURING SAFETY IN OPERATION, BASED ON EXPERIENCE WITH THE TOKAIDO LINE IN JAPAN
Schroder, H., Holzschwelle, No. 66, In German

0312
THE MECHANICS OF RAILWAY VEHICLES ON CURVED TRACK
Minchin, R. S., Journal of the Institution of Engineers, Australia, Vol. 28, July-Aug. 1956

0313
EMBANKMENT SUPPORT FOR A RAILROAD TEST TRACK DESIGN STUDIES
Dietrich, R.J. and Salley, J.R., Shannon and Wilson, Seattle, Washington, Final Rpt. FRA-RT-72-07, Aug. 1971, 167 p, Available: NTIS, PB 202808

The events and considerations leading up to the production of an embankment design for the support of the Kansas test track are described. Included are discussion of site description, field investigations, laboratory investigations, sub-surface conditions, embankment design, and instrumentation.

0314
GERMAN FEDERAL RAILWAYS EXPERIMENTS WITH CONCRETE TRACK BEDS
Birmann, F., Railway Gazette, No. 8, Apr. 18, 1969, pp 308-310

If sleepers and ballast prove inadequate for speeds over 200 km/h some form of structural support for the track will be necessary. Three designs were developed and are described. Test results are given.

0315
DESIGN STANDARDS FOR EUROPE'S FIRST 250 KM/H RAILWAY
Railway Gazette International, Vol. 126, 1970, pp 269-272

This article is concerned with changes made in the rail line which runs from Rome to Florence, Italy, so that speeds of 250 km/h may be attained. Problems include the rough terrain such that 31% of the route will be tunnel and 13% will be over viaduct. Details of bridge design, electrification, as well as characteristics of tunnel design and roadbed construction are discussed in relation to the requirements of high speed operation.

0316
PREPARING BRITISH RAILWAYS TRACK FOR HIGH SPEED RUNNING
Railway Gazette, Vol. 124, 1968, pp 413-416

Before speed limits are raised to 125 mile/h or higher, action must be taken to eliminate bolted rail joints and gaps in the rail at crossings. Experience with 100 mile/h trains running in quantity indicates that the standard continuous welded rail track on prestressed concrete sleepers will be capable of carrying trains at 125 mile/h without any particular difficulty. At speeds of 100 mile/h or over, the presence of all kinds of rail joints and of crossings present an increasing problem in maintenance. The desirability of providing monoblock or swing-nose crossings increases as the speeds rise.

0317
RAILWAY PASSENGER COMFORT
Railway Gazette, Vol. 120, 1964, pp 767-770

Seat and baggage rack designs for British passenger trains are illustrated and described. Designs for the British Railways, Kowloon Canton Railway (British Section in China), the Egyptian State Railways and the Jamaica Railway are included. Thermal and sound insulation used to reduce noise levels are discussed and a typical cross-section for the floor insulation for a prototype, British Railways passenger car is illustrated.

0318
LONG WELDED RAILS
Railway Gazette, Vol. 109, 1958, pp 242-243

A survey was taken to determine the uses and value of long welded rails, their manufacturing and laying techniques, and maintenance. The results were reported to the Seventeenth International Railway Congress. The maintenance costs are at least 15 percent less for the welded rail than for conventional track. The most suitable length for welded rail and anti-creep devices are discussed. Isolated cases of breakage due to weld defects, buckling due to disregard of temperature regulations or poor ballasting, and creep due to thermal stress are cited.

0319
WELDED RAIL IN THE U.S.A.
Railway Gazette, Vol. 107, 1957, pp 65-66

The elimination of rail-joint maintenance is claimed to be more than covering the additional cost of welding, transporting the welded strings to site, and handling them. In general, few troubles have been experienced. Expansion and contraction at the ends of welded strings has been little more than normal, and has been restrained by increasing the number of rail anchors applied over the last six lengths of rail (234 ft.) at the end of each string. Given proper anchorage, no trouble is experienced with buckling, but considerable care has to be exercised as to the temperatures at which continuously-welded rail is surfaced.

0320
BUILDING THE SAN YO LINE
Railway Gazette, Vol. 124, No. 19, Oct. 4, 1968, p 731

0321
RUBBER RAIL-TO-SLEEPER FASTENING
Railway Gazette, Vol. 109, 1958, p 654

A rail-to-sleeper fastening on trial on British Railways is applicable to ordinary flat-bottom rails, but is specially designed to resist any tendency towards buckling in long-welded rails. The advantages

claimed are: simplicity; cheapness in first, maintenance, and replacement costs; safety, sufficient elasticity to protect the sleepers against impact and so increase their lives; and no interference with track-circuiting. The fastening consists of a cast-iron baseplate enclosing a rubber pad upon which the rail-base is held securely both vertically, transversely and laterally by metal-rubber wedges fitting tightly into jaws cast integrally as part of the baseplate.

0322
RUNNING THROUGH CURVES
Koffman, J. L., British Railways Board, Railway Gazette, Apr. 21, 1967, pp 307-311

0323
TRACK LOADING FUNDAMENTALS-6. TRACK DESIGN RELATED TO BRIDGE LOADING
Railway Gazette, Vol. 106, Mar. 1957, pp 335-336

Track design is discussed in terms of its relationship to bridge loading. It is shown how track can be designed in accordance with B.U. loading, whereby rail section and ballast depth for given sleeper sizes and spacings can be determined to carry vehicles at the speed for which the bridges were designed.

0324
CURVE REDUCTION ON ROUTE OF SUPER CHIEF
Railway Gazette, Vol. 71, 1939, p 208

By extensive realignment works, hundreds of speed restrictions have been eliminated on 2,227-mile main line of the Santa Fe Railroad between Chicago and Los Angeles. Isolated curves, rather than curves forming a series, were removed to eliminate the speed restrictions placed on a very limited stretch of track necessitating appreciable deceleration below that allowed beyond both ends of the curve. The costs of removing single curves were also modest in comparison to removing curves in a series. In two years, 479-track curves were removed, 228 by realignment and 251 by slewing. The realignments eliminated 3626 degrees of curvature and 325 miles of track length.

0325
TRANSITION CURVES
Railway Gazette, Vol. 75, 1941, pp 55-56

A nomogram for readily finding the cant required on the arc and the length of transition for specified conditions is illustrated and the mathematical proof is shown. This method is an improvement over a prior method in which cant was dependent only on speed and radius of curvature. This earlier method did not account for the relationship between speed and rate of curvature, which exists as a governing factor in the maximum permissible speed. The nomogram is simple enough to use that it can be used for designing and setting out of transition curves on the site.

0326
THE RAILS ON THE GERMAN FEDERATED RAILWAYS
Eisenbahntechnische Rundschau - The Railway Technical Review No. 10, pp 341-350

With the introduction in Germany of greater train loads and higher operating speeds, it was necessary to replace earlier rail, known as S49 with heavier rail, designated S54. Its usage is on main lines at operating speeds of 140 km/hr and tonnage in excess of 30,000 gross tons per day. Another rail, S64, is used where axle loads are in the range of 30 to 35 tons and in tunnels on German railways. Rail breakages are compared for the various rail. Qualities and properties of the steel are discussed and theoretical stress lines in the rail sections are depicted. The shape of the rail head on the newer designs was changed to provide improved contact with the profile of the wheel tread. Specific costs of rail replacements on the German Railways are given for the various rail designs.

0327
VEHICLE DESIGN RELATED TO TRACK CONDITIONS
Railway Gazette, Vol. 110, 1959, pp 445-446

Recommendations which may influence improvements in the safety and comfort of passenger-train rolling stock are made in a paper, Vehicle Suspension and Bogie Design in Relation to Track Conditions, by Mr. R. M. Hancock of British Railways. The paper deals with the necessity of relating vehicle suspension and bogie design to the track conditions likely to be encountered in practice, particularly where lateral and crosslevel wave shape are concerned, as these are most likely to produce discomfort. The vehicle-response basis of systematic testing main routes as carried out with the Western Region track-testing car has provided much of the experience from which the illustrations in the paper are drawn. The effects of coning and track shape, in relation to the riding of four-wheel vehicles, are considered with reference to an investigation of their derailment in fast trains.

0328
LONG-WELDED RAILS ON BRITISH RAILWAYS
Railway Gazette, Vol. 112, 1960, p 644

Prior to installing long welded rail, British Railways conducted a thorough 5 year investigation of the factors and potential saving to be realized. Among other things, a formula was derived to predict the buckling load of any type of track under any conditions. Additionally, it was found that concrete sleepers were more suitable with long welded rail than wooden ones. Details on how the British accomplished their modernization, which began in 1955, are provided.

0329
INTERIM REPORTS ON DETRAILMENTS AT LICHFIELD, SOMERTON AND SANDY
Railway Gazette, Vol. 126, 1970, pp 314-315

This is an accident report of three derailments in England which occurred during June-July, 1969. All took place in welded rail and all were caused by distortions or buckling of the rail. No definite conclusions as to the cause of the incidents aside from an inherent track weakness was reached. Causes for track distortions, during the period 1958 to 1968, are reviewed.

0330
EXPERIMENTS WITH SOLID CONCRETE TRACK-BEDS
Railway Gazette International, Vol. 127, No. 8, Aug. 1971, pp 316-318

A study was made of the possibility of replacing conventional tie track in stone ballast by a solid concrete track-bed, either laid in-situ as a continuous slab or in the form of precast beams or panels. Experiments in Japan, West Germany and Italy are described.

0331
TRACK LOADING FUNDAMENTALS. 2. DETERMINATION OF RAIL SECTION
Railway Gazette, Vol. 106, Jan. 1957, pp 103-107

0332
HYDRAULIC TENSIONING OF CONTINUOUS WELDED RAIL
Railway Gazette, Vol. 125, 1969, pp 31-33

Stretches the rail to the expansion which would occur by a temperature rise from the installed temperature to the mean of the normal extremes of heat and cold to which the rail is subjected in the annual weather cycle. Rails installed in ambient temperature conditions higher than the specified ideal temperature range are not adjusted at the time of installion. The rail is laid, the temperature is noted, and at the first suitable opportunity it is brought into the optimum stress condition.

0333
LONG WELDED RAILS
Railway Gazette, Vol. 100, 1954, p 687

If very long weld rails are used to circumvent the many disadvantages of the jointed form of track, important safeguards are essential. The standard types of doubly-flexible rail-to-sleeper fastenings in use on the French railways are among the most efficient deterrents to the risk of fracture due to tension. With an 800 m. length an expansion joint of the sliding switch-blade and stock-rail type is used, allowing of a relative movement of up to 7 in. between the rail-ends. The French railways use arc-welding plant equipped with special finishing devices, in the shape of precision grinding and truing units working in both plan and profile, assisted by hydraulic jacks. It is too early to assess precisely the economies resulting from welded track, but the smallest calculated saving so far is about 30 percent, and was secured on the Paris-Marseilles line near l'Etang de Berre.

0334
AERIAL STRUCTURE AND RAIL SUPPORT METHODS
Parsons Brinckerhoff-Tudor-Bechtell, San Francisco, Calif., Final Rpt., No. 11, 1967, 47 p, Available: NTIS, PB 176433

The report describes a series of tests conducted as part of the development of the Bay Area Rapid Transit District (BARTD) system. The subject tests were performed primarily to evaluate rail fasteners and to determine their suitability for use on concrete aerial structures of advanced design. Specifically, the fasteners were evaluated in terms of their ability to maintain electrical isolation, reduce noise levels, and provide the safest and most economical system of hardware available. Upon completion of initial investigations a totally new concept in the installation of rail fasteners and associated hardware on concrete aerial structures was tested. Additionally, several types of concrete tie were evaluated for performance under the conditions imposed by the selected BARTD system.

0335
ENGINEERING PLANS AND COST ESTIMATES: ENGINEERING SUPPLEMENT, TRANSIT DEVELOPMENT PROGRAM 1965
National Capital Transportation Agency, Washington, D.C., Jan. 1965, 208 p, Available: NTIS, PB 169946

The volume consists of three parts: a description of the proposed 25-mile rail rapid transit system for the Washington D. C. area; estimates of cost, and plans and profiles, which depict the system in detail, and on which the cost estimates are based.

0336
RECOMMENDATIONS FOR TRANSPORTATION IN THE NATIONAL CAPITAL REGION. APPENDIX. VOLUME I. ENGINEERING
National Capital Transportation Agency, Washington, D. C., Rpt. to the President, Jan. 4, 1963, 165 p. Appendix to report dated Nov. 1, 1962, Available: NTIS, PB 168298

This volume discusses the engineering aspects of the rail rapid transit system recommended by the Agency for the National Capital region. Subjects presented include route alignments and profiles, establishment of criteria for the system, methods of construction, costs of construction and equipment, and the status of transit technology.

0337
DYNAMICS OF A MODEL VEHICLE RUNNING ON AN IMPERFECT ELASTIC TRACK
Institute for Rapid Transit, Washington, D. C., UMTA-DC-MTD-7-71-12, Feb. 1971, 49p. Prepared in cooperation with Aerospace Technology, City of Industry, Calif., Rpt. No. 7020-3-2, Available: NTIS, PB 201882

The report presents the dynamic analyses of a scale model of a subway station and tunnel (SAT) facility under development for the measurement of aerodynamic and thermodynamic interaction of train-station and tunnel. The purpose of the overall project is improved ventilation and environmental control in subway rapid transit systems. A simplified two degree of freedom dynamic analysis was carried out to determine the longitudinal and lateral stability of the model.

0338
RAILWAY ENGINEERING ABSTRACTS 1966
Japanese National Railways, Tokyo (Japan), Railway Technical Research Institute, Sept. 1966, 16 p, Available: NTIS, PB 173597

Contents include railway in general, transportation, safety, civil engineering, architectures, electricity, rolling stock, non-rail forms of transportation, machinery, machining, and materials.

0339
PRELIMINARY DESIGN OF RAIL RAPID TRANSIT ON THE SILVER SPRING-ROCKVILLE ROUTE (UNION STATION TO ROCKVILLE) AND ALEXANDRIA-SPRINGFIELD ROUTE (FOUR MILE RUN TO CAMERON)
Louis T. Klauder and Associates, Philadelphia, Pa., Contract NTA-34, May 1964, 233 p, Available: NTIS, PB 176978

Contents include design criteria, description of routes, description of stations, maintenance shops and storage yards, structures, subway, railroad crossings, track structure, changes to existing railroads and utilities, estimate of cost, and construction period.

0340
RAILROAD TECHNOLOGY AND MANPOWER IN THE 1970's
Bureau of Labor Statistics, Washington, D. C., Final Rpt., DOL-BLS-B-1717, 1972, 95 p, Available: NTIS, PB 211209

The report describes changes in technology in the railroad industry; projects the effects of these changes on productivity, employment, and occupational requirements; and discusses methods of adjustment. The study is based on discussions with company, union, and government officials and with railroad equipment manufacturers. It also is based on attendance at conferences and exhibits as well as on information obtained from BLS sources and others in government, and on trade and technical publications.

0341
EVALUATION OF TRANSPORTATION EQUIPMENT TECHNOLOGY FOR USE IN THE BALTIMORE REGION RAPID TRANSIT SYSTEM
Daniel, Mann, Johnson, and Mendenhall, Los Angeles, Calif., June 1968, 186 p

The report reviews current and anticipated developments in transit system operations as they may particularly apply to the proposed rapid transit system for the Baltimore Region. The primary objective of this evaluation was to provide a realistic set of alternatives upon which to base decisions as to the inclusion of advanced techniques and equipment in the preliminary engineering of the transit system. New concepts and improvement of well-established techniques are examined. Recommendations are included for various system components and subsystems.

0342
PROCEEDINGS OF A CONFERENCE ON TRACK/TRAIN DYNAMICS INTERACTION
Association of American Railroads, Research and Test Department, Chicago, Illinois, Dec. 1971

0343
WEAR RESISTANCE OF CARBON STEELS OF DIFFERENT STRUCTURE
Soroko-Novitskaia, A. A., Friction and Wear in Machinery, Vol. 13, 1959

0344
VIBRATION OF RAIL AND ROAD VEHICLES
Cain, B. S., Pitman Publishing Company, 1940

0345
PRELIMINARY SPECIFICATIONS FOR CONCRETE CROSS TIES (AND FASTENINGS)
American Railway Association, Bulletin 634, Oct. 1971

0346
SPECIAL STUDY OF RAIL RAPID TRANSIT SAFETY
National Transportation Board, Rpt. No. NTSB-RSS-71-1, June 1971

0347
MOVING PEOPLE SAFELY, SAFETY GUIDELINES FOR URBAN RAPID TRANSIT SYSTEM
Institute for Rapid Transit, Washington, D. C., May 1972, 166 p

A chapter, prepared by the Subcommittee on Track and Structures of the Institute for Rapid Transit, is included on inspection of facilities. Topics discussed include: track geometry by class; structure which defines by class defect limits, end batter, and fastenings; power rail; inspection types and records; and safety criteria.

0348
CONTRIBUTION TO THE EVALUATION OF COMFORTABLE RUNNING OF RAILWAY VEHICLES
Sperling, E., and Betzhold, C., Bulletin of the International Railway Congress Association, London, England, No. 625.2, Oct. 1956

0349
ROADBED/BALLAST
AREA Bulletin, No. 631, Jan./Feb., 1971, pp 257-290

Exploration, testing, and design are discussed, including stability of rock slopes; cuts in soil, sand, and clay; non-uniform soils; loess; foundation of fills; and selection of soils for fills.

0350
HIGH SPEED RAIL SYSTEM. REPORT ON HIGH-SPEED GROUND TRANSPORTATION SYSTEMS ENGINEERING STUDY
TRW Systems, Redondo Beach, Calif., 06818-6037-R000, FRA-RT-70-36, Feb. 1970, 608 p, Available: NTIS, PB 192506

The application of steel-wheel-on-steel rail trained vehicles to intercity passenger transportation at speeds of 200 to 300 mph is examined. The physical and human constraints, and the framework of ground-rules within which the study is constructed are described. Primary system elements are singled out and considered in the light of the higher speed requirements. The elements are the vehicle, propulsion and power, braking, suspension, guideway, control and communications and terminals. Present-day state-of-the-art operating systems are used as a point of departure. A baseline high-speed rail system is synthesized, and its performance and service characteristics are described parametrically, as a function of such independent variables as seating capacity and design cruise speed. Research and development, investment and operating costs are given.

0351
SOME PROBLEMS OF WHEEL/RAIL INTERACTION ASSOCIATED WITH HIGH-SPEED TRAINS
TRW Systems, Washington, D. C., Mar. 1969, 57 p

The objective of the study is to identify and evaluate potential problems involving wheel-rail interaction which could limit the speed of a high speed rail (HSR) system. The study is based upon a survey of existing knowledge in the areas pertinent to wheel-rail interaction; no extensive analytical work is presented, but several approximate calculations are given. An attempt has been made to investigate possible wheel-rail speed limitations and to set aside some of the 'non-problems' which may at first appear to constitute a serious constraint upon rolling HSR concepts.

0352
SUPPORTING STUDIES FOR HIGH SPEED GROUND TRANSPORTATION SYSTEM REPORTS
TRW Systems, Redondo Beach, California, Final Rpt., June 1970, 522 p

The document is a supporting studies volume which contains appendices covering various detailed analyses which are referenced in reports on a high speed rail system, tracked air cushion vehicle systems, multimodal systems, and automated highway systems.

0353
URBAN MASS TRANSPORTATION ABSTRACTS
Urban Mass Transportation Administration, Washington, D. C., UMTA-TRIC-1-72, Oct. 1972, 540 p, Available: NTIS, PB 213212/4

The volume contains 466 abstracts of reports in the field of urban mass transportation which are available from the National Technical Information Service. The reports were generated by research, development, and demonstration; technical studies, and university research and training projects sponsored by the Urban Mass Transportation Administration under the Urban Mass Transportation Act of 1964 (amended). Each abstract contains complete bibliographic data, from two to twelve keyword identifiers, up to 400 words of text capsulizing major topics covered in the report, and the NTIS accession number and prices.

0354
PROPOSED CONSTRUCTION PROGRAM METRO SYSTEM
Washington Metropolitan Area Transit Authority, Washington, D. C., Feb. 1970, 61 p, Available: NTIS, PB 189688

The document is published for the information of the construction, manufacturing and supply industries that may be interested in offering their services for the construction of the rapid rail transit system authorized for the Washington Metropolitan Area.

0355
CAPITAL COST ANALYSIS
Washington Metropolitan Area Transit Authority, Washington, D. C., Dec. 1967, 178 p

In this report the capital costs of the proposed Washington rapid transit system are explored. The basic system is outlined and construction methods are discussed. Costs are estimated for construction of the system and purchase of rapid transit vehicles and other equipment.

0356
OPERATING COST ANALYSIS
Washington Metropolitan Area Transit Authority, Washington, D. C., Dec. 1, 1967, 64 p

Operating costs for the proposed Washington rapid transit system are described in this report. Basis for these costs is a test system used to simulate actual operating conditions.

0357
NOISE AND VIBRATION CHARACTERISTICS OF HIGH SPEED TRANSIT VEHICLES
Wilson, Ihrig and Associates, Inc., Berkeley, California, June 1971, 99 p

The rapidly expanding problems of urban transportation have resulted in intensified activity in the development and construction of new fixed route, high speed rapid transit systems and equipment. The community noise and ground vibration caused by such systems and vehicles is a very important factor influencing public acceptance of these systems. Noise and vibration measurements obtained with modern operational and experimental transit vehicles provide a basis for determining the expected wayside or community airborne noise and ground-borne vibration levels for different types of new transit systems.

0358
WELDING A RAILROAD
Welding Engineer, Vol. 56, Nov. 1971, pp 36-37

0359
ACOUSTICS STUDIES
see 0168

0360
THE INFLUENCE OF TRACK DYNAMICS ON THE DESIGN OF ADVANCED TRACK STRUCTURES
Meacham, H. C., The Dynamics and Economics of Railway Track Systems Conference, RSMA paper No. 9, Feb. 1970, pp 137-153

In Part III the design of the DOT-Santa Fe test track is described in brief. Four types of structures will be included: cast-in-place twin beams, cast-in-place slab, precast twin beam, and precast slab.

0361
A COMPUTER STUDY OF DYNAMIC LOADS CAUSED BY VEHICLE-TRACK INTERACTION
Meacham, H. C., ASME Trans. Ser B, Journal of Engineering for Industry, No. 3, Aug. 1969, pp 808-816, ASME paper 69-RR-1

Three specific areas of concern to the railways which have been explored at Battelle by analog computer similation are: effect of rail joints on track structures and high speed passenger cars; interaction between bad joints and high-center-of-gravity cars at resonant speeds; and the relationship between track stiffness and corrugated rail.

0362
MODERN APPROACH TO TRAIN-TRACK DYNAMICS
Meacham, H. C., Battelle Technical Review, July 1968, pp 14-21.

The track structure as a dynamic system Advanced Track Structure and a new technique for measuring the dynamic profiles of track are described. Descriptions are given of the steps on the development of a dynamic model of a conventional track structure.

0363
STUDY OF NEW TRACK STRUCTURE DESIGN, PHASE I
Meacham, H. C., and Vorhees, J. E., Battelle Memorial Institute, Columbus, Ohio, Sept. 1966, 146 p

Conventional (tie-type) and non-conventional rail vehicle track structures were studied with the constraint that standard gage and rail head contour not be varied from current practices. Computer programs were developed and used to analyze track response to both static and dynamic vehicle loading. A major philosophy in the development of improved track structures was to reduce the magnitude and number of pressure cycles transmitted to the foundation by passing rail vehicles.

0364
STUDIES FOR RAIL VEHICLE TRACK STRUCTURES
Meacham, H. C., and Prause, R. H., Battelle Memorial Institute, Columbus, Ohio, Final Rpt., Sept. 1966-Apr. 1970, 208 p

Conventional (tie-type) and non-conventional rail vehicle track structures were studied, with the restriction that standard gage and rail-head contour be used. Computer programs were developed and used to analyze track response to both static and dynamic vehicle loading. The models of conventional track were validated on the Penn-Central high-speed track near Bowie, Maryland. The DOT research cars were used to obtain a series of controlled-speed passes at speeds up to 125 mph. Following the analysis, performance specifications were written for rail fasteners and three types of reinforced concrete structures recommended for further evaluation in field tests; cast-in-place slab, cast-in-place twin beams, and precast twin beams.

0365
STUDY OF NEW TRACK STRUCTURE DESIGN. PHASE II
Meacham, H. C., and Vorhees, J. E., Battelle Memorial Institute, Columbus, Ohio, Aug. 1968, 64p

Phase 1 of this research investigation was undertaken in September 1966, for the Office of High Speed Ground Transportation (OHSGT) of the Department of Commerce by Battelle Memorial Institute for the purpose of conceiving new and improved track structures for high-speed trains. As a result of the Phase 1 program, a number of track structures and fasteners were devised which met the specified requirements. Following the conclusion of the Phase 1 program, the OHSGT requested additional studies and computer analyses of track structures and rail fasteners. The additional track structures of interest were chosen by OHSGT from many designs which had been submitted to them. In addition to the analysis of the track structures, they were interested in a more detailed analysis of rail fasteners, particularly any analysis which was amendable to computer techniques. This project (which was then designated as Phase 2) was then conducted, and the results are summarized in this report.

0366
ON THE LIFE OF RAIL
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute-Quarterly Rpt., Vol. 7, No.1, Mar. 1966, pp 28-31

Annual trend of rail failures of the Japanese National Railways in recent years amounted to 5264 in 1963. There are included in rail failures the numbers of broken rails, cracked rails and defective rails all together, they do not always cause interference to train operation. It is known from the figures that end break ranks the first and amounts to more than 60%. The number of end breaks is divided into two parts, namely in tunnels and out of tunnels. Due to unfavorable conditions of corrosion in tunnels of our country. End breaks almost occur as results of rail fatigue by train loads. Stress induced on rail varies in magnitude according to train speed, wheel load, lateral force and position of wheel contact on rail, and the stress distribution was found in many measurements to be a normal distribution or its combination in most cases.

0367
THE STATE-OF-THE-ART CAR
The Boeing Company, Vertol Division, Pamphlet

0368
THE PUEBLO COLORADO, HIGH SPEED GROUND TRANSPORTATION TEST FACILITY
Publication Data Unknown

0369
A RECOMMENDED RAIL SAFETY RESEARCH PLAN FOR FISCAL YEARS 1971-1975
Melpar, Inc., Fall Church, Va., FRA-RP-70-1, Oct. 1969, 115 p, Contract DOT-FR-9-0047, Available: NTIS, PB 188967

The document is concerned with the initial picture of railroad safety, configured research projects which address specific needs as expressed by industry, labor and government, an estimation of the resources (in time and dollars) required to accomplish each project, and 3 alternative 5-year safety research program plans for the fiscal years 1971-1975.

0370
QUANTIFIED GEOMETRIC STATE OF RAILROAD TRACKS, (L'ETAT GEOMETRIQUE QUANTIFIE)
Juillerat, T., and Rivier, R, Bulletin Technical Suisse Romande, Vol. 97, No. 5, Mar. 6, 1971, pp 55-63, In French

General principles and methods of statisical analysis of railway track displacements adopted by the Swiss railways are given. The tracks are automatically tested by means of a track inspection car equipped with an analyzer. Statistical properties of discrete data distribution, and the algorithm of the analysis are discussed. Graphs are presented illustrating the analytical results of the track inspection.

0371
SAFE OPERATION OF HIGH-SPEED LOCOMOTIVES
Transactions of the ASME, Paper RR-57-3, Dec. 1935, pp 471-479

In this paper are presented the basic theories, test information, and the chief conclusions of an investigation of factors entering into the mechanical design of locomotives for high-speed operation. The fundamental problem in regard to the safe operation of high-speed locomotives has been to explain, and to learn to control by design means, the oscillations of locomotives which develop at high speeds, and which place a definite limit on the safe speed at which any particular design of locomotive can be operated over a given section of track. It was found that in order to keep a locomotive of conventional type from exerting high flange pressures on straight track when moving at high speed, the wheel base should be long and the clearances small to reduce angularity in the track. Springs should ba as soft as is practical to cushion blows and reduce the force due to oscillation. On high-speed curves, truck restraints and wheel bases should be studied to avoid instability. The height of the center of gravity of the locomotive is a comprise. In general the height should be reduced where the locomotive is well guided and where the track is good. Excessive axle weights should be avoided. Good track maintenance and uniform construction and stiffness with the minimum practical flange clearance are always of great importance.

0372
THE TRACK
French Railway Techniques, 1967, pp 3-10

Stresses caused to the track by future trains intended to operate at a maximum speed of 300 km/h will remain within acceptable limits for the orthodox type of track and comfort will be excellent without the necessity of maintaining a quality of track better than that already achieved on our present high-speed lines. The laying of concrete slab track is not justified neither from the technical or economic point of view.

0373
TEST WITH BALLAST-LESS TRACK
Eisenbahntechnische Rundschau-The Railway Technical Review, Vol 19, No. 1-2, Feb. 1970, pp 33-36

Maintenance work on the ballasted track bed in tunnels must be done at great disadvantage, therefore, research has been directed towards the design of a ballast-less track bed. A 210 meter long stretch is described of such a bed in the Boezberg Tunnel. This design has concrete ties laid upon suitable rubber cushioning over a reinforced concrete bed. The results of the tests of this track structure as to bending stresses, track level depression, rail stresses and noise levels are shown in graph form, and comparisons are made with similar test results in the ballast bed structure. Further development is necessary before a rapid program of changing to a ballast-less structure is indicated.

0374
TRACK MAINTENANCE ON HIGH SPEED RAILWAYS
Eisenbahntechnische Rundschau-The Railway Technical Review, Vol. 20, No. 1-2, Feb. 1971, pp 55-56

The results of six years of operation of the Takaido Line of the Japanese National Railways, the 200-210 km/h high speed, single purpose line for passenger service, are given in detail as relating to track alignment and level deformations and maintenance requirements of the track structure to keep it within the necessary limits for safety and comfort. This work has been found to be much higher in amount and cost than first envisioned, and instead of the nightly freight runs first planned, the track maintenance work is now scheduled for the night hours. The number of trains run on this line has now increased to 85 pairs daily, with a loading of 60,000 tons per day on the track structure. The details of the construction of this track is tabulated, including the type of rail, ties and and ballast bed. For this line, 160,000 tons of ballast are required yearly. Track maintenance, which approximates 50% more than anticipated, is compared with that on the German railways, where, with the mixed operation of heavy freight trains at 80 km/h and 200 km/h passenger trains, such maintenance is about 30% higher than on the lower speed and lesser load lines.

0375
THE PROBLEMS OF TRACKWAY AND SIGNAL TECHNIQUES FOR RAIL TRANSPORTATION AT HIGH SPEEDS
Eisenbahntechnische Rundschau-The Railway Technical Review, Vol. 17, No. 12, Dec. 1968, pp 506-512

The problems relating to high speed travel are outlined. For speeds up to 250 km/h, the conventional form of track structure, with ties on the ballasted road bed, will suffice, using the presently available equipment and motive power systems. The following improvements in the present rail permanent way are suggested for attaining the full benefit in travel time reduction form the high speed operation: strengthing the present track structure system; improving the soil foundation under the track structure; improving the track with consideration for the centrifugal forces of vehicles on curves; elimination of close track spacing; elimination of railway road crossings; and equipping the high speed sections with continuous train control.

0376
QUARTERLY REPORT OF THE RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 9 NUMBER 2 JUNE 1968
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, 1968, 69 p, Available: NTIS, PB 180027

Reports are presented on materials, methods, equipment and allied considerations.

0377
TRACK STRUCTURE FOR HIGH-SPEED TRAFFIC
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Special Issue, Oct. 1963, pp 2-6

Results of tests are given of factors related to a speed test of equipment at 200 km/h. Effect upon ordinary track, track on a solid bed (without ballast) an expansion and insulated joint, a PC sleeper, deformation of loamy embankment, ground vibration and finally, train wind force are considered. The second section is devoted to thermit welding of various types of rail and standards to be followed.

0378
LATERAL BALLAST RESISTANCE AND STABILITY OF TRACK IN EARTHQUAKE
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 11, No.1, Mar. 1970, pp 3-6

The behavior of the railway track on an earthquake was studied through experiment and theoretical analysis. The experiment was performed with real tracks in the RC-box placed on the vibrational table of 5 x 5m^2 in dimensions. The conclusions are as follows: against the earthquake acceleration with which railway structures are designed, 83% of the track on the Shin Kansen and 78% in the track

with PC-ties and crushed stone ballast on the narrow gauge lines. The long weld rail track holds the safety factor at least 1.15 for the buckling due to temperature rise in the earthquake with the same acceleration mentioned above.

0379
THE ALLOWABLE LEVEL OF NOISES TENTATIVELY ACCEPTED IN 1953
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute-Quarterly Rpt., Vol. 1, No. 3, Sept. 1969, p 10

High signal-to-noise ratio is needed to allow radio listeners to enjoy pleasant listening, regardless of whether a noise level is above the allowable level. There is no harm to radio listeners in the vicinity of the large cities even when the noise level is beyond 40 dB, but there is complaint of noises in secluded places among the mountains even in the case of noise below 40 dB. The level has been practically fixed to make clear the action which should be taken by railway administrations for the broadcasting services in reducing noises.

0380
A THEORY OF THE DERAILMENT OF WHEELSET
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 7, No. 3, Sept. 1966, pp 30-34

In this study, in order to find out an allowable limit of derailment the author made four assumptions and analyzed the simplest case where a wheelset derails. In order to prove the theory, the author made experiments by 1/10 and 1/5 scale model wheelset. The results of either case of 1/10 or 1/5 models coincide with theoretical values, and no difference was observed on the limit value of derailment by stationary side thrust having a various kinds of radii of the wheels.

0381
GROUND VIBRATION DUE TO TRAIN--ON EFFECTS OF RAIL JOINT GAP
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 8, No. 2, June 1967, p 119

Ground vibration due to train passage is described referring to the results of a measurement carried out between Matsukawa and Kanayagawa on the Tohoku Truck Line in October 1964. The main purpose of the measurement was to study effects of rail joint gap on the noise and ground vibration. Results can be summarized as follows: horizontal vibration caused by an expansion joint is smaller at 2.8 m from the track center than at 5.8 m; and the dominant frequency of horizontal displacement due to the joint with the gap of 15 mm is lower than that of the expansion joint and the joint with the gap of 5 mm.

0382
PRESENT STATUS OF STUDY AND PROBLEMS ON SUPER-HIGH-SPEED TRAIN
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 9, No. 3, Sept. 1968, pp 163-167

From June 1966 to August 1967, seminars were held for the study of the super-high-speed train systems in RTRI to grasp the present status of study and to ascertain the problems in future on this subject. Materials and discussions in the seminar are arranged and described in this report. Topics of social and economic aspects, power requirements, suspension systems, propulsions systems, current collection, tunnel ventilation, are discussed.

0383
WELDED RAIL JOINT FRACTURES AND THEIR EFFECT ON 200 km/h OPERATION
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 15, No. 3, Sept. 1964, pp 21-24

JNR conducted a series of tests to determine the effect of broken welded rail joints on trains running at high speed. A rail gap of 20 to approximately 30 mm was employed since this was considered the likely amount just after a rail fracture in winter on the New Tokaido Line. The train used for this test consisted of six 2-axle bogie type electric rail-cars with an axle-load of 15 tons. Items measured included: rail deflection, rail stress, stress on the fastening device, track vibration acceleration and sleeper stress and the like; most of these were measured using wire strain gauges. On-the-rolling-stock measurements included: wheel side thrust, wheel load, bogie stress, car body vibration, axle box vibration and similar forces. The results of the test indicate that train operation on the New Tokaido Line is judged as completely safe from the point of view of possible broken welded rail joints, in that even the lateral discrepancy of ends of the broken rails and wheel side thrust at the train passing the broken point were found to be less than 1/2 of respective maximum limits for safe train operation, and values for car body vibration and other items were also found to be sufficiently small.

0384
DEFORMATION OF RAILWAY TRACK UNDER HIGH-SPEED TRAIN--MEASUREMENTS ON THE TEST-RUN SECTION OF THE NEW TOKAIDO LINE
Railway Technical Research Institute - Quarterly Rpt., Vol. 7, No. 7, June 1966, pp 20-23

In designing the new Tokaido line, many field tests through actual operations of trains at high

speed were conducted in parallel with model experiments, laboratory tests and theoretical analyses. Major items of measurement on the ground were rail deflections, rail stress, stress on fastening device, track vibration acceleration and sleeper stress. Major measured items on the car were wheel side thrust, wheel load, bogie stress, car body vibration, axle box vibration and similar forces.

0385
HIGH-SPEEDS SYMPOSIUM
Bulletin of the International Railway Congress Association, Aug. 1968, pp 391-460

Theoretical and experimental solutions are discussed of track problems for high speeds, especially in regard to the design of curves and transition curves, track laying and maintenance tolerances as well as dynamic stability. Conclusions as regards the design of tracks and points are reached.

0386
TRACK GEOMETRY AND DESIGN OF THE PERMANENT WAY OF HIGH-SPEED LINES
Bulletin of the International Railway Congress Association, June 1969, pp 393-428

The increase in maximum speed envisaged by many railway administrations makes exacting demands on the permanent way. In the following, the resulting problems associated with the railway track are discussed mainly on the basis of theoretical considerations and on the strength of the results of experimental research carried out by the German Federal Railway (D.B.) at speeds of 200 km/h. The resulting conclusions are also applied to even higher speeds. Comparisons are made with similar developments abroad.

0387
SANTA FE INSTALLS CONCRETE TIE TESTS
Railway Track & Structures, Vol. 68, No. 1, Jan. 1972, pp 30-32

Four out-of-face service installations at widely scattered points on system include various types of prestressed mono-block ties as well as different types of fastenings. The fifth installation tests concrete ties on a one-for-one basis. Details of the several test installations, each identified by its location, are described.

0388
FIGHTING SHELLY RAIL WITH HIGH-CANT TIE PLATES
Railway Track & Structures, Vol. 67, No. 5, May 1971, pp 20-21

Extensive tests with plates having a 1-in-14 cant were carried out at Union Pacific. The results of the tests lead to decision to make them standard for curves of two degrees and over the heavy-traffic road which has encountered a serious and extensive shelling problem.

0389
FOR THE WOOD TIE: WHAT SIZE, WHAT SPACING
Railway Track & Structures, July 1968, pp 22-24

0390
WHAT KIND OF FASTENING FOR THE CONCRETE TIE
Railway Track & Structures, May 1966

0391
27 MILES OF BART AERIAL STRUCTURE
Riggs, L. W., Railway Track & Structures, Vol. 62, No. 7, July 1966, p 17

0392
EXPERIMENTS ON NEW TYPE RAILWAY TRACKS
Satoh, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Rpt. No. 8

0393
DETRAILMENT REPORT
Unpublished Rpts.

Several anonymous derailment reports from various railroads are contained in this unpublished package. Each report includes information on a particular train, the nature of the derailment and track geometry parameters. Detailed charts illustrate track conditions as revealed by measurements taken. Derailment costs are given when available. Speed at time of derailment is indicated.

0394
TRACKS WITHOUT BALLAST FOR UNDERGROUND LINES IN URBAN CENTERS
Office of Research and Experiments, UIC, Netherlands, Rpt., Question D 87

The article discusses a testing program to determine the feasibility of using non-ballasted track for underground railways. Problems of noise level, vibration, as well as tunnel characteristics are among those variables to be considered in the program.

0395
ASSURING THE STABILITY OF THE BARTD LIGHTWEIGHT RAPID TRANSIT VEHICLE
Parsons Brinkerhoff-Tudor-Bechtel, Research Rpt.

The BARDT System will utilize lightweight cars about 800 lbs per linear foot operating at higher average speeds than any other transit system in the world. These vehicles will be subjected occasionally, on 31 miles of aerial structures and 24 miles of at-grade construction, to high winds. Mathematical formulas were developed to determine the reliability of vehicle-track systems constructed to a range of gauges under various combinations of adverse conditions. As a result of these investigations, it is recommended that the BARTD System vehicle and track system be designed to a gauge of 5'-6". Findings clearly indicate that this approach would assure the lateral stability and safety of the desired lightweight vehicle more effectively and economically than any other design approach.

0396
DATA COLLECTION AND ANALYSIS REPORT, TRACK & ROADBED INVESTIGATIONS FOR TEST TRACK PROGRAM OF SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT
Kaiser Engineers, Oakland, Calif., Rpt. No. 64-25-R, May 1964, 282 p

100 RE rail section is satisfactory for type and loading of transit service, adequacy of supply, past performance and rail head design. Control-cooled rail is adequate for transit service in tangent rack and curves to 2°; additional wear benefits of high-silicon is justifiable for curves over 2°; and hardened rail is desirable for points of intense traffic at wye junctions, stations, switches and crossings. Continuous welded rail is more reliable and economical by electric-flash or gas-pressure plant methods. Thermit welding is acceptable for joining long welded rail strings. Rail grinding is recommended for new installations prior to vehicle operation. Polyurethane treated rail has insufficient development at this stage to consider its inclusion. The adaptations of anchor studs and twist-shank spikes for plate anchorage is recommended on wood ties. The bent and formed spring rod types of clips have an advantage over threaded and bolted lead types. Resilient tie pads do not contribute substantially to noise reduction but reduce considerably vibration and shock to structures. Use of asphalt ballast stablilization and soil cement base will result in track that will be superior in riding quality and economical from reduced maintenance. Concrete ties show best promise for feasiblity and stability of track for at-grade sections. The inclusion of sections of continuous concrete slab in test track will permit evaluation of fasteners, resiliency of support, and performance of slabs cast by slip-form. Track inspection cars are recommended for system use.

0397
HIGH SPEED TEST EMBANKMENT--DESIGN STUDIES
Shannon and Wilson, Inc., for The Atchison, Topeka and Santa Fe Railway and the U. S. Department of Transportation

0398
COMBINED EFFECTS OF FRICTIONAL AND ELASTIC MONENTS AGAINST TRUCK TURNING UPON HUNTING OF TRUCK
Matsudara, T., Arai, S., and Yokose, K., Railway Technical Research Institute - Quarterly Rpt., Vol. 7, No. 3, 1966, pp 40-45

0399
HUNTING PROBLEMS OF HIGH SPEED RAILWAY VEHICLES WITH SPECIAL REFERENCE TO BOGIE DESIGN FOR THE NEW TOKAIDO LINE
Matsudara, T., Proceedings of the Institute of Mechanical Engineers, Vol. 180, Part 3F, 1965-1966, p 58

0400
RAILWAY TRACK
Matsubara, K., Japanese Railway Engineers' Association, Tokyo, Japan, Japanese Railway Engineering, Vol. 4, No. 1, Mar. 1963

0401
NEW SANYO LINE
Matsubara, K., Permanent Way, No. 42-43, May, 1970, pp 1-16

This article deals with the roadbed, curves and gradients, track structure (rails, turnouts, expanding joints, adjustable ballast track), and track layout.

0402
LEMNISCATE--ITS USE FOR TRANSITIONING RAILWAY CURVES AND CALCULATIONS FOR
Dickshit, G., International Railway Congress Association--Monthly Bulletin, Vol. 40, No. 6, June 1963, pp 403-411

Advantages of lemniscate processes over cubic parabola and its use on railroads for transitioning circular curves are discussed. Method is described by which suitable length of transition spiral and equation for setting it out without use of fractional angles, can be calculated from first principles.

0403
RATE OF RUNNING UP CANT ON RAILWAY CURVES AS APPLICABLE TO DIFFERENT GAUGES
Dickshit, G., International Railway Congress Association--Monthly Bulletin, Vol. 40, No. 7, July 1963, pp 449-458

Methods for calculating amount of equilibrium cant to fully balance centrifugal force are given. Cant provided is not for maximum speed but for a certain proportion of it.

0404
CUBIC PARABOLA AS TRANSITION CURVE, ITS INACCURACIES AND AMENDMENT
Dickshit, G., International Railway Congress Association--Monthly Bulletin, Vol. 40, No. 4, Apr. 1963, pp 223-241

An extension is given of a study conducted by G. Polsoni concerning inaccuracies of transition curve equations. Amendment of accepted equation to cubic with calculations that eliminate existing inaccuracies is presented.

0405
EXPERIMENTAL STUDY FOR DYNAMIC BEHAVIOR OF RAILWAY VEHICLES ON LATERALLY ANGLED TRACK
Matsumoto, Y., and Fujisawa, N., Proceedings of the Japanese Society of Civil Engineering, No. 200, Apr. 1972, pp 91-102, In Japanese

0406
TRACK GEOMETRY AND PERMANENT WAY DESIGN ON SPEED RAILWAYS
Birmann, F., IRCA Bulletin, June 1969, pp 393-428

Conclusions are given for designing rails, rail fastenings, ballast and subsoil stressing, subsoil stressing with a transverse-sleeper track and with bedplates.

0407
PLASMA TREATMENT OF RAILWAY RAILS TO IMPROVE TRACTIONS
SEE 0086

0408
STRESS DISTRIBUTION IN THE PERMANENT WAY DUE TO HEAVY AXLE LOADS AND HIGH SPEEDS
Eisenmann, J., AREA Bulletin, No. 622, Sept. 1969, pp 24-60

0409
STRESSING THE RAILS AS SUPPORTING MEMBERS
Eisenmann, J., Eisenbahntechnische Rundschau, Aug. 1969, pp 306-312, In German

With an unballasted permanent way on concrete slabs, the subsoil reaction value depends on the resilience of the rubber sheeting placed between the rail and concrete block. Inertia and resistance moments of different rail sections, temperature stress and body stress, and ascertaining the subsoil reaction value are described.

0410
TRACK FASTENER PERFORMANCE
Cooperrider, N. K., Rpt. to the N. Y. State Department of Transportation, Sept. 1972

0411
LATERAL STABILITY OF CONVENTIONAL RAILWAY PASSENGER TRUCKS
Cooperrider, N. K., Proceedings of the First International Conference on Vehicle Mechanics, Detroit, Michigan, July 1969, pp 37-67

0412
UNDERGROUND TRAILWAY TRACKS & NOISES
Kazamaki, T., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Rpt.

0413
DYNAMICS OF HIGH SPEED ROLLING STOCK
Matsudaira, T., Japan National Railways-Quarterly Rpt., Special Issues 57-65, Apr. 1960, pp 20-26, Nov. 1961, pp 13-22, Nov. 1962, pp 21-27, Oct. 1963, pp 21-25, and Aug. 1964

0414
REDUCING THE DEFORMATION OF THE BASE AREA
Pozdnyakov, B. I., Putj i Putevoe Hoziaistvo, May 1969, pp 25-26, In Russian

0415
DRILL-LIME TREATMENT OF SHALLOW RAILWAY SUBGRADE FAILURES IN EXPANSIVE CLAYS
Farris, J. B., AREA Bulletin, No. 626, Feb. 1970, p 5749

0416
INCREASING THE LOAD-CARRYING CAPACITY OF THE FOUNDATION SUBSOIL ON THE LINES OF THE CSD
Kraus, J., Signal und Schiene, May-June 1970, pp 233-235, In German

0417
APPLICATION OF POLYMER MATERIALS TO BALLASTLESS TRACK STRUCTURES
Usami, T., Railway Research Rpt., No. 2, June 1970, p 116

Performance tests for rubber mats used in open bed, slab-type track structures are described in brief.

0418
SOIL STABILIZATION. LIME USED FOR SOIL STABILIZATION
Ireland, H. O., AREA Bulletin, No. 628, June-July 1970, pp 846-855

0419
ANALYSIS OF COEFFICIENTS FOR THE CALCULATION OF REINFORCED CONCRETE TIES (BETRACHTUNGEN UEBER BEIWERTE ZUR BERECHNUNG VON SPANNBETONSCHWELLEN)
Talposi, A., Glasers Annalen, Vol. 95, No. 4, Apr. 1971, pp 89-90, In German

From static and dynamic stress measurements on rails and ties, coefficients were derived which are required for calculating the strength properties of concrete ties.

0420
SERVICE TESTING CONCRETE TIES/SLEEPERS IN THE SEARCH FOR OPTIMUM TRACK
Way, G. H., The Dynamics and Economics of Railway Track Systems Conference, RSMA, Feb. 1970, Paper No. 10, pp 155-168

Design of a service test, test objectives, and procedure, measurement of track geometry deterioration, and track response to dynamic load are discussed.

0421
STRESSES IN RAILROAD TRACK
Timoshenko, S., and Langer, B. F., ASME Transactions, New York, Vol. 54, 1932, pp 277-293

0422
METHOD OF ANALYSIS OF STATISTICAL AND DYNAMICAL STRESSES IN RAIL
Timoshenko, S. P., The Collected Papers of Stephen P. Timoshenko, McGraw-Hill Book Company, 1953, pp 422-435

0423
FUNDAMENTAL OF SOIL MECHANICS
Taylor, D. W. John Wiley and Sons, Inc., New York, 14th Printing, 1965

0424
THEORETICAL SOIL MECHANICS
Terzaghi, K., John Wiley & Sons, Inc., New York, Second Printing, 1944

0425
ULTRASONIC TESTS ON RAILS IN SITU WITH ELECTRO-MAGNETIC AND ACOUSTIC TRANSDUCERS
Vlassov, V. V., Lonchak, V. A., Glukhov, N. A., Invanov, I. V., and Runov, N. N., Russian Ultrasonics, Vol. 1, No. 3, July-Sept. 1971, pp 178-184

Article describes ultrasonic contactless testing equipment used for detecting defects in rails. System uses ultrasonic oscillations produced by an electromagnetic-acoustic transducer. Mechanical details of the assembly are described, as well as block diagram of electric circuitry.

0426
SYSTEM OF RESILIENT RAIL MOUNTING
Varga, O. H., and Jebson, L. A., Bulletin of the International Railway Congress Association, London, England, No. 625-143-5, May 1957

0427
FATIGUE-WEAR TESTING OF RAILS UNDER ROLLING LOAD
Toth, L., Acta Tech (Budapest), Vol. 70, No. 3-4, 1971, pp 445-457

The fatigue-wear endurance model tests conducted on surface hardened and untreated low-carbon rails, as well as the test results, are presented. Both the wear and fatigue load resistance of the surface hardened rails surmounted those of the untreated rails.

0428
STRESSES IN RAILROAD TRACK
Talbot, A. N., American Railway Engineering Association, Chicago, Illinois, Progress Rpts. 1-7, AREA Proceedings, Vols. 19, 21, 24, 26, 31, 35, and 42

0429
DESIGN OF 60 KG. RAIL AND FISH-PLATE
Watanabe, K., and Sugiyama, T., Tokyo, Railway Technical Research Institute--Quarterly Rpt., Vol. 10, No. 2, June 1969, pp 71-72

New type of rail for a truck line has been designed. The weight of the rail is 60.8 kg/m. The design procedure is discussed.

0430
TRACK FOR TODAY'S AND TOMORROW'S VEHICLES
Maughan, R. G., Dynamics and Economics of Railway Track Systems Conference, RSMA, Feb. 1970, Paper No. 3, pp 29-41

The type of track structure which appears to be desirable to give the maximum ride qualities is discussed.

0431
HOW TO REDUCE THE VOLUME OF LEVELLING WORK ON TRACKS WITH FERRO-CONCRETE SLEEPERS
Evdokimov, B. A., Putj i Putevoe Hoziajstvo, Mar. 1968, pp 30-33, In Russian

Description of the test section, the ballast, rails, fastenings, and the liners is given. The results obtained, and the value of the elastic modulus for the under-rail foundation is presented.

0432
NEW METHODS OF INVESTIGATING SWOLLEN AREAS/TRACK DISTORTIONS
Kryukov, G. N., Putj i Putevoe Hoziaistvo, Mar. 1968, pp 39-40, In Russian

0433
EXPERIMENTAL STRESS ANALYSIS OF RAILS
Babb, A. S., Institution of Mechanical Engineers Proceedings, Vol. 180, No. 41, 1965-1966, pp 949-969, Discussion, pp 970-971, Reply, pp 978-079

0434
MANPOWER SAVING IN TRACK MAINTENANCE. FURTHER DEVELOPMENT OF CONCRETE SLAB TRACKS
Murayama, H., Japanese Railway Engineering, Tokyo, Vol. 12, No. 2, 1971, p 13

The superiority of unballasted track as developed by the JNR is discussed. Different types of slab are being tested under severe conditions.

0435
BUCKLING OF TRACK
Schader, S..E., Jarnvags Teknik, No. 4, 1971, pp 82, 84-88, In Swedish

Rail creep and thermal stresses may result in local distortions if the lateral resistance of the track is reduced. The importance of ballast profile and the degree of compactness due to maintenance work is discussed.

0436
DETECTION OF RAIL FAULTS ON SNCF
Deutsch, R., Railway Gazette, No. 12, June 20, 1969, pp 459-464

0437
MEASURING ON WEAR OF RAIL STEELS BY MEANS OF THE PROFILE CASTING METHOD
Borup, L., Jarnvags Teknik, No. 5, 1969, pp 119-121

A measurement of the wear of the rail is reported.

0438
ANALYSIS OF THE NON-LINEAR DYNAMICS OF RAILWAY VEHICLE WHEELSET
Law, E. H., University of Connecticut, Storrs, and Grand, R. S., Joint ASCE-ASME Transportation Engineers meeting, Seattle, Washington, July 26-30, 1971, Preprint No. 1427, 30 p (From Ph.D. Thesis University of Connecticut, 1971)

0439
AXLE LOAD AND WHEEL DIAMETER CONSIDERED FROM ASPECT OF STRESSES ACTING ON MATERIAL OF WHEEL AND RAIL
Kilb, E., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 10, Oct. 1967, pp 663-668

0440
TRAIN ELEVATED GUIDEWAY INTERACTIONS, HIGH SPEED GROUND TRANSPORTATION SYSTEM ENGINEERING STUDY
Kaplan, A., and Lipner, N., TRW Systems Group, to the Federal Railroad Administration - Office of High Speed Ground Transportation, FRA-RT-70-23, Feb. 1970, 144 p, Contract C 353-66-NEG, Available: NTIS, PB 190635

0441
MICROSLIP BETWEEN A ROLLING ELEMENT AND ITS TRACK ARISING FROM GEOMETRIC CONFORMITY AND APPLIED SURFACE TRACTIONS
Halling, J., Journal of Mechanical Engineering and Science, Vol. 6, No. 1, Mar. 1964, pp 64-73

0442
STABILITY AND RIDING QUALITIES PROBLEM AREAS OF HIGH SPEED FLANGED-WHEEL/RAIL TRANSPORTATION SYSTEMS
Clark, J. W., United Aircraft Corporation, Research Laboratory, East Hartford, Connecticut, UAR-D43, Mar. 1965

0443
INVESTIGATION OF THE TRACK HUNTING INSTABILITY PROBLEM OF HIGH-SPEED TRAINS
Clark, J. W., and Law, E. H., ASME Publication 67-Tran-17, for presentation at the Sesquicentenial Forum on Transportation Engineering, New York, New York, Aug. 28-30, 1967

0444
INFLUENCE OF VEHICLE AND DISTRIBUTED GUIDEWAY PARAMETERS ON HIGHSPEED VEHICLE - GUIDEWAY DYNAMIC INTERACTIONS
Chiu, W. S., Massachusetts Institute of Technology, Cambridge, Mass., Smith, R. G., and Wormley, D. N., ASME Paper 70-Tran-13, for a meeting Oct. 11-14, 1970, 10 p

0445
DYNAMIC RESPONSE CHARACTERISTICS OF THE URBAN GRAVITY - VACUUM TRANSIT SYSTEMS
Caywood, W. C., Johns Hopkins University, Silver Springs, Md., and Dailey, G., ASME Paper 69-WA/PID-23, for a meeting Nov. 16-20, 1969, 5 p

0446
EFFECT OF DESIGN VARIATION ON SERVICE STRESSES IN RAILROAD WHEELS
Bruner, J. P., Jones, R. D., Levy, S., and Wandrisco, J. M., ASME Paper 67-WA/RR-6, for a meeting Nov. 12-17, 1967, 16 p

0447
THERMAL ELONGATION OF RAILS ON ELASTIC MOUNTINGS
Varga, O. H., American Railway Engineering Association Bulletin, Vol. 626, Feb. 1970, pp 621-643

Thermal elongation is considered in conjunction with the longitudinal elasticity of rail fastenings. Calculation was made of the behavior of rails on temperature rise in quantitative terms. The sequence of longitudinal loads on elastic rail mountings, thermal elongation involving creep at proportion of rail mountings, and evaluation of continuously distributed rail mounting resistance are discussed.

0448
STRESSES DUE TO THE PRESSURE OF ONE ELASTIC SOLID UPON ANOTHER
Thomas, H. R., and Hoersch, V. A., University of Illinois, Urbana, Illinois, Bulletin No. 212, July 1930

0449
EFFECT OF TRACK GEOMETRY ON RIDE QUALITY
Ullman, K. B., and O'Sullivan, W. B., IEEE Transaction on Industrial and General Applications, Vol. 7, Nov. 1971, pp 755-759

0450
RAIL VEHICLE DYNAMIC STUDIES
Sewall, J. L., NASA Langley Research Center, Hampton, Va., Parrish, R. V., and Durling, B. J., U. S. Naval Research Lab., Shock & Vibration Bulletin 49, Pt 6, Dec. 1969, pp 109-126

0451
COMPUTER PROGRAM FOR DETERMINING THE EFFECT OF DESIGN VARIATION ON SERVICE STRESSES IN RAILROAD WHEELS
Riegel, M. S., et al., ASME Transactions, Series B, Vol. 88, pp 352-357

0452
MEASUREMENT AND ANALYSIS OF WHEEL-RAIL FORCES
Peterson, L. A., Bessemer & Lake Erie Railroad Company, Pittsburgh, Pa., Freeman, W. H., and Wandrisco, J. M., ASME Paper 71-WA/RT-4, Presented at a meeting Nov. 28 - Dec. 2, 1971, 20 p

0453
INCREASING THE STRENGTH OF RAILS AND THEIR RELIABILITY IN SERVICE ON THE RAILWAYS OF THE USSR
Zolotarsky, A. F., and Rauzin, Y. R., Rail International, Vol. 2, No. 12, Dec. 1971, pp 908-915

The main measures are aimed at increase of the rail strength. Partly the rail strength increase is attained by means of raising the carbon content in steel, improvement of its metallurgical quality and by addition of alloying elements. The drastic improvement of the rail strength is being attained through the heat-treatment. This article comprises also a short review of the investigation of mechanical properties of hardened rails and their performance after 4-year service. The strength is noted to be considerably increased, the contact-fatigue damage reduced greatly and the general durability raised. Authors give also the method of recovering the hardness of the metal in the zone of welded joints in cwr.

0454
COMBINED EFFECT OF FRICTIONAL AND ELASTIC MOMENT AGAINST TRUCK TURNING ON RUNNING STABILITY OF A TRUCK WITH ELASTICALLY SUSPENDED AXLES
Yokose, K., Japanese National Railways, Kokubunki, Japan, Bulletin JSME, Vol. 13, No. 61, July 1970

0455
APT-E TAKES TO THE RAILS
Wickens, A. H., Railway Gazette International, Vol. 128, No. 5, May 1972, pp 185-188

Features of the British Railways experimental Advanced Passenger Train is reported to offer the prospect of 250 km/hr on existing tracks and possibly 400 km/hr on the new lines, and greatly extending the range of conventional steel-rail track by virtue of a suspension which combines a high critical speed and passage through curves without flange contract.

0456
GENERAL ASPECTS OF LATERAL DYNAMICS OF RAILWAY VEHICLES
Wickens, A. H., ASME Paper 68-WA/RR-3, Presented at a meeting Dec. 1-5, 1968, 7 p

0457
THE PROPER AND MOST ECONOMICAL SIZE AND SPACING OF WOOD CROSS TIES
Reiner, I. A., and Law, C. W., B&O - C&O Research Services Planning Department, Baltimore, Md., 1966

0458
ENGINEERING AND ECONOMIC ANALYSIS OF WOOD TIE VERSUS CONCRETE TIE TRACK
Reiner, I. A., B&O - C&O Research Services Planning Department, Baltimore, Md., 1966

0459
MEMORANDUM - THE HORIZONTAL STABILITY OF TRACK
Reiner, I. A., B&O - C&O Research Services Planning Department, Baltimore, Md., May 13, 1964

0460
THE PERMISSIBLE DISTORTION OF TRACK
Reiner, I. A., and Law, C. W., B&O - C&O Research Services Planning Department, Baltimore, Md., Mar. 1963

0461
ECONOMIC SECTION OF RAIL
Reece, A. N., A.R.E.A., Chicago, Illinois, A.R.E.A. Proceedings, Vol. 31, 1932, p 1497

0462
FINDING THE BEST RAIL CANT
Blessin, F., Signal Und Schiene, Aug. 1965, pp 343-344

0463
RESISTANCE TO WARPING OF CONTINUOUSLY WELDED OLD & NEW RAILS
Rubin, H., Bulletin of the International Railway Congress Association, No. 625.14(01), Mar. 1957, pp 199-203

0464
INVESTIGATION OF THE FORMATION OF CORRUGATIONS IN RAILS ON SELECTED TEST TRACKS UNDER CONDITIONS OF ORDINARY TRAFFIC (UNTERSUCHSSTRECKEN UNTER
Spieker, W., Koehler, H., and Kuehlmeyer, M., Stahl und Eisen, Vol. 91, No. 26, Dec. 23, 1971, pp 1470-1487

This is an evaluation of a large amount of data collected on two tracks since 1951 and 1958, respectively. Emphasis was on determining the behavior of different steels as a function of composition, melting practice, and treatment after rolling. Examples of findings are that increasing tensile strength and nitrogen content increase corrugations, increasing Mn and Si decrease the defect. In German.

0465
SHELLING OF RAILS EXPERIENCED IN JAPANESE RAILWAYS
Ito, A., and Kurihara, R., Permanent Way, Vol. 8, No. 2, Permanent Way Society of Japan Report No. 27b, Tokyo, Japan, pp 17-32

0466
REDUCTION OF NOISE AND VIBRATIONS WHICH AFFECT BUILDING STRUCTURES CAUSED BY THE PASSAGE OF RAILWAY ROLLING STOCK
Devaux, A., Monthly Bulletin of the IRCA, Dec., 1969, pp 717-760

0467
STUDY OF NEW TRACK STRUCTURE DESIGNS
Bhatia, G. A., Romualdi, J. P., and Thiers, G. R., Rpt. from U. S. Department of Transportation, Office of High Speed Ground Transportation to Carnegie-Mellon University, Mar. 1968

0468
FIELD AND LABORATORY STUDIES OF MODULUS OF ELASTICITY OF A CLAY FILL
Soderman, L. G., Kim, Y. D., and Milligan, V., Highway Research Record, No. 243, 1968, pp 1-11

0469
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF CLAY
Hanna, T. H., and Adams, J. I., Highway Research Record, No. 243, 1968, pp 12-22

0470
MODERN RAILWAY BALLASTS
Protzeller, H. W., Presented at 32nd Annual Meeting, National Sand and Gravel Association, Cincinnati, Ohio, Jan. 19, 1948

0471
LABORATORY INVESTIGATION OF RAILROAD BALLAST
Okabe, Z., Permanent Way Society of Japan, Tokyo, Japan, Rpt. No. 13, Dec. 1961

0472
NUMERICAL COMPUTATIONS OF STRESSES AND STRAINS IN A MULTIPLE-LAYER ASPHALT PAVEMENT SYSTEM
Warren, M., and Eieckmann, W. L., Chevron Research Corporation, Unpublished Internal Rpt., Sept. 1963

0473
SURVEY OF EUROPEAN CONCRETE CROSSTIES
Kunze, W. E., Transactions ASCE, Pt. II, 1963, pp 483-515

0474
FATIGUE CHARACTERISTICS OF FLEXIBLE PAVEMENT
Hong, H., Journal of Highway Division, ASCE, Apr. 1967

0475
EFFECT OF STRESS HISTORY AND FREQUENCY OF STRESS APPLICATION ON DEFORMATION OF CLAY SUBGRADES UNDER REPEATED LOADINGS
Seed, H. B., and Chan, C. K., Proceedings of the Highway Research Board, Vol. 37, 1958, pp 555-575

0476
RAILWAY EMBANKMENTS WITHOUT SETTLEMENT
Shakhunyants, G. M., Proceedings of the 6th International Conference on S.M.&F.E., Vol. 2, 1965, pp 193-196

0477
STUDY OF SUBGRADE PRESSURE OF RAILROADS
Miyako, J., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 3, No. 3, Sept. 1962, pp 28-33

Study was made of subgrade and rail pressure under traffic loading to improve methods of subgrade pressure evaluation along with the measurement of rail pressure as theoretically obtained from rail deflection analysis. Subgrade pressure is illustrated by model of track system. Techniques of pressure measurements are discussed.

0478
AERODYNAMICS OF HIGH-SPEED TRAIN
Hara, T., Kawaguti, M., Fukuchi, G., and Yamamoto, A., International Railway Congress Association, High-Speed Symposium, Vienna, Austria, 1968

0479
TRACK-SHARING FOR URBAN TRANSPORTATION
Rechel, R., Graves, F., Garcia, J., Jewell, W., and Swerzy, R., Institute of Public Administration, Washington, D.C., Rpt. No. INPUBADM-70-01, Final Rpt., Jan. 30, 1970, 150 pp, Contract DOT-UT-24, Available: NTIS, PB-192784

The study covers the potential use of existing under-utilized railway tracks in urban areas for passenger movements to the center city. Examination is made of the implications of instituting such service either by dual-mode railbus or by conventional rail equipment. The substantial vehicle development in railbuses is reviewed.

0480
DYNAMIC RESPONSES OF RAILROAD CAR MODELS TO VERTICAL AND LATERAL RAIL INPUTS
Sewall, J. L., Parrish, R. V., and Durling, B. J., National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va., NASA-TN-D-6375, L-7283, Nov. 1971, 97 p, Available: NTIS, N72-10964

0481
A TECHNIQUE FOR EVALUATING TRACK CONDITION USING RAILCAR VIBRATIONS
Clevenson, S. A., and Ullman, K. B., National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va., Rpt. No. FRA-RT-72-05, Apr. 1971, 7 pp, Paper presented at the 12th AIAA/ASME Structures, Structural Dynamics, and Materials Conference, Anaheim, California, Apr. 19-21, 1971, Available: NTIS, PB 201623

A technique for evaluating rail track roughness and irregularities using vibration measurements in the railcar is discussed. The technique has been applied to a demonstration train route now operated under DOT contract and has been used in establishing priority for track maintenance. Specific attention is placed on the portable, low-frequencv, low-amplitude, acceleration measuring/recording system. The data reduction and computer programs are described. Sample vibration measurements are given and the rating system is described. The project was a joint DOT-NASA effort.

0482
THE CONTINUOUSLY SUPPORTED RAIL SUBJECTED TO AN AXIAL FORCE AND A MOVING LOAD
Kerr, A. D., New York University, New York, Dept. of Aeronautics and Astronautics, Rpt. No. NASA-CR-109950, NYU-AA-70-03, Apr. 1970, 16 p, Contract NGL-33-016-067, Available: NTIS, N70-35610

0483
DYNAMICS OF FLEXIBLY SUPPORTED TUNNELS AND OTHER ROADBEDS
Brown, F. T., Massachusetts Institute of Technology, Cambridge, Mass., Rpt. No. DSR-76107-1, Nov. 1, 1966, 31 pp, Contract C-85-65, Available: NTIS, PB-173645

Vehicles supported by flexible roadbeds can exhibit violent vibrations near a particular critical volocity. This situation is idealized to a concentrated load traveling on a Bernoulli-Euler beam which rests on an elastic foundation. A floating tunnel design of the type proposed by Edwards is so modeled, and found to have a critical velocity of about 262 miles per hour and nearly negligible damping. Avoidance of excessive vibration by rapidly accelerating or deceleration through the critical frequency is studied with preliminary results. The tentative indication on the particular example is that an impractically high acceleration would be necessary unless changes are made.

0484
AUTOMATED TRACK INSPECTION INFORMATION AND ITS USE
Woll, T. P., Federal Railroad Administration, Washington, D.C., Rpt. No. FRA-RT-72-02, Sept. 29, 1970, 39 pp, Presented at the Roadmasters and Maintenance of Way Convention, Chicago, Ill., Sept. 29, 1970, Available: NTIS, PB-201621

The paper describes the type of track inspection information provided by the Department of Transportation test cars (railroad) and the way it is to be used. The D.O.T. track inspection car program and a computer program from which gage data is produced are discussed. The basic principle discussed apply to all track parameters. The concepts for data processing described and the resulting preferred formats for the presentation of track geometry data resulted from discussions with knowledgable people within the railroad industry. In particular track maintenance personnel were consulted regarding their preferred form for data presentation from the viewpoint of track maintenance.

0485
NEW DESIGNS FOR HIGH SPEED RAIL TRANSPORTS (NOVYE KONSTRUKSTII VYSOKOSKOROSTNOGO RELSOVOGO TRANSPORTA)
Rodovskii, A. B., Army Foreign Science and Technology Center, Charlottesville, Va., Rpt. No. FSTC-HT-23-1438-71, Feb. 22, 1972, 12 pp., Translation of Zheleznodorozhnyi Transport (USSR) No. 12, 1969, pp 79-82, Available: NTIS, AD 741726

A review is presented of Soviet and foreign research in the area of the design of high speed rail equipment. Designs are illustrated, developed from research conducted in the United States, England and Japan.

0486
FRICTION AND CREEP IN ROLLING CONTACT
Nayak, P., et al., Bolt, Beranek and Newman, Inc., FRA Rpt. No. RT-71-64, Nov. 1970

0487
EVALUATION OF THE PLASMA TORCH. STUDY OF OPERATIONAL TESTING AND EVELUATION OF AN ARC PLASMA GENERATOR AS A MEANS TO IMPROVE WHEEL-RAIL ADHESION
Dobbs, D. J., British Railways Board Research Department, Electrical Research Division, Derby, England, Rpt. No. FRA-RT-70-27, Final Rpt. for June 1968-June 1969, Jan. 1970, 59 pp, Contract DOT-FR-9-0009, Available: NTIS, PB-192885

Wheel-rail adhesion is one of the most important parameters for railway operation. The evaluation of the plasma torch for increasing and stabilizing this parameter is the subject of the report.

0488
EXPERIMENTS ON LATERAL STABILITY OF THE EXPERIMENTAL VEHICLE HSFV-1
Hobbs, A.E.W., . British Railway Research Department, Rpt. DYN 53, 1967

0489
INVESTIGATION OF THE TRUCK HUNTING INSTABILITY PROBLEM OF HIGH SPEED TRAINS

Law, E. H., and Clark, J. W., ASME Paper 67-TRAN-17

0490
APPLICATION DE LA THEORIE DES VIBRATIONS NON-LINEARIES SUR LE PROBLEM DU MOMENT DE LACET D'UN VEHICULE DE CHEMIN DE FER
Van Bummel, P., Technological University, Delft, Netherlands, Phd Thesis, 1964

0491
GENERAL ASPECTS OF THE LATERAL DYNAMICS OF RAILWAY VEHICLES
Wickens, A. H., Journal of Engineering for Industry, Transactions of the ASME, Aug. 1969, pp 869-878

0492
STUDY ON FILLING VOIDS UNDER RAILWAY TRACK STRUCTURE
Harada, Y., and Sugiyama, M., Tokyo Railway Research Institute - Quarterly Report, Vol. 10, No. 2, June 1969, pp 73-79

0493
TRACK FOUNDATION DESIGN
Waters, J. M., Railway Gazette, No. 19, Oct. 4, 1968, pp 734-737

0494
RESEARCH ON REASONABLE EMBANKMENT CONSTRUCTION
Michitaka, S., Railway Technical Research Institute, No. 3, Sept. 19, 1968, pp 139-150

Several methods of soft subsoil stabilization were compared with each other with particular reference to prevention of base failure, acceleration of settlement, and reduction of excessive vibration.

0495
VERY HIGH RAILWAY SPEEDS ON THE NEW SUBSTRUCTURES
Prud'Homme, A., Revue Gen. Chemins de fer, Jan. 1970, pp 56-72, In French

Spectrum of the geometrical defects in the permanent way are given. Vertical movements and lateral movements are described. The permanent way structure characteristics of the layout of a new line for speeds of 250 to 300 km an hour are discussed.

0496
STABILIZATION OF SOFT SUBSOILS. COMPARISON OF DEFORMATIONS AND BEARING CAPACITIES OF SOFT SUBSOILS REINFORCED WITH SAND/GRAVEL POLES
Muromachi, T., Railway Research Rpt. No. 1, Mar. 1970, pp 25-29

Four stabilization methods of sand/gravel pile type (sand drain, sand compaction pile, chemico-pile and gravel pile) were compared with the net-cloth method.

0497
THOUGHTS ON THE SIZE OF BASE COURSES IN RAILWAY CONSTRUCTION
Richter, F., Signal und Schiene, Feb. 1970, pp 57-58, In German

Base courses are the bed of ballast under the sleepers, protective courses or layers laid or made artifically (gravel, cement and lime stabilization, and bituminous courses). The foundation for these courses are the untreated or soil bed. The basic construction of the system; deciding the size of protecting courses; and critical remarks on the process are discussed.

0498
STABILIZATION OF SOFT SUBSOILS. VARIATION OF VIBRATION CHARACTERISTICS OF A LOW EMBANKMENT DUE TO SUBSOIL STABILIZATION
Miyako, J., Railway Research Rpt. No. 1, Mar. 1970, pp 22-25

0499
TWO WAYS OF DETERMINING A RAIL'S COORDINATES FROM ITS MID-ORDINATE-TO-CHORD MEASUREMENTS
McConnell, P., and Greenspun, R., Advances in Instrumentation, Vol. 24, Pt. 4, Paper 69-686 Proceedings of 24th Annual ISA Conference, Houston, Texas, Oct. 27-30, 1969, 8 p

0500
EFFECT OF VACUUM DEGASSING ON QUALITY OF RAIL HAVING TENSILE STRENGTH NOT LOWER THAN 90 Kg/mm^2
Mazanek, T., and Klisiewicz, Z., Hutnik, Vol. 37, No. 12, Dec. 1970, pp 559-564

0501
PROBLEMS IN GROUTING AS APPLIED TO CONSTRUCTION WORK
Higuchi, Y., Railway Research Rpt. No. 1, Mar. 1971, pp 1-6

0502
FOUNDATION DESIGN OF THE CAMAS PRAIRIE RAILROAD
Moore, H. E., Proceedings of Engineering Geology & Soils Engineering Symposium, Boise, Moscow, Idaho, Apr. 1969, pp 33-47

The concepts presented were developed to explain the engineering properties of a rather limited group of angular non-plastic, silty soils.

0503
RAIL TO SLEEPER FASTENINGS
Srinivasan, M., Railway Gazette, Vol. 125, No. 16, Aug. 15, 1969, pp 611-615

Review of research work and developments on British and French railroads in fastening design by combining rigidity and flexibility of fixtures with need to raise speeds and cut maintenance.

0504
SLAB 30E - A COMPUTER PROGRAM FOR AIRFIELD SLAB ANALYSIS
Panak, J. J., A Rpt. to the Transportation Facilities Branch, Department of the Army, Construction Engineering Research Laboratory, Sept. 1970

0505
PAVEMENT EVALUATION STUDY - RUNWAY 7-25, USAF PLANT 42, PALMDALE, CALIFORNIA
McCullough, B. F., and Frederick, J. H., Jr. Materials Research and Development, Inc., May 1968

0506
A SENSITIVITY ANALYSIS OF THE FLEXIBLE PAVEMENT SYSTEM FPS-2
Kher, R. K., McCullough, B. F., and Hudson, W. R., Research Rpt. No. 123-8, to be published jointly by Texas Highway Department, Texas Transportation Institute, Texas A&M University, and Center for Highway Research, the University of Texas at Austin.

0507
DYNAMIC ANALYSIS OF DISCRETE-ELEMENT PLATES ON NON-LINEAR FOUNDATIONS
Kelly, A. E., The University of Texas at Austin, Ph.D Dissertation, Jan. 1970

0508
A DISCRETE-ELEMENT METHOD FOR TRANSVERSE VIBRATIONS OF BEAM-COLUMNS RESTING ON LINEARLY ELASTIC OR INELASTIC SUPPORTS
Chan, J. H., and Matlock, H., Center for Highway Research, University of Texas at Austin, Rpt. 56-24

0509
RESEARCH INTO TRACK BED CONDITIONS
Walters, J. M., Railway Engineering International, June 1971

0510
TRACK ANALYSIS
Erismann, T., I.R.C.A., London, England, Bulletin of the International Railway Congress Association, No. 625.171: 625.172, Aug.-Sept. 1967, pp 571-591

0511
MODERN RAILWAY TRACK
Derniame, G., Editions De La Capitelle, Uzes (Gard), France

0512
RAILWAY TRACK & STRUCTURES CYCLOPEDIA
Dick, M. H., et al., Simmons Boardman Publishing Corp., New York, Eighth Edition, 1955

0513
CURVE RESISTANCE
Schramm, G., International Railway Congress Association - Monthly Bulletin, Vol. 40, No. 7, July 1963, pp 483-491

It is shown that conventional equations expressing curve resistance are only valid for certain ranges of curve radii and for certain extreme cases. On strength of track guidance considerations, new equations for curve resistance are developed which have general validity and take into account reduced gage widening used in curves. The results are plotted on a chart, and they differ from values based on conventional formulas by about 10%.

0514
TRACK AND ROADBED FOR HIGH-SPEED TRAINS
Johnson, R. P., Baldwin Locomotive Work, Railway Gazette, Vol. 83, Aug. 1945, pp 113-114

The article discusses the factors of roadbed and track as related to high speed operations, as well as the importance of maintenance for such operations. Track layout and the relationship of curves and superelevation are also discussed.

0515
TWENTY YEARS' EXPERIENCE OF FLEXIBLE PERMANENT WAY
Sonneville, R., Editions De La Capitelle, Uzes (Gard), France, 1966

0516
TRACK OF SUBWAY
Sekino, H., and Kazamaki, T., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way Rpt. No. 6b

0517
TEMPLATE SETS FASTENERS IN CURVED TRACK BED
Drossel, M. R., Construction Methods 53:63-5, Apr 1971

0518
THE RAILS AS A TRACK
Eisenmann, J., Eisenbahntechnische Rundschau, Jan.-Feb. 1971, pp 64-70, In German

This article discusses the following: rail profiles or sections; a model for permanent way calculations and actual condition; stressing at the underside of the rail; and surface pressure between cross tie and ballast.

0519
NEW TRACK STRUCTURE OF STEEP-GRADE SECTION
Numata, M., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 18a

0520
EXPERIMENTS ON TOKYO METROPOLITAN GOVERNMENT UNDERGROUND RAILWAY TRACK
Ozawa, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Report No. 18b

0521
BETTER RAILS (AMELIORATION DES RAILS)
Pomey, J., Chavane, R., Cornet, R., Rozenhole, S. and Leger, D., Rev de Metallurgie, Paris, Vol. 67, No. 1, Jan. 1970, pp 19-22

By using eutectoid steel with higher carbon and manganese contents than customary, only insignificantly deformed, hard, fatigue resistant rails are obtained when the following patented heat treatment is applied. Start heat treatment immediately after finish rolling. Step-quench in fluidized powder (e.g., of metallic chromium and superheated steam) above Ms, transform isothermally to lower bainite, and temper.

0522
TRACK FOR HIGHER SPEEDS
Ponnuswamy, S., Journal of Institute of Engineering, Civil Engineering Division, India, Vol. 52, No. 3, Pt. CI 2, Nov. 1971, pp 86-93

The paper reviews the studies conducted and practices adopted on various railroads in the world for attaining higher speeds, and experiments that are conducted in developing a continuous concrete bed with elastic pads between rail and the bed to meet needs of future higher speeds.

0523
BALLASTLESS TRACK CONSTRUCTION FOR TUNNELS
Sonneville, R., Stedef Company, Paris, France, Technical Bulletin, Mar. 1967

0524
THEORETICAL AND EXPERIMENTAL SOLUTIONS OF TRACK PROBLEMS FOR HIGH SPEEDS, ESPECIALLY IN REGARD TO DESIGN OF CURVES AND TRANSITION CURVES, TRACK LAYING AND MAINTENANCE TOLERANCES AS WELL AS DYNAMIC STABILITY--CONCLUSIONS AS REGARDS DESIGN OF TRACKS AND POINTS
Birmann, F., International Railway Congress Association -- Monthly Bulletin, Vol. 45, No. 4, Apr 1968, pp 391-460

Survey of correlations between permanent way data and stresses acting on track at speeds of 200 km/hr, and problems of railway tracks for high speeds and experimental investigations carried out by German Federal Railway are discussed. Investigations were conducted of alignment and curves, transition curves, counter-curves and changes in track spacing, vertical curves, track spacing and tunnels, track laying and maintenance tolerances, and dynamic stability of track. Conclusions are drawn as regards design of tracks and turnouts.

0525
MESSUNGEN AM GLEIS
Birmann, F., Glasers Annalen, Vol. 91, No. 9, Sept. 1967, pp 293-299, In German

Track measuring techniques are discussed. Modern measuring technique investigates oscillations of wheel loads and tension of rails under influence of flexibility of springs of track, and faults in cross-over heights and tightening of ties.

0526
ON LIFE OF RAIL
Satoh, Y., and Sato, Y., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 7, No. 1, Mar 1966, pp 28-31

Annual trend of rail failures of Japanese National Railways in recent years and relative comparison of types of rail failures in 1963 are shown. Failures are classified into inherent and external according to primary cause. Stress measurements at rail ends are described. To decrease chance of end break in new rails, 50 N and 40 N bolt holes are lessened in size and shifted to middle part expecting reduction of local stress near holes. Inclination of fishing surface is increased expecting increase of wear allowance at fishing surfaces to prevent contact of fishplate to rail web.

0527
DYNAMIC EFFECT OF FLAT WHEEL ON TRACK DEFORMATION
Satoh, Y., Permanent Way Society of Japan, Vol. 7, No. 1, Mar. 1964, pp 14-22; Institute Railway Congress Association-Monthly Bulletin, Vol. 42, No. 8-9, Aug.-Sept., 1965, pp 547-553

A series of riding tests were made to study dynamic effects of wheels, whose treads were set with flat spots, on rolling stock as well as on track at various speeds up to 200 km/hr on test run section of New Tokaido Line. Major test results concerning track deformation are outlined. Test train was composed of four prototype electric cars and flat spots were artificially created on treads of two wheels of third axle of second car.

0528
INFLUENCE OF GAPS AT RAIL SUPPORTS ON RAIL DEPRESSION CHARACTERISTICS
Satoh, Y., and Hirata, G., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 5, No. 4, Dec. 1964, pp 29-30

Formulas are proposed for calculating rail depression under wheel load rolling on supports one after another on track where rails are supported on equi-distant springs with equal stiffness and where some gaps exist between rails and springs. Assuming that gaps are distributed in magnitude of exponential random digits whose mean value is 1 mm and rail supporting springs are spaced at equidistance of 60 cm and stiffness is equal to 20 ton/cm, rail depression at 120 successive supported points is calculated by means of computer for Japanese National Railroad rail types of 30 kg, 40 N, 50 N, 50 T, and 60 kg.

0529
ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK

Sato, Y., International Railway Congress Association-Monthly Bulletin, Vol. 42, No. 2, Feb. 1965, pp 115-120

Tests to measure strength of spikes for ties sampled out of test sections, to measure pressure on several spikes under lateral pressure and wheel load imparted to rails by lateral pressure test car, and to measure shift of spikes on all ties in test sections after conducting loading run by lateral pressure test car are described. The test car was a two-axle freight car equpped with special additional axle below its center, which can exert both lateral and wheel loads of variable amounts by means of compressed air.

0530
TOLERANCE OF TRACK LONGITUDINAL LEVEL IRREGULARITY DETERMINED BY RIDING QUALITY
Sato, Y., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 8, No. 1, Mar. 1967, pp 43-48

Vertical vibration of trucks as result of irregularity of track longitudinal level was investigated. Calculations were made of the relation between riding quality, car structure and condition, running speed and measuring method of track irregularity. A method is proposed for determining tolerance of longitudinal level irregularity. Theoretical formula of car-body acceleration caused by bent point of track is introduced. Direct tolerance for versine record can be estimated from both minimum tolerance and average tolerance.

0531
METHOD OF FILLING GAPS IN PERMANENT RAIL BEDS
Sato, Y., Japanese National Railways, U S 3,432,098, Mar. 11, 1969

Disclosure deals with the construction pad which is formed as a flat bag that is inserted in voids or gaps between contacting structures, and is then filled with liquid synthetic resin which on curing permanently fills out the void or gap.

0532
CONCRETE SLEEPER TO RESIST EFFECTS OF FROST
Railway Gazette, Vol. 122, No. 19, Oct. 7, 1966, p 789

Ties used in Hokkaido, Japan are described. A sketch is shown of the prestressed tie with 20 instead of 16 pairs of 2.9 mm diameter prestressing wires. The first tests were generally satisfactory.

0533
TREATMENT OF UNSTABLE SLOPES
Railway Gazette, Vol. 120, No. 14, July 17, 1964, pp 610-612

Methods are given of grouting, reinforcement and draining for treatment of unstable slopes. Development of a system used extensively on British Railways of cement grouting for stabilizing slips in embankments and cuttings is described. The method of insertion is by driving a hole with 1-1/2 in. diameter steel pipe to a depth below the slip surfaces. Pipe is then withdrawn and polythene tube 1/2 in. ID inserted in its place.

0534
RAIL FASTENINGS
Railway Gazette, Vol. 120, No. 3, Feb. 7, 1964, pp 111-114

A review is presented of different methods available for securing rails to wood and concrete ties. Use of elastic spike, resilient bar-type, spring clip-type, and baseplate-type fastenings on British railroads is described. Fastening use on German and Swedish railroads is also described.

0535
RAILWAY SLEEPERS
Railway Gazette, Vol. 119, No. 18, Nov. 1, 1963, pp 486-489

This survey concerns types of timber, steel and concrete ties, insulating materials, and fastenings used in European countries including Great Britain, West Germany, Switzerland and Sweden.

0536
SELF-PROPELLED TRACK RECORDER
Railway Gazette, Vol. 106, 1957, p 688

A track recording trolley, is being used by the civil engineering department, Eastern Region, for detecting and recording track irregularities. It is self-propelled, weighs some eight tons, and is powered by a 65-h.p. petrol engine. As the vehicle travels along the track a series of probes and wheel flanges in contact with the rail surfaces communicate any irregularities to the recording table by means of wire cables and mechanical linkage. Records obtained include gauge variation, superelevation, and alignment. Speeds during recording are up to 20 m.p.h., but up to 50 m.p.h. can be attained when not recording. A crew of five is carried.

0537
EXPERIMENTAL COACH WITH PENDULUM SUSPENSION
Railway Gazette, Vol. 106, 1957, p 506

The prototype coach of the French National Railway, which uses a pendulum suspension to improve stability, is shown and described. The relationships between speed, superelevation of the track and centrifugal force are explained. In trail tests run at about 100 mph, g-forces were reduced from 0.24 to 0.06 by the use of the pendulum suspension, which greatly added to passenger comfort and reduced track stress.

0538
THE SUPERELEVATION OF RAILWAY CURVES
Railway Gazette, Vol. 78, 1943, pp 509-511

The most suitable superelevation for a given curve is determined as follows: the average speed on a tonnage basis should be ascertained from the actual known speeds of all trains, and the curve given the full theoretical superelevation corresponding to this average speed; and the maximum permissible speed on the curve should then be fixed as that corresponding to the above superelevation plus 4 inches. The first condition will result in equal loading of the two rails, and hence equal head wear and even maintenance of surface. The second ensures passenger comfort, and gives an ample factor of safety against derailment which is uniform for all curves, while at the same time it fixes an upper limit to the lateral forces acting on the track which is also the same for all radii. A table gives the superelevation for various radii for different average speeds, and the corresponding maximum permissible speeds.

0539
LATERAL DYNAMICS OF RAILWAY VEHICLES
Railway Gazette, Vol. 121, 1965, pp 987-990

The fundamentals of lateral dynamics theory of railway vehicles is reviewed. Numerous topics are presented, including: stable running theory, longitudinal creep, forward speeds, sinusoidal path, forces acting, hunting, conditions for stability, critical speeds, profiled wheels, suspension, coned and profiled wheels, wear of treads, vehicle design, and track geometry.

0540
TRUE GAUGE IN STRAIGHT TRACK
Railway Gazette, Vol. 82, 1945, p 445

The permissible amount of slack gauge in straight track in relation to the lateral oscillation or nosing of locomotives is considered. S or slack gauge, for any one locomotive and type of track will vary inversely as the square of the speed. Mathematical derivations for engineering physics aspects of the problem are given.

0541
SPEED ON CURVES ON THE L.N.E.R.
Railway Gazette, Vol. 87, 1947, pp 692-693

The item comments upon early standards for alignment and superelevation of curved track and extracts from the text of Technical Booklet No. 11 "Speed on Curves". Portions of the extract include information related to the determination of the amount of superelevation or cant to be applied to the track and the determination of the permissible rates of change of cant and diffusing, and their relation to the form and dimensions of the transition curve of the track. A portion of the booklet is devoted to the consideration of curves without transition, and formula are developed which cover permissible speeds through crossover roads, double junctions, and reverse curves.

0542
VEHICLE RIDING CONVENTION
Railway Gazette, Vol. 121, 1965, pp 913-916

The convention on interaction between vehicle and track convened by the Railway Engineering Group of the Institution of Mechanical Engineers consisted of four sessions at which 10 papers were read: "An Appreciation of the Practical Problems--a Survey of the Problems and Their Importance", "Some Observations on Linear Theory of Railway Vehicle Instability", "The Dynamics of Railway Vehicles on Straight Track: Fundamental Considerations on Lateral Stability", "Dynamics of Railway Vehicles on Curved Track", "Hunting Problem of High-Speed Railway Vehicles with Special Reference to Bogie Design for the New Tokaido Line", "Track Parameters Static and Dynamic", "The Influence of Track Twist on Vehicle Design", and "The Static and Dynamic Parameters of Railway Coaches".

0543
MEASURING ACCURACY OF MECHANICAL TYPE TRACK INSPECTION CAR
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Vol. 9, No. 2, June 1968, pp 113-117

Mechanical type track inspection car YA210 has a measuring chord length 4.6m, its measuring accuracy being 19%. The accuracy has been improved to 12% by means of softer restoring springs. YA210 may be used up to the speed of 72km/h. There are prospects of constructing a mechanical type track inspection car with a measuring accuracy 10% and a measuring chord length 10 m. The new mechanical type track inspection car will have an integral type measuring equipment for superelevation of track, and a mechanical type automatic data processing equipment.

0544
HIGH SPEED TRACK INSPECTION CAR
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Quarterly Rpt. No. 2, Mar. 1960

The primary requirement for a rational control of track maintenance is to know the state of the track exactly. A high speed track inspection car of a new type was completed last year. In view of the high speed operation during which the measurement is made, arrangements have been made to take all records electrically. Accuracy of records is quite good even at a speed of 120 km/h.

0545
TRACK INSPECTION CAR FOR NEW TOKAIDO LINE
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Quarterly Rpt.

New ideas have been incorporated in the design and manufacture of a new track inspection car for use on the New Tokaido Line, which has performed well so far. Items to be measured are: (1) unevenness, left, (2) unevenness, right, (3) variation of unevenness, left, (4) variation of unevenness, right, (5) twist of track, (6) track gauge, (7) alignment, left, (8) alignment, right, (9) variation of alignment, left, (10) variation of alignment, right, (11) cross level, (12) rolling of car body, (13) vertical acceleration of car body, (14) lateral acceleration of car body, (15) lateral thrust, left, (16) lateral thrust, right, (17) wheel load, left, (18) wheel load, right, (19) lateral thrust/wheel load, left, and (20) lateral thrust/wheel load, right. Systems are designed for accurate and sensitive measurement at speeds up to 200 km/h. The frequency response is within plus or minus 2% up to 50 cycles and within plus or minus 10% up to 70 cycles, and the linearity plus or minus 0.3 mm.

0546
NEW SHAPE OF TRANSITION CURVE IN HIGH-SPEED RAILWAY TRACK AND ITS ALIGNING
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Quarterly Rpt., Vol. 3, No. 2, June 1962, pp 38-45

Usually use the quantity called "Track Irregularities" as basic data and technical inferences are made from them. From the view-point of safety and comfort of travelling, we are requested to decrease the track irregularity especially with regard to high speed railway track. First of all grasp the essential meaning of "Track Irregularity" and consequently the next two quantities clearly: (i) difference between geometrically practicable shape and the actual shape of railway track, (ii) difference between physically rational shape and geometrically practicable shape of railway track. These two items are almost self-evident for the straight railway track, but for the curved railway track, especially transition curve, there are many problems yet to be solved.

0547
DESIGN OF TRACK INSPECTION CAR
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Quarterly Rpt., Vol. 3, No. 4, Dec. 1962, pp 56-61

An efficient method of detecting the defects of track is desired. New track inspection car has already been reported. Register the following values during high-speed run (up to 100 km/h), being equipped with electronic data processing machine, (1) curvature (right rail), (2) curvature (left rail), (3) unevenness (right rail), (4) unevenness (left rail), (5) width of gauge, (6) superelevation, (7) twist of the track, (8) rolling of the body, (9) vertical acceleration of the body, (10) horizontal acceleration of the body.

0548
DATA HANDLING OF HIGH-SPEED TRACK INSPECTION CAR
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Quarterly Rpt., Vol. 4, No. 3, Sept. 1963, pp 37-38

Measurement records made from the high-speed track inspection car are for the two purposes, one of them is to defect and locate large track irregularities for preparation of the data necessary for spot maintenance. The other purpose is to give an overall information on the track irregularities found within a certain distance, as this helps service and maintenance planning. For the second purpose, however, records must be sorted, classified and processed statistically. The machine operation shows more stability than that of manual work and this is because the machine has no personal error. The machine has been employed officially since April 1961 and the inspection data over 40,000 km throughout Japan has been already handled. Therefore saving of man-power, cost and time to date have been very large.

0549
ADAPTATION OF THE METHODS OF LAYING, ALIGNING AND MAINTAINING THE PERMANENT WAY TO CARRY TRAFFIC AT VERY HIGH SPEEDS (120 km/h AND MORE): A) ON THE STRAIGHT: B) ON CURVES; SO FAR AS THEY AFFECT SAFETY AND TAKING INTO ACCOUNT THE TYPE OF ROLLING STOCK USED
International Railway Congress Association, Bulletin of the International Railway Congress Association, Vol. 39, No. 4, pp 492-725

This article discusses the following topics: effects of rolling stock on track, layout of lines; points and crossings, loading gauges; distances between running lines, equipment, ballast and track renewal of high speed lines, and finally safety of trains, staff and inspection processes of high speed lines. Appendices include answers relating to railway technology from responding members.

0550
ADAPTATION OF THE METHODS OF LAYING, ALIGNING AND MAINTAINING THE PERMANENT WAY TO CARRY TRAFFIC AT VERY HIGH SPEEDS (120 km/h AND MORE): A) ON THE STRAIGHT; B) ON CURVES; SO FAR AS THEY AFFECT SAFETY AND TAKING INTO ACCOUNT THE TYPE OF ROLLING STOCK USED
International Railway Congress Association, Bulletin of the International Railway Congress Association, pp 960-1039

A report on the results of a questionnaire which was sent to 36 railways. The questions deal

with the manner in which the railways are dealing with the laying, aligning, and maintenance of railroads where traffic at speeds in excess of 120 km/h. The conclusions of the report include a general view of the elements of maintenance of the permanent way as practices on an international scale.

0551
PROBLEM OF INCREASE OF SPEED, AS FACED BY THE RAILWAYS IN DEVELOPING COUNTRIES
International Railway Congress Association, Bulletin of the International Railway Congress Association, pp 591-609

The immediate problem, in many of the developing countries, is not that of attaining very high speeds, but is that of reaching moderately high speeds. The economic conditions in these countries require that such increase of speeds should not entail any appreciable additional capital investment nor should it result in an increase in the maintenance and operating costs. The Indian Railways have undertaken investigations, research and studies with a view to achieve moderately high speeds on their broad gauge and metre gauge railway systems. The results of these are discussed.

0552
SPECIAL ACCOUNTS SUMMING UP THE REPORTS ON THE QUESTIONS FOR DISCUSSION AT THE EIGHTEENTH SESSION OF THE INTERNATIONAL RAILWAY CONGRESS ASSOCIATION (MUNICH, 1962)
International Railway Congress Association, Bulletin of the International Railway Congress Association, Vol. 39, No. 6, pp 888-924

The data and opinions are set out in the following five chapters: (1) Effect of Locomotives and Rolling Stock on the Track; (2) Track Alignment Points and Crossings; (3) Gauges; Distances Between Running Lines, Obstructions; (4) Equipment and Ballasting of Present Day High-Speed Tracks, Track Renewal Conditions; (5) Safety of Trains and Staff On High Speed Lines; Control of These Lines; Measures Taken Concerning the Quality of Track; Increase in Maintenance Costs Due to Increased Maximum Speeds.

0553
UPPER STRUCTURE OF RAILWAY TRACK UNDER SUPER-HIGH-SPEED TRAINS
Railway Technical Research Institute, Japanese National Railways, Tokyo, Japan, Vol. 9, No. 3, Sept. 1968, pp 168-169

The possibility of constructing railway track for operating rolling stock of wheel-set type at super-high speed up to 350 km/h upon its rails is discussed from the viewpoint of the bearing strength of track for train operation and maintenance for track irregularities.

0554
MEASUREMENTS OF VERTICAL AND LATERAL FORCES ON BOTH RAILS OF A SIX-DEGREE REVERSE CURVE UNDER DIFFERENT TYPES OF SIX-AXLE AND FOUR-AXLE DIESEL LOCOMOTIVES
Association of American Railroads, Letter Correspondence, Mar. 1967

An investigation was conducted on a 6 deg. reversed curve with 150 ft. spirals and practically no tangent between them. The track was instrumented at two locations, one on each of the spirals near the juncture with the 6 deg. curve. Vertical and lateral wheel loads were measured for each passing wheel of the locomotives on both rails. Four classes of locomotives having four wheel trucks. The lateral force exerted against the high rail increases with speed; is relatively low for the freight diesel locomotives with four axles and the passenger diesel locomotives with six axles; and is appreciably higher for the two types of freight locomotives with the trimount trucks.

0555
DERAILMENT ON REVERSE CURVE
Association of American Railroads, Unpublished Data, Oct. 1971

Four data sheets concern derailments on reverse curves and turnouts. The derailment on the reverse curve involved a hopper car, loaded with bulk clay, which climbed the high rail at 15 mph. The Santa Fe rules for laying and maintaining turnouts are given. One derailment at a No. 8 turnout involved splitting a switch by entering the turnout at 18 mph, prescribed speed was 10 mph. Crosslevel information is given for a derailment at the point of a frog.

0556
PROBLEMS OF RAILWAY MAINTENANCE OF WAY
Jahrbuck des Eisenbahnwesens - The Railways' Yearbook, 1967

A historical discussion is presented on the achievements of heavier axle loads and higher speeds. The planning of new and larger cars for the Rheinische Braunkohlenrevier is included. These cars will have an axle load of 50 tons. This is followed by both a theoretical presentation and actual results of tests of the behavior of the track structure under the loading of locomotives and cars. One interesting point brought out is that there is practically no difference in the depth and frequency of the deflection of the track under an E-10 locomotive at 10 KM/H versus 200 KM/H. Studies show the effect on track deflections with closer spacing of narrower ties, and also on an concrete track bed plate. Problems encountered with long, continuous welded rail are presented, and the stresses in the rail are shown

under the varying conditions of temperature. The importance of exact alignment of the track laid in curves is stressed. It is concluded that with stiffer section, harder rails of steel free of impurities, heavier axle loads may be safely carried without damage, especially when the track is laid on narrower ties spaced more closely together (50 cm) on a deeper rock ballast bed. Further research will be required to determine if a new concept of track bed will be required for speeds of 250 KM/H and 40 ton axle loads.

0557
COMPARISON OF CAR STABILITY AND TRUCK CONDITION--100 TON LOADED COAL HOPPER CARS
Pennsylvania Railroad, Unpublished Data

Tests were conducted in the Hollidaysburg, Pa., yard, of modified and unmodified Class H-43 Hopper cars on tangent track and on a 2 degree curve having 4 inches superelevation, subsequently changed to 5 and to 6 inches. Track surface was warped to predetermined amounts. Results of selected test runs have been tabulated to show the effect of speed, superelevation and increase in number and severity of successive uniform changes in cross level on the stability of these cars. The H-43 cars can negotiate an indefinite succession of uniform changes in cross level, regardless of interval or speed. Elevation in excess of 6 inches should be corrected regardless of uniformity.

0558
SUPER-ELEVATION OF CURVES
Seaboard Coast Line Railroad Company, Instruction Manual, May 1971

The purpose of this operation table is to provide a general practice reference to the speed for various degrees of curvature and superelevation.

0559
TERMITE CONTROL INVESTIGATION--INSPECTION OF SPECIMENS AFTER 112 MONTHS OF EXPOSURE
American Railway Engineering Association--Bulletin, No. 608, Sept.-Oct. 1967, pp 1-25

Report of progress in 15 year investigation to determine most effective preservative with minimum retention to be used in treating oak, pine or fir ties to reduce decay and termite attack. The report presents results of inspection of about 2000 treated and untreated specimens in exposure test plot of Austin Cary Memorial Forest of University of Florida near Gainesville, Florida. Results showed that coal-tar creosote affords more resistance to decay and termite attack than other preservatives.

0560
IMPRESSIONS ON THE NEW TOKAIKO LINE, JAPANESE NATIONAL RAILWAYS, BASED ON A RECENT VISIT TO JAPAN
Journal of the Institution of Locomotive Engineers, Institution of Locomotive Engineers, Vol. 54, No. 302, p 595

The trains are made up of 12 coaches, but can be expanded to 15 to 16 as demand increases. The track is designed for high speed running. Track centers are widened to lessen the air impact effects as trains pass. Gradients are limited to 1.5 per cent, minimum radius of curved track is 220 yards, and maximum cant is 7.08 inches. Welded rail is padded by rubber and fastened to concrete cross ties with spring clips. Signals controlling train speed and operation are transmitted from a Central Train Control Office to the cab. Train brakes and speed are automatically controlled to eliminate collisions. The driver can assume control to counteract adverse environmental conditions. Revenues are described.

0561
IMPROVING THE RUNNING QUALITIES OF THE COACHES TO BE INCLUDED IN HIGH SPEED LUXURY TRAINS--MODERN BOGIES--POSSIBLE TECHNICAL EVOLUTION
French Railway Techniques, No. 21968, pp 97-122

This article discusses the needs of bogie design when rolling stock speeds reach 200 km/h. Suggested areas include relationship of connections between axles, bogie frames and coach bodies; tire profile for stability of 250 km/h speeds; vertical suspension systems for light weight coaches, reduction of unsprang weight, use of rubber in suspension systems. Finally, the problems of running coaches on lines with superelevated curves where problems exist in retaining a level coach interior.

0562
ROCK OFF DERAILMENTS
B&O - C&O, Unpublished data

A tabular summary of rock-off derailments indicating curvature, elevation, velocity and cause is provided for about 30 accidents.

0563
INSTRUCTION GOVERNING THE SUPERELEVATION OF OUTER RAIL AND THE SPEED OF TRAINS ON CURVES
B&O - C&O, Engineering Report R-13

This specification for operations practice provides four superelevation tables: Table A gives the equilibrium elevation for various speeds on curves at which the overturning forces are balanced by the superelevation. Table B gives the speed at which conventional passenger equipment will ride comfortably around a curve. Three additional inches of superelevation would be required for balance of overturning forces. Table C gives a modified speed which may be authorized freight trains. The superelevation is between equilibrium and comfortable. Table D gives a maximum theoretically safe speed assuming a center of gravity at 98 inches above the rails. This table is not to be used for elevating track. It is for information only. Change in superelevation will follow the alignment spiral where possible. The rate of change of superelevation should not exceed 1/2" in 31' for speeds up to 50 mph or 3/8" in 31' for speeds over 50 mph.

0564
SPEED EFFECTS ON ADHESION ARE MINOR
Railway Locomotives & Cars, Vol. 143, No. 1, Jan. 1969, pp 22-24

A study of factors affecting wheelrail adhesion carried out at Electro-Motive Division of General Motors (EMD) showed advantage for welded rail and good track maintenance. The test train consisted of a 3600 hp SD-45 locomotive towing a EMD test car and two other locomotive units which were operated in dynamic braking during runs to produce trailing load. Available adhesion on tangent jointed track includes curve usable for drag ratings.

0565
ATSF 'GLUES' WELDED-TRACK JOINTS
Railway Age, Vol. 155, No. 23, Dec. 9, 1963, pp 19-20, (See also Railway Track & Structure, Vol. 59, No. 12, Dec. 1963, pp 19-21)

Method used at Santa Fe when laying butt-welded rails is described. The connection of long strings is made with conventional bolted joints in which angle bars are bonded to rails by applying epoxy "glue" to contact surfaces of joint bars and rails to provide strength necessary to resist pulling action of rails. The glue used is a two-part epoxy formulation.

0566
HOW FRISCO CUTS COSTS WITH CONCRETE TIES
Railway Age, Vol. 162, No. 18, May 8, 1967, pp 16-17

Construction of a 33-mile rail line to a lead-zinc mineral deposit in southeast Missouri is described using about 66,000 prestressed concrete ties at 31-in. centers. A brief description is included of tie production. A one million cubic yard of rock excavation and a two million cubic yard of common excavation. Two 4-span, deck-girder bridges were erected. One, 282 ft long and 35 ft high, spans Dry Creek; and the other, 294 ft long and 47 ft high spans Huzzah Creek. Two other steel and concrete bridges carry state primary roads over track. A total of 190 culverts was installed. Largest was multiplate pipe 120 ft long and 18 ft in diam, built for accommodating a rural road.

0567
HOW SCL "THREADS" LONG RAIL STRINGS INTO ITS TRACK
Railway Age, Vol. 165, No. 2, July 15, 1968, pp 15-17

Methods and equipment used in installation of butt-welded rail at Seaboard Coast Lines are discussed. The method involves use of rail threader featuring steel frame with built-in rollers on sides and bottom for laying strings 1323 ft long. The ballast is cleaned from tie-plate areas by a Kershaw cribbing machine. Ties are prepared for new tie-plates by a Nordberg self-propelled machine. The welded rail string, extending through leaders on a Multikrane, is picked up and laid on new tie-plates as the machine moves ahead. Rail anchors are applied to the base of the rail by a Racine Anchor-Fast machine. Joints between long strings are thermit welded by the Orgotherm method.

0568
NEW WAY TO FIGHT RAIL SHELLING
Railway Age, Vol. 166, No. 5, Feb. 10, 1969, pp 21-23

A special tie plate with unusually high angle of cant was developed. The 1-in-14 cant adopted for Hi-Cant tie plates is equivalent to angle of 4° 12 min. Tie plates are designed to establish outer rails on curves at angle that positions running surfaces of rails so that wheel loads are spread more uniformly over rail heads.

0569
SHORT LINE MAKES SHORT WORK OF INSTALLING CONCRETE TIES
Railway Age, Vol. 161, No. 19, Nov. 14, 1966, pp 18-20

An illustrated description is given of replacement of part of the wood ties by concrete ties on the Apalachicola Northern Railroad, Florida. A crane is used to remove wood ties and space concrete ties, as well as scarifier and tie inserts. An electromatic tamper with Auto-Jack was used to surface track. Ballast was dressed with Kershaw Ballast Regulator.

0570
CONCRETE TIES FOR LONG FRISCO BRANCH
Railway Track & Structures, Vol. 63, No. 5, May 1967, pp 15-17

32.7 mile line now under construction in Missouri is being built throughout with MR-type prestressed concrete ties. Reasons for selecting these ties included desire to avoid displacement of regular programmed maintenance work that would ensue from use of wood ties; saving of about 5% in favor of concrete ties; and 4 years of satisfactory experience with 1/2-mi test section of concrete ties in main track.

0571
'HI-CANT' TIE PLATES--NEW WEAPON AGAINST SHELLY RAIL
Railway Track & Structures, Vol. 65, No. 2, Feb. 1969, pp 16-17

In a new concept offered by CF&I Steel Corp., the objective is to place the high rail of curves at an angle that will cause wheel loads to be distributed across a greater portion of the rail head instead of being concentrated at the

gage corner. This is accomplished by tie plates with a cant of 1 in 14 which compares with a standard of 1 in 40 for plates used on tangent and curved track.

0572
HOT, DRY CLIMATE CAUSES COMPLICATIONS ON NEW-LINE JOB
Railway Track & Structures, Vol. 64, No. 11, Nov. 1968, pp 17-20

Problems encountered and special measures used are described to obtain moisture needed to secure proper compaction of embankments in construction of a 27-mi new line of the Missouri-Pacific in western Texas. High temperatures and lack of moisture were factors to contend with. Water needed to secure proper compaction of fills was pumped through temporary pipe line. Special precautions taken when building track with long welded rail strings are discussed.

0573
HOW U. S. STEEL HARDENS RAILS FOR LONGER LIFE ON CURVES
Railway Track & Structures, Vol. 59, No. 9, Sept., 1963, pp 26-28

Techniques and equipment employed at Gary, Indiana, Steel Works rail mill for heat-treating heads of rails are discussed. Electrical induction is used for heating and compressed air for quenching.

0574
ON C&O/B&O--MAIN-LINE TEST OF CONCRETE CROSSTIES
Railway Track & Structures, Vol. 65, No. 1, Jan., 1969, pp 22-24

An analytical study completed on Chesapeake & Ohio/Baltimore & Ohio concluded that properly performing concrete ties, when installed out of face, could be economically justified in many territories where rail-replacement cycle was short. To permit respective determination to be made, a test section of concrete ties was made in high-speed, main-line track. Three different types of concrete ties were included in the test. The types, along with descriptions of each, are shown.

0575
NEW CONCRETE-TIE MANUFACTURING PLANT NOW IN PRODUCTION
Railway Track & Structures, Vol. 64, No. 5, May 1968, pp 26-29

Details of the B-66 prestressed concrete tie are given and it is shown how it is manufactured at a new mechanized facility. The tie is based on a design that is used in Germany and other countries, but is longer, heavier and stronger to adapt it to heavier axle loads. The quality-control program includes bending test, made on one tie per shift, in which moment resistance in area of the middle of the track is determined.

0576
RAPID-TRANSIT EXTENSION IS BUILT WITH BUTT-WELDED RAIL
Railway Track & Structures, Vol. 64, No. 10, Oct. 1968, pp 24-25

A double-track line at Cleveland, Ohio, 4-1/2 mi long, is built with Thermit-type butt welds, which are made after the rail is laid. A two part forming mold with integral crucibles is applied from opposite sides of rails and held in position with bolts. Molds are expendable with a steel pan in position under rails, all openings between rails and mold are closed with sand. Two steel pipe sections are placed atop the crucible.

0577
TIE RENEWALS MADE WITH MACHINE 'PACKAGE'
Railway Track & Structures, Vol. 59, No. 12, Dec. 1963, pp 28-29

A tie renewal technique is described that uses machines consisting of a Model C Hydraulic Spike Puller, Tie-Axe which chops ties into 3 pieces to facilitate their removal from track, and a recently developed Nordberg Scarifier-Inserter. A different procedure was tested in which new ties were cross-tamped with shovels to bring them up against the base of the rail. Scarifier-Inserters use 2 bulldozer-type blades for cutting and shaping tie bed.

0578
DYNAMIC MEASUREMENT OF RAIL PROFILE AND RELATED LOCOMOTIVE TRUCK MOTIONS
American Society of Mechanical Engineers, Conference Paper 66-RR-1

The profile of the railroad track on which a railway vehicle operates represents an input into the vehicle. This input is due to vertical and lateral rail irregularities and can cause dynamic loads that result in excessive damage or wear and tear on vehicle components and on the track itself. In order to study the dynamic operation of rail vehicles, it is necessary to know the profile of the track on which they operate. Since the unloaded profile of the rail can vary significantly from the loaded condition, it is the loaded-rail profile that must be known. This paper presents a method for the rapid measurement of the loaded-rail profile and includes some typical rail profiles and related truck motions resulting from these profiles. The instrumentation resulting from this work appears to have immediate application in day-to-day railroad operation and in high-speed rail transportation studies.

0579
PERMISSIBLE SPEED OF FREIGHT CARS ON CURVES
A.R.E.A., Vol. 70, pp 1019-1029

In Part I, the dynamic effects due to lateral roll motion of a freight car are analyzed

and the position of the resultant dynamic force with respect to center line of track for cars having 71, 85 and 99 inches combined center of gravity heights is calculated. These calculations use data on the amplitudes of the lateral roll motion of a fully loaded 70-ton 55-ft gondola which were measured during an extensive series of running tests on the Lackawanna Railroad in 1955. In Part II, calculations, based on extensive tests with freight cars having center-of-gravity heights of 71, 85 and 99 in with 3 11/16 in travel springs and conventional snubbing, were used to establish the elevation for curves and maximum permissible speeds for the operation of freight trains.

0580
THE NEW C AND O TRACK INSPECTION CAR
A.R.E.A., Vol. 63, pp 758-767

The design of the new car allows accurate measurements to be made at all speeds through 100 mph. The overall system of the RI-2 includes means for measurement of such track characteristics as curvature, cross level or superelevation of rails, surface, and joint condition. These measurements are continuously recorded on tape along with landmarks and other notes indicating location, as well as speed of the car. The recording and control facilities are compactly located near the center of the car. Facilities are provided for unobstructed visual observation of the railroad through an observation deck seating 31 persons. The car is placed as the last car in a train with the observation end towards the rear. At the other end of the car are kitchen, office, conference, sleeping and toilet facilities. Two men can operate all the measuring and recording facilities. The operation and facilities of the RI-2 are illustrated.

0581
PROGRESS TOWARD SCIENTIFIC DESIGN AND ANALYSIS OF TRACK
A.R.E.A., American Railway Engineering Association, Vol. 70, pp 946-954

This paper surveys the DOT research and development program aimed at better track structures. This program includes the following: (1) improved ability to measure track geometry at speeds under load, (2) developing methods to analyze the measurements, and ways to make better use of the information, (3) looking at the possibility of designing track of greater stability, (4) experimental research on the dynamics of wheel-rail interaction.

0582
ENGINEERING TRACK RECORDER CAR
A.R.E.A., Vol. 71, pp 161-169

The Canadian National Railways have developed a track recorder car which measures and records condition of track. Track measuring and recording equipment has been installed in a converted passenger car which is equipped with two six-wheel trucks. This car is capable of testing track when operated within the speed range of 20 mph to 100 mph. This car is equipped to measure and record the surface conditions of each rail, cross level and gauge. Photographs show the instrument panel and the equipment installation. Sample output is illustrated.

0583
A STUDY OF THE MAGNITUDE OF TRANSPORTATION NOISE GENERATION AND POTENTIAL ABATEMENT. VOLUME VI. COMMUNITY TRANSPORTATION NOISE
Serendipity, Inc., Eastern Operations Division, Arlington, Virginia, Rpt. No. OST-ONA-71-1-Vol. 6, Final Rpt., 206 p, Contract DOT-OS-A9-018, Available: NTIS, PB 203187

Community noise levels result from transportation and nontransportation noise surces. The extent to which transportation noise dominates other sources and the exposure to it is a measure of the magnitude of the transportation noise problem. A prototype model has been developed to estimate community noise levels resulting from the operation of all modes of transportation in a community. The model has been exercised for the Baltimore Metropolitan Area and two statistics are computed, the median noise level and the Noise Pollution Level; both use the A-weighted sound level as a noise measure. Acceptable limits for the median level and the Noise Pollution Level are applied to the levels estimated for the Baltimore Metropolitan Area and the implications are discussed in terms of land areas and population exposed to unacceptable noise levels. It is shown that the effect of transportation noise is widespread and the magnitude is such that comprehensive planning involving all of the extant and expected modes is required to effect any overall reductions to transportation generated noise levels.

0584
RAIL PADS--GETTING GREEN LIGHT
Childs, B. M. C., Rubber Developments, Vol. 21, No. 3, 1968, pp 97-100

World-wide look at growing use of rubber pads in construction of permanent way. The pads, fitted between rail and sleeper, protect sleeper and foot of rail, adds resilence to track laid on concrete, and provides electrical insulation for track circuited signaling systems. The large scale markets are now established in the United Kingdom, Japan, and Western Europe. The advantages of rubber-bonded cork over rubber pad and their applications are discussed.

0585
TESTS ON THE TRACK ON THE RIDING STABILITY AND THE GUIDING QUALITY OF VEHICLES BY MEANS OF A SPECIAL VEHICLE. RESULTS OF THE FIRST TRACK TESTS
Office for Research and Experiments, UIC, Rpt. No. 2, Interim Report, Question B52

The report gives an account of the results of the tests made with the experimental bogie described in a previous report. The first part of the report supplies data relating to four series of tests during which the various parameters of the bogie (lateral play between axle-box and axle, axle load) and also the riding speed were successively varied. These tests have made it possible to establish conclusions relating to the wave-length of the hunting movement, the amplitude of the transverse movements of the bogie and the maximum transverse forces occurring between bogie and axles. The second part of the report supplies data relating to the tests during which the wheelbase of the test bogie was varied. The data obtained have permitted the establishment of some conclusions relating to the wave-length of the hunting movement, the transverse displacement of the bogie frame, the maximum angle of rotation of the bogie and the transverse forces. The third part of the report contains an account of the results obtained during the tests, the object of which was to study the same magnitudes as those prevailing during the previous tests, the wheel tyres of the test bogie having, however, been machined in accordance with the wear profile "Muller No. 2". All the tests were made on one one and the same section, this being in an excellent state of repair and having a relatively constant gauge and chiefly consisting of straight track.

0586
TRACK FOR JAPAN'S 210 KM/H TRAINS
Permanent Way, Japan Railway Civil Engineering Association, Vol. 11, No. 3-4, 67 p

A detailed report of high speed operation, including details of maintenance of the right of way, are discussed. The main features of the system are outlined, track cross sections and construction are further examined. The planning, organization and personnel of the maintenance operation are discussed, also, and the use of high speed inspection vehicles and their operation is included. Protective devices against earthquake, rain and snow damage are mentioned and studied in detail.

0587
DYNAMIC EFFECT OF A FLAT WHEEL ON TRACK DEFORMATION
Permanent Way, Permanent Way Society of Japan, Vol. 7, No. 1, pp 14-22

A series of riding tests was made to clarify dynamic effects of wheels (whose treads were set with flat spots) on the rolling stock as well as on the track at various speeds up to 200 km/h on the test run section of the New Tokaido Trunk Line on December 7-11, 1963. In the present report, major test results concerning track deformation are outlined. Shock values resulting from rail bending stress and pressure between rail and sleeper grow rapidly with train speed, showing the peak at 20 to approximately 30 km/h, and thereafter up to 100 km/h, they gradually decrease.

0588
INVESTIGATION OF RAIL-TO-CONCRETE FASTENERS
Hsu, T. T. C., and Hanson, N. W., Portland Cement Association--Research & Development Laboratories-J, Vol. 10, No. 3, Sept. 1968, pp 14-35

The investigation deals with rail-to-concrete fasteners for concrete ties, bridge decks, and tunnel linings. Three methods of electrical insulation were studied for spring-clip fasteners in concrete ties. The fasteners were subjected to tie-wear, longitudinal-slip, and electrical-resistance tests. Anchors used were also subjected to pullout tests. For fasteners in bridges and tunnels, three different fastener types were tested under repeated loading.

0589
INTERNATIONAL SYMPOSIA ON PRESTRESSED CONCRETE
Civil Engineering, Vol. 38, Sept., 1968, p 64-66, Symposia held Madrid, Spain

0590
KLEBUNGEN IM GLEISBAU
Geys, K., Bauingenieur, Vol. 39, No. 3, Mar 1964, pp 94-97

This article discussed gluing in track building, and description of techniques applied in tieless fastening of rails to concrete. Epoxy resin mixtures are used for bolt fastening in predrilled holes and for gluing rail base plates to concrete slab. This method was applied successfully to crane and traveling platform runways and to experimental stretch of rails, base plates of which were glued to steel bridge beams without any additional bolting.

0591
BEHAVIOR OF INCISED BEECH CROSSTIES INSTALLED IN TRACK
Franciosi, G. F., Forest Products Journal, Vol. 17, No. 2, Feb. 1967, pp 48-50

The results of tests made in experimental track of Italian State Railways in 10 year period under fairly heavy traffic by European standards; and behavior of incised versus unincised beech crossties in track are discussed.

0592
BITUMINOUS WATERPROOF COATING MATERIALS FOR ANTI-SPLITTING TREATMENT OF TIES
Oikawa, I., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 7, No. 2, June 1966, p 24-26

Heating and solvent type coatings were developed for protection of tie surface. Heating type coatings were prepared from blown asphalt including creosote oil, and portland cement and asbestos as filler. Solvent type coatings were made from special blown-straight asphalt compound including hydrocarbon solvent and filler of asbestos and vermiculite. The conditions and test methods for coatings, composition and application, and properties of solvent type coatings are described. The results of use of tar pitch system and solvent type coatings are compared.

0593
BODENVERFESTIGUNG MIT ZEMENT UNTER EISENBAHNGLEISEN
Beton, Vol. 18, No. 4, Apr 1968, pp 137-142

Cement stabilization of soil under railroad tracks, and special application of soil cement to stabilize railroad embankments is described.

0594
LATERAL FORCES BETWEEN WHEELS AND RAILS
Olson, P. E., and Johnson, S., Swedish State Railways, A.S.M.E. Publication, Paper No. 60-RR-6, Apr. 1960, 8 p

0595
AERIAL STRUCTURE NOISE AND VIBRATION MEASUREMENTS
Wilson, G. P., Wilson, Ihrig and Associates, Inc., Berkeley, California, Technical Rpt., Oct. 1966, 27 p, Contract 3Z4966, Available: NTIS, PB 173858

The report presents results of sound and vibration level measurements taken at the aerial structure section of the Test Track of the San Francisco Bay Area Rapid Transit System. The primary objective of these tests was to compare the performance of prototype rail fasteners with regard to wayside noise level and mechanical vibration isolation. In addition, the effectiveness of a sound barrier (acoustic parapet) as a wayside noise reducing device was to be evaluated.

0596
NOISE & VIBRATION STUDY -- TORONTO SUBWAY -- THE GENERAL TIRE 'INSTRAC' FASTENER
Toronto Transit Commission, PN-7572-1, Nov. 15, 1966

0597
NOISE AND VIBRATION CONSIDERATIONS IN DESIGN OF THE LOS ANGELES M.T.A. RAPID TRANSIT SYSTEM
Bolt Beranek & Hewman, Inc., Rpt. No. 817, July 1962

0598
FEASIBILITY STUDY FOR A WHEEL-RAIL DYNAMICS RESEARCH FACILITY
General American Transportation Corporation, General American Research Division, Niles, Ill., Oct. 1969, 146 p, Contract DT-7-35363, Available: NTIS, PB 189096

The principal areas requiring design modification and/or better design definition for the Wheel-on-Roller design are those associated with curve negotiation behavior generally, and especially those peculiar to sharper curves and slower speeds. To properly set forth the need for, and the merit of, the suggested design modifications, a brief review and assessment of the Roller Concept as it was disclosed in the Phase I final report is first presented. Then the specific areas requiring additional engineering and design consideration are cited.

0599
TRANSIT VEHICLE TRUCK CONCEPTS
Parsons Brickerhoff-Tudor-Bechtel, San Francisco, Calif., Rpt. No. TR-5, Final Technical Rpt., Rpt. on San Francisco Bay Area Rapid Transit District, Demonstration Project, Sponsored by Department of Housing and Urban Development, Washington, D.C., Mar. 1968, 124 p, Available: NTIS, PB 179351

The report discusses an evaluation of experimental suspension systems for public transportation vehicles. Design criteria and specification data are presented.

0600
A STUDY OF THE MAGNITUDE OF TRANSPORTATION NOISE GENERATION AND POTENTIAL ABATEMENT. VOLUME V. TRAIN SYSTEM NOISE
Serendipity, Inc., Eastern Operations Division, Arlington, Va., Rpt. No. OST-ONA-71-1-Vol. 5, Nov. 1970, 118 p, Contract DOT-OS-A-018, Available: NTIS, PB 203186

Analysis of contemporary mass transit vehicle noise indicates that the rank order of conventional rail vehicle noise sources is: wheel and rail system; propulsion; and auxiliary equipment. Noise levels alongside the right-of-way, are a function of the vehicle type, its operation and the configuration of the roadbed and surrounding areas. For a given vehicle and guideway, the right-of-way configuration has the greatest impact on the sound levels received at a specific wayside location. Rail vehicle wayside noise levels can be reduced by interrupting the sound transmission paths between the vehicle and the receiver. To the extent that this is achieved, rail vehicle wayside noise levels can be reduced in a manner which is similar to that used for highway noise reduction.

0601
MODEL EMSE275 DYNAMIC TRACK ANALYZER
Gulton Engineered Magnetics Division, Instruction Manual, June 1971

A Gulton Dynamic Track Analyzer is described. The Dynamic Track Analyzer performs three distinct functions. These are measurement of track dimensions, prediction of worst case roll amplitude of a selected type of car, and accumulation of a defect count (figure of merit) for each statute mile of track. All of these functions are performed in real time, giving immediate printed results. Train speed and distance traveled are measured and recorded. By operating the business car equipped with analyzer over a given stretch of track, it is possible to produce a chart showing the car roll for any desired type of car. A chart is attached showing the actual measured roll of a particular car over a section of track compared with the predicted roll determined from operating a business car equipped with the analyzer over the same track.

0602
THE EFFECT OF TRACK GEOMETRY ON RIDE QUALITY
IEEE/ASME, Conference paper, 69CP355-IEA

In this test, acceleration measurements were taken with one lateral and one vertical accelerometer attached to the floor of the test car. The sensitivity of ride roughness to changes in cross-level during the negotiation of a curve is shown. Also shown is the change in ride response due to bolted to welded rail transition. The track geometry measurements used in this investigation were: centerline profile, the average profile of both rails; alignment; gauge; rate of change of gauge; and warp. The track and ride data were then sorted according to speed. The data for the 100-110 mph tests are plotted on scatter diagrams. Correlation coefficients were then computed for each of the six track exception densities and the density of the sum of all exceptions with vertical, lateral, and mean lateral/vertical ride. The results are shown. Though sample populations are small, data correlation is sufficiently reasonable to lend support to the approach.

0603
TEST CAR PROGRAM SECOND PROGRESS REPORT
Department of Transportation, Progress Rpt., FRA-RT-71-48

Developments such as a new signal conditioner for the gage sensors, a magnetic pulser for improved speed and distance measurement, and new sensor configurations were aimed at increasing the accuracy and reliability of track measurements. Improvements in overall system performance resulted from the development of special-purpose calibration devices, modifications to existing electronic circuitry, a more extensive use of selective filtering, and use of accelerometers which withstood the rough environment. Data processing techniques and displays were also modified to make better use of the data being collected and to present it in a convenient form for operating personnel. The design and development of an onboard digital data acquisition system is a distinct technological innovation with the ultimate purpose of improving the performance of the existing track geometry measurement system. Research during this period was conducted to provide data as input to other independent studies. These included data-collection runs to support the joint D.O.T./C&O-B&O RR Program, validation runs to verify the General Electric Pantograph-catenary simulation model and the Melpar rail car simulation model, track survey runs, ride quality studies, and Southern rail car roll oscillation studies.

0604
TRACK ANALYSIS
International Railway Congress Association, Bulletin of the International Railway Congress Association, pp 571-592

In the present paper an attempt has been made to create the physical based for an objective assessment of the quality of railway track. For this purpose, the damage occasioned by faults in the geometric position of the track has been reduced to the universally applicable notion of 'deterimental energy' which is, in its turn, based on the detrimental integral exclusively derived from the geometry of the track. The definition of these novel notions is made possible by classifying the faults as sub-critical critical or super-critical depending on the period length of the oscillations caused by them. This leads to a coherent evaluation system which is largely founded on physical facts, lends itself to automation by means of modern computers, and furnishes directly applicable data not only for short-term maintenance programmes (marking of danger spots) but also for long-term renewal programmes (quality assessment of entire sections of track). The necessary computing techniques are outlined in their logical set-up.

0605
FROM THE INSULATED RAIL JOINT TO THE INSULATED ADHESIVE JOINT. FOR THE CONSTRUCTION ENGINEER'S EXPERT GUIDANCE
Eisenbahn-Praxis, No. 31965, pp 2-5

0606
TRACK GAUGE WIDENING ON TANGENT TRACK -- ROLLER BEARING TIE PLATE TESTS -- MILE POSTS 614.08 AND 626.61
Union Pacific Railroad Company, Unpublished report

A program of gauge widening on tangent track led to these tests with instrumented ties with roller bearing tie plates and an instrumented diesel-electric locomotive. The road bed was in average condition, with the track of 133 lb. rail. Conclusions drawn from these tests were as follows: no class of locomotives or cars individually were found to exert a lateral force

at the test site sufficient to result in the gauge widening being experienced. The cars created a greater number of and higher values of lateral forces than the locomotives involved. Dynamic braking of the trains produced no noticeable lateral forces in the trailing unit of the locomotive consist or the head end cars. Apparently the gauge widening had resulted from the high utilization of the track and high train speeds.

0607
THE EFFECTS OF THE LATERAL INSTABILITY OF HIGH CENTER OF GRAVITY FREIGHT CARS
Journal of Engineering for Industry, ASME

High center of gravity freight cars experience extreme weight shift from side to side as a result of lateral resonance on track with cross-level differences from alternately staggered joints, as well as soft or other local variations in either rail. Dynamic measurements from tests made on test track with controlled 3/4-inch cross-level difference changes illustrate the force and motion magnitudes resulting from resonant and near resonant operating speeds; side bearing loads of 138,000 lb and spring group loads of 100,000 lb, accompanied by center plates separating and wheels lifting. The rotational energy input to the car body can be approximated for a given motion cycle and is preportional to the product of the amplitudes of the track profile and the car body motion. The high lateral (horizontal) forces on the track at the side bearing and center plate make the truck unstable and cause wheels to lift off the rail on one side. This lateral force at a given end of the car is proportional to the corresponding vertical side bearing load. Freight cars traveling at resonant speed are especially prone to derail on curved track under high wheel-rail friction conditions. Forces and motion generated between the car body, truck, and the track, cause high cyclical stresses and severe track maintenance problems. The purpose of this paper is to describe the resonance environment, the forces and motion, that result when high center of gravity cars traverse truck with cross-level difference changes, and to illustrate how this environment relates to the car body, the truck, and the truck structure.

0608
COMPUTING TRACK MAINTENANCE
Engineering, Vol. 202, No. 5232, July 29, 1966, pp 190-192

Use of data loggers and computer for automatically evaluating records produced by track-condition recording car are discussed. This installation is known as Neptune, and is a joint patented development of North Eastern Region of British Railways and Derwent Electronics Ltd. The problem was to devise means of measuring amplitude of deviations about mean curve, in factors of cant, gradient, and versine, where datum varies because of track geometry. Equipment and circuits were evolved which measure these quantities numerically and automatically.

0609
NOISE GENERATED BY SUBWAYS ABOVE GROUND AND IN STATIONS
Bender, E. K., and Heckl, M., Bolt Beranek and Newman, Inc., Cambridge, Mass., Rpt. No. OST-ONA-70-1, Technical Rpt, Jan. 1970, 64 p, Contract DOT-OS-A9-040, Available: NTIS, AD 701220

The report presents and discusses subway noise data acquired near various outdoor subways in seven European cities as well as noise generated by trains entering and leaving nine subway stations. Outdoor noise is measured at distances between 3 and 300 feet. It was found that there are substantial variations (of the order of 20-30 dB) in levels generated by trains at a given distance on elevated sections, depending on whether the supporting structure is steel, concrete, or earthen. Rail joints and poor quality wheels are shown to increase noise levels by 8-10 dB. Trains on rails which have been ground smooth generate 6dB (A) less noise than trains on unground rails. Effects of train speed, distance from a train, and track grade are analyzed. Finally, noise levels in small stations lacking significant sound-absorbing surfaces are found to be 22 dB (A) higher than larger acoustically well-treated stations.

0610
MEASUREMENT OF DYNAMIC FORCES ON TRACK
Brown, T. P., and Loach, J. B., Railway Gazette, Vol. 120, No. 22, Nov. 20, 1964, pp 938-940

The design and development of baseplate for measuring vertical loads and lateral forces between rails and ties are described. The baseplates are designed to withstand combined loads of 15 tons applied vertically and 10 tons applied laterally, loads which are in excess of values likely in practice.

0611
AUTOMATIC LASER SMALL-OBSTACLE DETECTION SYSTEM FOR HIGH-SPEED TRAIN ROADBEDS
Bernstein, F., RCA, Princeton, N. J., Conant, L. C., Heck, J. C., Clay, B. R., Kornstein, E., Luce, N. A., and Wetzstein, H. J., IEEE-Journal of Quantum Electronics, Vol. QE05, No. 6, June 1969, Paper 9.7, p 340

Technique uses pulsed GaAs laser diode and optical system to form 2 mrx 0.1 to 0.2 mr illuminating beam are discussed. This transmitter is placed in a fixed location 3.5 ft away from the

roadbed and a rotating mirror provides scan to cover roadbed to distance of 600 ft on either side. The opposite side of track fence is provided for mounting of strip of retroreflectors. The strip of retroreflectors is designed to provide strong return of light pulse transmitted just above roadbed and back over same path to optical system in absence of obstacle on roadbed. If an obstacle is present, a large portion of transmitted pulse is interrupted and no pulse or weaker pulse is returned.

0612
ZUR AKUSTIK VON VERKEHRSBAUWERKEN
Bruckmayer, F., Bauingenieur, Vol. 42, No. 6, June 1967, pp 201-208

Acoustics in traffic structures, such as problems of noise and vibration damping in railroad and subway stations and tunnels, street underpasses, vehicular tunnels, and other structures subjected to or transmitting traffic noise are discussed. Practical means of reducing air- and structure-transmitted noise in several railroad stations and vehicular street tunnels are also described.

0613
DER SCHWELLENLOSE OBERBAU IM TUNNEL DER HAMBURGER U-BAHN
Buch, W., VDI Zeit, Vol. 105, No. 24, Aug. 3, 1963, p 1130

A tieless railroad track in the tunnel of Hamburg's underground railroad is discussed. Laying of rails directly on cement floor of subway tunnel by means of stud bolts and adhesive cement, without using ties and ballast, proved reliable after 6 months practical operation of 400-m-long test section. Construction results in considerable savings, since tunnel height is 30-35 cm lower than usual.

0614
RESEARCH INTO TRACK DYNAMIC PROPERTIES
Cass, R., King. F. E., and Caldwell, W. H., ISA-Transactions, Vol. 2, No. 4, Oct., 1963, pp 337-341, ISA-Proceedings Preprint 15.1.62

Statistical analysis of data obtained from measurements of vertical displacement and velocity profile of track by double or single integration of journal box acceleration is discussed. The preliminary results indicate that some quantitative measure of track surface roughness can be obtained. It may also be possible to specify type of track defect within wide limits.

0615
DYNAMIC MEASUREMENT OF ABSOLUTE TRACK PROPERTIES
Cass, R., Canadian National Railways, Montreal, Que., Berthiaume, P. P., Kalita, R. E., and St. Louis, L., ASME Paper 69-RR-6, for meeting Apr. 15-16, 1967, 7 p

A transducer developed to mount on the truck of standard railway coach is the basis of special track evaluation car. A practical application of the facility to track maintenance is described.

0616
RAIL GAUGE AND RAPID-TRANSIT TRAIN STABILITY
Chilton, E. G., IEEE-Transactions on Systems Science & Cybernetics, Vol. SSC-2, No. 2, Dec. 1966, pp 135-145

Wind tunnel investigation and analysis of major static and dynamic forces that might combine to overturn light weight train either when running or when standing still is discussed. The results are shown in parametric form and indicate trends to be expected if wind velocity, car weight, rail gage, speed around curve, and several other factors are varied. Since stability is almost linearly related to product of war weight and rail gage, it is essential to use wider gage when trains are made lighter, if stability is to be maintained.

0617
ANTI-SPLITTING DEVICES
Code, C. J., Railway Track & Structures, Vol. 59, No. 6, June 1963, pp 32-34, 57-58

This article discusses a series of extensive tests conducted by Pennsylvania Railroad to develop information on effectiveness of various devices for protecting ties against splitting. The results of doweling tests are given. It is proposed to dowel all 3A, 4 and 5 cross-ties, and all switch and bridge ties, before seasoning.

0618
WHEEL LOADS AND RAIL FAILURES
Code, C. J., Railway Age, Feb. 15, 1965, New York

0619
PATENT, SYNTHETIC PLASTIC RAILROAD TIE
Collins, B. P., U. S. Patent 3,416,727, Dec. 17, 1968, Filed Apr. 27, 1966

Synthetic railroad tie primarily constructed in laminations of molded shredded hardwood filler and synthetic resin of phenol formaldehyde is discussed.

0620
MECHANISATION OF TRACK MAINTENANCE ON B.R.
Coombs, D. H., Railway Gazette, Vol. 122, No. 22, Nov. 18, 1966, pp 917-919

An historical review is presented of machinery availability with existing background of use of on-track machines. The necessity of training is emphasized for transition to mechanical maintenance. Use of on-track electric tamping hammers and mobile maintenance gangs is described. Essential savings are expected due to technical improvements in ride quality and durability of track, and very substantial economies in renewals cost of system.

0621
VLIYANIE TEKHNOLOGII VYPLAVKI REL'SOVOI STALI NA ZAGRYAZNENNOST REL'SOV OKSIDNYMI STROCHECHNYMI VKLYUCHENIYAMI
Derfel, A. G., Kotin, A. G., Kotlyar, V. L., Sviridenko, F. F., Tarasova, L. P., Yudin, N. S., and Nikulin, N. G., Stal, No. 8, Aug. 1968, pp 687-689, (See also Stal in English, No. 8, Aug. 1968, pp 639-641)

The effect of melting practice on contamination of rails by oxide stringer type inclusions is discussed. The correlation of data from three Soviet plants showed that when rail steel is melted in 400-ton open hearth furnaces, minimum length of oxide stringers is obtained when duration of bottom boil is 50 to 65 min, carbon elimination rate being 0.16 to 0.24%/hr, and when metal temperature at beginning of pure boil is 1515 to 1535 C, not exceeding 1585 C before deoxidation. The slag basicity during bottom boil must not be high.

0622
L'EVOLUTION RECENTE DE LA SUPERSTRUCTURE FERROVIAIRE
Derniame, G., Genie Civil, Vol. 144, No. 5, May 1967, pp 406-411

The recent development of railroad roadbeds is discussed. French Railways use so-called doubly elastic rail fastening consisting of rail sole made of grooved rubber, and elastic sleeper clip in form of hairpin. A new type sleeper (so-called SL sleeper) widely used in France and exported to various countries consists of steel angle crosspiece with folded ends to which concrete blocks provided with sleeper slips are fastened. A sleeper of this type can be manufactured by totally mechanized and automated technique. In French.

0623
CONCRETE TIES FOR TIMBER TRESTLES
DeValle, J. W., Railway Track & Structures, Vol. 64, No. 9, Sept. 1968, pp 25-29

Extensive testing and developments on Southern that were influential to adaptation of new standards for replacing wood ties on long structures with concrete ties are discussed. The width of ties was increased from 8 in. to 9 1/2 in. while maintaining same depth. A spike-hole insert was enlarged to prevent future bursting and to permit better spacing of reinforcing cables.

0624
AFFAIBLISSEMENT DES VIBRATIONS TRANSMISES AUX STRUCTURES PAR LE MATERIEL FERROVIAIRE
Devaux, A., Genie Civil, Vol. 145, No. 4, Apr. 1968, pp 252-263

Damping of vibrations transmitted to structures by railroad equipment is discussed. A report is made of tests performed in multilevel subway and railway stations on vibration-damping ribbed mats "Isolif" fabricated from ethylene-propylene-terpolymer elastomer. Double or triple layers of 290 cm wide Isolif carpet placed between concrete slab and ballast reduced sound level under slab by 14 db and reduced tenfold vibrations of track-carrying structure. Theoretical calculations justify the results obtained. In French.

0625
ERMITTLUNG VON EIGENSPANNUNGEN IN ALUMINOTHERMISCH GESCHWEISSTEN SCHIENEN
Dohse, R., Schweissen u Schneiden, Vol. 19, No. 10, Oct. 1967, pp 471-476

Determination of internal stresses in aluminothermally welded rails, in comparison with unwelded rails, showed that welding reversed tensile stresses parallel to longitudinal axis in rail head and flange and compressive stresses in web in unwelded rails to compressive stresses in head and flange and tensile stresses in web in welded rail. This effect is of advantage in service. In German.

0626
MODERN RAIL LAYING--HOW EL LAYS LONG STRINGS
Dove, R. E., Railway Track & Structure, Vol. 64, No. 10, Oct. 1968, pp 26-28

A continuous welded rail laying method employed by Erie Lackawanna in laying operation near Elmira, N. Y., is described. Rail laid was a new 132-lb section which had been welded at road's welding plant near Scranton, Pa., into lengths 1476.5 ft. long.

0627
ON-SITE ULTRASONIC RAIL TESTING
Egelkraut, K., Deutsche Bundesbahn, Minden, West Germany, Non-Destructive Testing, Vol. 1, No. 5, Aug. 1968, pp 297-305

Ultrasonic methods offer considerable advantages over electrical techniques for detecting flaws in rails. This article describes hand-held devices developed by Deutsche Bundesbahn (German State Railways) and also automatic rail testing train which has proved extremely successful.

0628
ROLLING FRICTION AND WEAR
Glagolev, N. I., ASME-Friction & Wear in Machy, Vol. 19, 1965, pp 144-171

Attempt to determine rolling friction of railway wheels and wear of wheels and rails is discussed. It is assumed for simplicity's case that wheels and rails are made of elastic material and are subjected to two-dimensional strain. The wheel axle moves at constant velocity and the wheel rotates about its axis with constant velocity. A comparison of experimental and theoretical results obtained on asumption that wheel and rail are made of the same material and that vertical wear per unit area on rail head is proportional to work of frictional forces on this area. It is concluded that hypothesis of linear

relationship between work of frictional forces and wear of wheels gives satisfactory approximation in many cases.

0629
USLOVIYA OKHLAZHDENIYA PRI POVERKHNOSTNOI ZAKALKE REL'SOV
Gologin, G. F., Smirnov, V. I., Suchkousov, V. P., Zannes, A. N., and Bikhunov, L. Ya., Stal, No. 5, May 1968, pp 452-455, (see also Stal in English, No. 5, May 1968, pp 427-429)

This article discusses the cooling conditions in case hardening of rails. A method was developed for continuous case-hardening of R65 rail heads with HF current. The rails are quenched with a mixture of water and air and there is required steady reduction of hardness in case-hardened layer. Additional consumption of compressed air is needed and sprayer length is comparatively long. Rails must initially be bent in order to prevent high residual stresses from developing when they are straightened after quenching.

0630
ATTENUATION OF NOISE AND GROUND VIBRATIONS FROM RAILWAYS
Grootenhuis, P., Journal of Environmental Sciences, Vol. 10, No. 2, Apr., 1967, pp 14-19

Various test methods and apparatus are described. Effectiveness of sandwich damping layer in preventing deck from responding like sounding board was measured by attaching two identical velocity transducers to finished deck and recording their outputs at equal amplification levels with two pens on single roll of paper. Vibration measurements were made with velocity transducers, one mounted on deck close to rubber bearing block and other on footing alongside bearing block. A comparison of outputs of transducers for same amplification settings gave indication of attenuation across suspension.

0631
PATENT. INSULATED RAIL JOINTS
Hamilton, W. R., Jr., Portec, Inc., U. S. 3,416,728, Dec. 17, 1968, Filed June 17, 1965

A rail joint comprising of metal point bars retained on opposite side of abutting rail sections by transversely disposed bolts and including replaceable insulating component positioned between each bolt and joint bar is described. Each component comprises a metal core to which is bonded a thermosetting resin layer.

0632
STRESS DISTRIBUTION IN TRACK STRUCTURE
Hardy, R. M., American Railway Engineering Association-Bulletin, No. 614, June-July 1968, pp 924-940

The study reported was made on the Sangudo Subdivision in the Mountain Region of Canadian National Railways in Western Canada. The line is 103 mi long and runs from Edmonton to Whitecourt in Alberta. The test program was laid out to assess performance of track structure in terms of rail stresses, deflection of ballast and deflection of ballast and deflection of subsoil. Variables included were weight of rail, thickness, density, and quality of ballast with performance of crushed gravel being compared to that for pit run gravel, and weight of traffic.

0633
TRACK MAINTENANCE TO ACCOMMODATE FAST, HIGH AND HEAVY LOADS
Hay, W. W., Railway Track & Structures, Vol. 63, No. 10, Oct. 1967, pp 36-39

Principal effects of modern equipment include tendency to derail and excessive wear on track structure, and restricting clearances. In maintenance the first step is limiting of speeds and imposed loadings. Track inspection has increased. Maintenance may be reduced by using concrete ties, adequate tie bedding, and use of heat-treated and alloy rails.

0634
STRESSES BENEATH RAILWAY TRACK
Heath, D. L., and Cottram, M., Railway Gazette, Vol. 122, No. 24, Dec. 16, 1966, pp 1001-1007

Stress testing of railroad bed materials in Great Britain is described. Tested soils included clay and marl. Stresses were determined between ties and ballast and under rails. Pressure cells were used for quasi-static and for dynamic testing. Smaller sized pressure cells of series Y and Z are most suitable. Test and theoretical values show close agreement. Mohr's circle representation demonstrates that vertical and horizontal stresses are principal ones. Results obtained have enabled realistic stress levels to be adopted in laboratory tests of repeated stressing of soils.

0635
NOISE ATTENUATION--THE EXPO EXPRESS
Heffernan, J. J., Paper presented at Rail Transit Group Conference of American Transit Association, Montreal, Canada, Apr. 5, 1967

0636
AENDERUNG DER MECHANISCHEN EIGENSCHAFTEN VON SCHIENENSTAEHLEN DURCH WASSERSTOFFEFFUSION
Heller, W., and Jaeniche, W., Stahl und Eisen, Vol. 83, No. 3, Jan. 31, 1963, pp 145-154

Change in mechanical properties of rail steel by hydrogen effusion is reported. Different grades of rail steel were aged at 20, 100, 200, and 275 C. Determination of mechanical properties, including fatigue, and of hydrogen content as function of time showed that treatment caused considerable improvement of properties because of hydrogen elimination. Activation energy of hydrogen diffusion averaged 10,490 cal/g atom over the temperature range investigated. Revision of acceptance tests is proposed.

0637
DAS UMWANDLUNGSVERHALTEN DER SCHIENENSTAEHLE UND FOLGERUNGEN FUER DAS SCHWEISSEN UND BRENNSCHNEIDEN
Heller, W., and Beck, G., Archiv fuer das Eisenhuettenwesen, Vol. 39, No. 5, May 1968, pp 375-386

Characteristics of transformation of rail steels and their effect on welding and flame cutting were investigated on steels of normal quality and grades A, B, and C of code 860 of International Railway Union. Data are correlated with structures and mechanical properties and discussed in terms of recommendations for standardization of carbon and manganese ranges, and for preheating, cooling rates, and intermediate heating in welding. The possibility of flake formation and thermal stresses are included in the discussion. In German.

0638
TRACK BED AND TRACK MAINTENANCE ON HIGH-SPEED TRACKS
Henn, W., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 7, July 1967, pp 513-525

Information concerning alignment, design and maintenance condition of permanent way on a high-speed section between Munich and Augsburg in West Germany, is followed by a discussion of test run results, with special reference to relationships between track bed faults and vehicle accelerations at high speeds.

0639
MAXIMUM VALUE OF TRACK IRREGULARITY
Hiroi, I., Permanent Way Society of Japan, Vol. 5, No. 3, Sept. 1962, pp 16-24

Mutual relations are shown between maximum value of irregularity and mean values and standard deviation sampled at random. Investigations were made on curved and straight tracks, and for longitudinal level, at rail joints and at intermediate points.

0640
FIELD TEST OF CORROSION PREVENTED RAILS ON THEIR ENDURANCE LIMIT TO RAIL END FRACTURE
Hirose, S., Kose, Y., Sato, Y., Takihara, M., Tomita, K., Takeuchi, Y., and Tsuyuki, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 9, No. 1, Mar. 1968, pp 17-20

Various measures for prevention of rail end fracture caused by corrosion fatigue cracking were examined by field tests. In preliminary test, 25 measures for prevention of corrosion were examined in tunnels under steam traction. Considering test results, 4 measures were selected for life test. Life test results showed that in a tunnel, in which mean life of nontreated rail was only 3 yr, that of shot-peened rail covered with zinc metalicon was elongated up to 5 or 6 yr.

0641
GLUED RAIL JOINT FOR INSULATION
Hojo, T., Umekubo, S., and Sekiguchi, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 3, Sept. 1965, pp 29-33

A study was carried out to develop a new type rail joint for insulation, with sufficient vertical rigidity and also sufficient strength to bear axial force due to temperature variation in long welded rail. Rail and fishplates of the joint used in strength tests were glued with high-polymer adhesive. The structure of the joint and the test results are described along with the composition and hardening temperature of the adhesive.

0642
EVALUATION OF FORCED-AIR DRYING AND COVERED AIR SEASONING OF OAK CROSS TIES
Huffman, J. B., and Post, D. M., American Railway Engineering Association--Bulletin, Vol. 64, No. 575, Dec. 1962, pp 246-252

A study was conducted of seasonal drying of oak cross ties by methods of forced-air drying, air seasoning under covers, and conventional air seasoning without covers at the School of Forestry, Univ. of Florida. The purpose of the study was to determine what seasoning improvements would result if cross ties were protected by covers to prevent wetting by rainwater, and also, if large quantities of relatively dry atmospheric air were induced to move through covered stacks of cross ties to accelerate drying.

0643
LONG WELDED RAIL IN NEW TOKAIDO LINE
Inouye, Z., and Fukazawa, Y., Permanent Way, Vol. 10, No. 2, 1968 26 p

Special aspects of long welded rails as related to track structure, rail welding, control of rail temperature, and maintenance of long welded rails primarily to prevent buckling are outlined. Maximum length of long welded rail adopted on Japanese National Railways is 1500 m and at both ends, expansion joints are attached. Long welded rails are not used in curves whose radius is shorter than 1000 m. In construction of the New Tokaido Line, maximum rail temperature was assumed as 60 C, minimum rail temperatures as -10 C and normal rail temperature at which rails are fastened to sleepers in free state as 20 to 30 C. Releasing and refastening of rails to control fastening temperature is described.

0644
RAPID TRANSIT TEST TRACK FOR SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT
Irvin, L. A., ASCE Transportation Engineering Conference, Preprint 217, May 17-21, 1965, 28 p

Diablo Test Track, a 4.4 mi installation, is described. Construction features are

discussed. Types of rail, rail supports and structures, and importance of noise attenuation are emphasized.

0645
COMPARISON BETWEEN MATERIAL QUALITY OF PURE OXYGEN CONVERTER (LD) STEEL RAILS AND THAT OF BASIC OPEN HEARTH FURNACE STEEL RAILS
Ito, A., Permanent Way, Vol. 10, No. 4, 1968, pp 16-52

Results of test concerning mechanical properties and microscopic structures of rolled rails are reported. Tests showed that converter steel is in no respect inferior to open hearth furnace steel. Compared with open hearth furnace steel, converter steel has less dispersed segregation and contains less gases. Brittleness transition temperature of converter steel rail, and their embrittlement due to strain aging are smaller, and shatter cracks are less liable to arise.

0646
CONTINUOUS WELDED RAIL--INSTALLATION AND MAINTENANCE
Johnson, W. H., Railway Track & Structures, Vol. 63, No. 10, Oct. 1967, pp 30, 32-33

On the basis of 50 replies to a questionnaire, considerable information has been accumulated and is presented. Preparatory work includes elimination or correction of drainage problems, renewal of switch and cross ties, unloading ballast, road crossing rehabilitation, and preparation for unloading at road crossing and bridges. Rail length should be adjusted at "mean" temperature. Continuous welded rail should be tailored in the field. Where possible, eliminate all joints in continuous-welded-rail territory. Newly laid rail should be surfaced and lined as soon as practicable.

0647
CONTINUUM MODEL STUDY OF PREVIOUS EFFECTS IN ACTIVELY SUSPENDED LONG TRAINS
Karnopp, D., Journal of the Franklin Institute, Vol. 285, No. 4, Apr. 1968, pp 251-260

An analysis is given of riding qualities of railroad vehicles traveling at high speed in which a "preview" of rough roadway ahead is obtained through dynamic variables of proceding cars in long train. Analysis involves treatment of partial differential equations instead of a large set of simultaneous ordinary differential equations. Applicability to design of active suspensions for vertical motion and to active roll control systems for guided vehicles is described.

0648
ANALIZA ZMECZENIOWA SZYN TYPU CIEZKIEGO
Kawczynski, A., and Radomski, R., Archiwum Inzynierii Ladowej, Vol. 14, No. 3, 1968, pp 503-533

Fatigue analysis of heavy-type rails, involving stresses caused by external loading together with additional bending of the head, by temperature changes, and by metalworking processes is discussed. Two types of rails, S 49 and UIC 60, are considered. For heavy traffic, it is suggested that UIC-60 type of rails be used. In Polish.

0649
INTEGRAL TYPE MEASURING EQUIPMENT FOR SUPER-ELEVATION
Kishimoto, S., and Takeshita, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 8, No. 4, Dec. 1967, pp 221-225

New mechanical integral type measuring equipment was constructed for a mechanical track inspection car which makes it possible to measure superelevation from the twist of track. Equipment needs no source of electric power. Results of the calculation show that frequency characteristics of equipment are good for ordinary superelevation, accuracy of mechanical parts being approximately 10%. Graphical data are given on relation between amplitude and frequency of superelevation.

0650
PRICHINY VYKROSHIVANIYA RABOCHEI POVERKHNOSTI REL'SOV P-50 VBLIZI VNUTRENNEI GRANI
Kontorshchikov, P. V., Stal, No. 5, May 1963, pp 464-466

Why R-50 rail surfaces chip away near the inner face is explained. Rails removed from track because they had chipped away, and rail steel specimens were tested. Second order stresses of 34-42 kg/sq mm were found to cause crystal lattice distortions under which cracks form in rails. Vanadium improves resistance to cracking, which is the initial cause of metal chipping away.

0651
PRESTRESSED CONCRETE SLEEPERS ON THIRD-RAIL ELECTRIFIED SUBURBAN LINES
Leipold, E., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 8-9, Aug.-Sept. 1967, pp 593-596

Design of rail support ties is based on that of BS-60 ties. To enable the current support to be mounted, the tie was extended by 210 mm on one side. To prevent it from taking part in transmission of vertical forces to the ballast, this extension was weakened by raising its bottom by 35 mm. To compensate for unavoidable tolerance at current rail support and to enable distances to be adjusted in accordance with rail wear, current rail supports are fastened to tie by means of long bolt holes. A wooden shim plate of variable thickness is inserted between the top and the current rail support.

0652
RESEARCH INTO SOME FACTORS WHICH INFLUENCE VERTICAL LOADING OF RAILWAY TRACK

Loach, J. C., Institute of Civil Engineers, Proceedings, Vol. 30, Apr. 1965, pp 731-746

A special baseplate was developed to measure vertical load on track. With baseplates on every sleeper in the vicinity of a rail joint, maximum vertical loads on running-on ends of rails were obtained at several places. From wheels having identical loads and carrying unsprung weights, results obtained at different sites varied considerably, and it was established that stiffness of track bed plays important part. It is concluded that any advantage to be gained on track from fully-sprung electric motors instead of axle-hung motors is negligible, and that magnitude of maximum load is primarily influenced by speed and stiffness of track bed rather than by amount of unsprung weight carried by wheel.

0653
HYDRAULIC TENSIONING OF CONTINUOUS WELDED RAIL
Macleod, N. J., Martyn, P. H., and Mipi, A., Railway Gazette, Vol. 125, No. 1, Jan. 3, 1969, pp 31-33

Application of Greenside Thompson Group tensioning equipment is discussed, that is designed for opening rail joints to change fish plates and insulating end posts. Techniques of tensioning are described which ensure that the weld is free of stress when it is made and that stress condition of continuous length produced will be within that acceptable for normal climatic conditions. A schematic diagram is given of tensioning procedure on curved track.

0654
ISSLEDOVANIE KONTAKTNOI PROCHNOSTI STALEI DLYA ZHELEZNODOROZHNYKH REL'SOV
Makukhin, S. I., Navrotskii, I. V., and Kazarnovskii, D. S., Stal, No. 9, Sept. 1962, pp 838-842

Contact strength of steels for railway rails is discussed. Contact defect types were reproduced on heavy rails R-50 using models. In studying conditions responsible for their formation, it was found that rails of chromium-containing non-heat treated open hearth steel should have high resistance to formation of contact defects, whereas resistance of rails of non-heat treated open hearth carbon steel and of hardened chromium-containing Bessemer steel will be smaller. Results were confirmed by track tests.

0655
INFLUENCE CHART FOR MOMENTS IN RAILWAY RAILS
Martin, G. C., American Railway Engineering Association--Bulletin, No. 612, Feb. 1968, pp 710-718

This report contains a graphical method and includes an influence chart for determining moments in railroad rail arising out of beam on elastic foundation analysis. The method requires use of the influence chart and wheel loading configuration under consideration to be drawn to scale of 1 in. equals 1 ft and then be placed on chart. Coefficients taken from chart are used to determine the moment at a given point in rail. Changes in track properties or finding moment at another point in rail are accomplished by changing position of scaled wheel loading configuration on chart and noting new coefficients. An example of the method application is presented.

0656
DESIGN AND MANUFACTURE OF PRE-STRESSED CONCRETE TIES
Miura, I., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 4, No. 3, Sept. 1963, pp 46-49

Causes of failure of prestressed concrete ties on Japanese National Railroads were investigated. Tentative ties with approximately the same shape and dimensions as contemplated PC ties for new Tokaido line were utilized to establish concrete mix and vibrating conditions which make it possible to use vibromolding machine and make ties by immediate demolding.

0657
MANUFACTURE AND TEST OF TRIAL PC TIES FOR FROST-HEAVE SECTIONS
Miura, I., and Iwasaki, I., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 7, No. 3, Sept. 1966, pp 35-36

A test is given to study changes of supporting conditions for prestressed concrete ties through measurement of bending moment produced in them by train load. Resisting moment of ties due to prestress was +98,000 kg-cm in section beneath rail and -50,000 kg-cm and +61,000 kg-cm at top and at bottom of midsection respectively.

0658
SOIL-CEMENT AS APPLIED TO SUBGRADE STABILIZATION OF RAILROADS
Miyako, J., and Nagal, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 3, No. 3, Sept. 1962, pp 20-25

Field experiments are discussed of subgrade stabilization on track for express trains in Japan. Laboratory tests of subgrade aeolian soil of volcanic origin show variations in compaction characteristics, in consistency, and in unconfined compressive strength when cement or lime is mixed.

0659
NOISE & VIBRATION STUDIES
Murray, R. J., Toronto Transit Commission, Subway Construction Branch, Toronto, Ontario, Canada, RD106, May 1967

0660
NOISE & VIBRATION CONTROL - TRACKWORK
Murray, R. J., Toronto Transit Commission, Subway Construction Branch, Toronto, Ontario, Canada, RD 109-B, Nov. 1, 1967

0661
SOIL INVESTIGATIONS AND DESIGN OF RAILWAY EMBANKMENT ACROSS LITTLE RANN OF KUTCH
Nagarajan, R., Indian Roads Congress Journal, Vol. 30, No. 3, Sept. 1967, pp 473-498

This paper deals with soil investigations and design of railroad enbankment across soft marshy areas. The design provided for enbankment with balancing banks of suitable dimensions to be made up of compacted local clay soil on layer of sand laid at ground level and with topping layer of compacted moorum. Design of enbankment sections and construction of embankment are described.

0662
RAIL SHELLY CRACK TO JAPAN
Nakamura, R., Owaku, S., and Enomoto, N., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 3, Sept. 1965, pp 34-44

Mechanisms of growth of shelly cracks which proved peculiar to Japan and developed very rapidly on many rails of Sanyo Trunk Line were investigated to establish methods of prevention. Extensive, elaborate examinations of track condition, materials quality, loading condition and friction and wearing phenomenon of affected rails were made. Statistical analysis of rail and comparative tests performed on track with rails of different qualities are described.

0663
STEERING FLEXIBLE RAILWAY TRUCK ON CURVED TRACK
Newland, D. E., Sheffield University, England, American Society of Mechanical Engineers, Paper 69-RR-5, Apr. 15-16, 1969, 12 p

Linear analysis is given for steady motion of flexible two-axle railway truck on curved track. It is shown that flexible truck can negotiate main line curves without slipping or flange contact. Results are obtained for maximum rolling displacement of wheelsets and minimum radius of curvature for no slipping, expressed as function of suspension stiffness. It is shown that lateral loads due to superelevation deficiency have only a small effect on motion of truck, which is mainly determined by creep forces arising from geometric inability of four wheels to roll freely on curved track.

0664
ABNORMALLY WIDE TIES--CAN THEY BE JUSTIFIED
Nicholson, L. P., Railway Track & Structures, Vol. 59, No. 5, May 1963, pp 26-27

Analysis of AREA equations show how modulus of rail support increases with width of ties. Ultimate supporting capacity of ties in terms of 8 in. tie width, and method of finding modulus of rail support for 12 in. ties and increase when changing from 8 in. or 9 in. ties are given.

0665
FATIGUE TEST OF WOODEN BLOCK FASTENINGS EMBEDDED IN CONCRETE-BED
Onishi, A., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 5, No. 3, Sept. 1964, pp 57-60

Track structures were investigated and fatigue tests carried out on some practical methods of fastening for comparison of their relative merits. Conditions of wooden block fastenings are proposed. In fatigue tests, a vibration fatigue testing machine was used for upward force, and a Losenhausen type track fatigue testing machine for lateral force.

0666
PREPARING BRITISH RAILWAYS TRACK FOR HIGH SPEED RUNNING
Paterson, A., Railway Gazette, Vol. 124, No. 11, June 7, 1968, pp 413-416

Design and maintenance specifications are described for track on which conventional trains will run at 125 mph. Experience and results of research have shown that before speed limits are raised to 125 mph or higher, action must be taken to eliminate bolted rail joints and gaps in rail at crossings.

0667
SWITCHPOINT REBUILDING
Penney, D. T., Welding Engineer, Vol. 50, No. 12, Dec. 1965, pp 56-57

Problem of switchpoint wear due to sharp turnouts and heavy traffic was solved by installing allied equipment, which consists of usual shop items, including 9-in. portable grinder, gas cutting and heating torch, two large C-clamps and two easily made gages for checking. There are two related rewelding projects, one welding of worn or broken toe area, and the other rebuilding of general section. Standard welding procedure is applied for producing weld of maximum deposit consistent with good quality and appearance.

0668
UN CHANTIER DE RENOUVELLEMENT DE VOIE A AVANCEMENT RAPIDE
Picot, Rousse, Vennin, Rev Gen des Chemins de Fer, Vol. 82, Jan. 1963, pp 1-30

High-speed track renewal system, techniques employed on French National Railroads for replacement of track by new track fitted with long-welded rails and detailed description of renewal procedure carried out in 2 phases and solutions adapted to problems that arose are discussed.

0669
OSOBENNOSTI DEFORMATSII REL'SOV PRI KHOLODNOI PRAVKE NA ROLIKOVYKH MASHINAKH
Plekhanov, P. S., Gladkov, G. A., Rudol'skii, N. L., Valenko, N. S., Mogilenko, A. S., Sivokho, A. F., and Fradina, M. G., Stal, No. 2, Feb. 1968, pp 145-148

Special features are given of deformation of rails cold straightened on roller machines. Cold straightening of rails on roller straightening machines produces not only longitudinal but also transverse deformations at an angle of 45° to the generatrix of the section. In areas of compression where rail is bent on straightening machine, longitudinal tensile stresses occur on side surfaces. Rails are actually deformed in straightening machines not only by the middle part of the rollers but also by their ends.

0670
APPLICATION OF RAIL STRESS TO LOCOMOTIVE DESIGN
Radley, R., Institute of Locomotive Engineers Journal, Paper 689, Vol. 57, No. 316, 1967-1968, pp 196-208

Rail stress analysis deals with stresses due to vertical loading on tangent track giving rise to high stress in flange of rail foot, and stresses due to lateral flange forces and associated eccentric vertical loading on curved track which give in addition high stress in web fillet radii. Analysis was made to match the load imposed on track with its load bearing capabilities to avoid undue stress in rail, and to determine overall maximum axle loading within which locomotive has to be designed.

0671
NOISE CONTROL IN THE BAY AREA RAPID TRANSIT SYSTEM
Salmon, V., and Oleson, S. K., Stanford Research Institute, Menlo Park, Calif., Interim Rpt., Copy No. 231, Feb. 1965

0672
NOISE IN MASS-TRANSIT SYSTEMS
Salmon, V., Stanford Research Institute, Menlo Park, Calif., SRI Journal, No. 16, Sept. 1967

0673
PRESERVATIVE TREATMENT OF BEECH SHORT SLEEPERS FOR CONCRETE BED--COMPARISON OF RESULTS OF TREATMENT ON GREEN AND UNSEASONED BEECH SLEEPERS
Shimizu, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 4, No. 2, June 1963, pp 51-54

Study of the practicality of beech short ties as block-ties fixed with hook-bolts on concrete bed track. Various results of treatment were compared by means of pressure, conditioning, and conditioning-pressure combination processes.

0674
DEVELOPMENT OF CONCRETE SLEEPER
Shrinivasan, M., Railway Gazette, Vol. 124, No. 1, Jan. 5, 1968, pp 25-28

Performance characteristics and comparative advantages of concrete ties developed and used on railroads of various European countries on 4 ft 8.5 in. gage are described. Ties within categories of reinforced concrete in one-piece, two blocks and tie; prestressed concrete in one-piece post-tensioned, one-piece pretensioned, two-blocks and tie, articulated; and special in asbestos cement, longitudinal, zig-zag are dealt with.

0675
BUCKLING OF LONG WELDED RAILS
Sinha, H., Institute of Engineers (India) Journal, Vol. 45, No. 3, Pt. Cl 2, Nov. 1964, pp 428-435

Stability of long welded rails against lateral buckling is analyzed and circumstances under which normal track with fish-plated joints behaves as long welded rail are described.

0676
MARTENSITBILDUNG AN DER OBERFLAECHE KOHLENSTOFFHALTIGER STAEHLE ALS FOLGE KURZZEITIGER INTENSIVER GLEITREIBUNG
Stolte, E., Technische Mitteilungen Krupp (Forschungsberichte), Vol. 20, No. 4, Dec. 1962, pp 143-151

Martensite formation is discussed at the surface of carbon steels as result of brief, strong sliding frictions. Theoretical considerations of temperatures engendered by friction are followed by a description of the experimental investigation in which carbon steels were tested under conditions resembling rapid travel of wheels over worn rails. Surface temperatures of over 1000 C and cooling rates of over 100,000 C/sec were measured. Dependence of martensite formation on rate of friction is described.

0677
GRAPHITE REPLACES OIL AS SWITCH PLATE LUBRICANT
Strom, E. M., Railway Signaling & Communications, Vol. 60, No. 10, Oct. 1967, pp 44-45, 48, 50

Ease of application, and ability to be better lubricant than oil, plus use of portable cleaning and application unit, make graphite a natural replacement for oil as switch plate lubricant. Good switch plate lubricant must be dry and hard, resistant to journal drippings, brine drippings, weed retardants and have low friction, be resistant to elements, such as rain and snow, must dry fast, be easy to apply, inexpensive, and have a flash point above 80 F.

0678
ACOUSTIC NOISE AND VIBRATION CONTROL SYSTEMS FOR RAPID TRANSIT
Swanson, R. C., B. F. Goodrich Research Center, Apr. 1967

0679
TECHNICAL LIMITATIONS OF CONVENTIONAL RAILWAYS
Sykes, W.J.A., Institute of Mechanical Engineers Proceedings, (Guided Land Transport), Vol. 181, Pt. 3G, 1966-1967, pp 8-12

Stopping from highest speeds requires braking distances such that current ideas and requirements on emergency braking become meaningless. High standards of mental and physical soundness are required of drivers; even so, driver's reaction to lineside signals is too slow, and external control of train speed by lineside detection systems will be required, linked inductively to regulating equipment on trains. Provided that suitable line of route is available, there appears at present to be no precise engineering limitation to attainment of highest speeds on rail which will intervene before a cost ceiling is reached at which further increases cannot be justified. There may also be a limit to the rate at which passengers can contemplate changes of scenery.

0680
RAIL FASTENING DEVICES FOR FROST-HEAVING SECTIONS
Takahara, K., Permanent Way Society of Japan, Vol. 8, No. 3, 1965, pp 17-24

Rail fastening devices manufactured as trail types 8 and T-1 for prestressed concrete ties to be used in frost heaving sections of Hokkaido area, Japan, are described. Before field tests, laboratory experiments were conducted to ascertain their strength.

0681
JNR EXPERIMENTS WITH CONCRETE TRACK BED
Takahara, K., Railway Gazette, Vol. 125, No. 7, Apr. 4, 1969, pp 260-262

Experimental lengths of concrete bed on Tokaido line in Japan show considerable promise. As result of a study to develop permanent track structure, three types of concrete track were laid on Tokaido line over short distances so that direct comparisons could be made with ballasted track. Performance of trackbed with concrete slabs supported on rubber mats as a means of adjusting line and level and track with concrete slab bedded in asphalt was compared with conventional concrete track bed in use.

0682
L'INFLUENCE DES VARIATIONS DE LA TEMPERATURE SUR LES DEPLACEMENTS DE LA VOIE A LONGS RAILS SOUDES
Teodoresco, C. C., Rev Roumaine des Sciences Techniques--Serie de Metallurgie, Vol. 9, No. 2, 1964, pp 261-290

The influence is discussed of temperature variations on displacements of railway track with welded long rails. The latter are dealt with as hyperstatic system with n unknowns. By making n very high, rail of infinite length is obtained. Elastic and plastic regime during increase and decrease of temperature is studied. An expression for tensions and displacements is presented, and their variations are shown graphically, emphasizing phenomenon of hysteresis. In French.

0683
CALCULATION OF LONGITUDINAL STRESSES, ACCORDING TO VARIATIONS IN TEMPERATURE, IN SECTION OF LINE LAID WITH LONG WELDED RAILS
Teodoresco, C. C., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 10, Oct. 1967, pp 637-652

Relation between longitudinal displacements of track and corresponding forces was deduced experimentally to have the form of the curve, on curvature of which characteristics of track depend. Rheological models are proposed for linearization of this curve to obtain more simple mathematical calculation. Equations and example calculations are presented to evaluate sliding of ties, elasto-plastic behavior of ballast with reinforcement, and rigid-plastic behavior of ballast.

0684
ZVYSENI PEVNOSTI A OTERUVZDORNOSTI OBLOUKOVYCH KOLEJNIC
Vondrasek, V., Singel, J., Telecky, J., and Kaczmarczyk, E., Hutnicke Listy, Vol. 22, No. 11, Nov. 1967, pp 764-770, In Czech.

Methods of increasing strength and abrasion resistance of rails for curves, found most promising at Trinec steelworks, are to increase hardness through-out rail section by increasing carbon content, and quenching heads of rails from final rolling temperature.

0685
BIRTH OF 60 KG/M RAIL
Watanabe, K., and Sugiyama, T., Permanent Way, Vol. 10, No. 4, 1968, pp 1-15

Sixth kilogram per meter rail was selected for use in New Sanyo Line because profile of railwear observed in New Tokaido Line and possibility of growth of volume of traffic on line advised use of heavy rail. Studies were undertaken by the Track Group of New Sanyo Line Construction Committee. Studies concerning weight of rail and lower part of construction gage were conducted by Track Maintenance Section of Maintenance Department, and studies concerning cross sectional shape by Track Laboratory of Railway Technical Research Institute. This report described results of these studies.

0686
ZUM PROBLEM DER QUERREIBUNG ZWISCHEN RAD UND SCHIENE BEIM DURCHFAHREN VON GLEISBOEGEN
Weber, H. H., Glasers Annalen, Vol. 92, No. 4, Apr. 1968, pp 107-113, In German.

Problem of transverse friction between wheel and rails during running through rail curves is discussed. A study of dependence of coefficient of transversal friction on state of rails showed that for curves with radius smaller than 600 m coefficients of transversal friction to be applied for purpose of making predeterminations must be higher than value of 0.2 to 0.25. The laboratory curve established by C. T. Mueller is confirmed. Comparisons made between measuring results and theory of H. Heumann showed that they correspond with each other remarkably well.

0687
CONCRETE CROSSTIES IN UNITED STATES
Weber, J. W., Portland Cement Association, Skokie, Ill., Prestressed Concrete Institute Journal, Vol. 14, No. 1, Feb. 1969, pp 46-61

Feasibility of using prestressed concrete crossties is explored, with emphasis on development of economical, efficient tie suitable for fast, heavily laden American railroads, along with history of past tests and performance.

0688
RECENT DEVELOPMENTS IN LATERAL DYNAMICS OF HIGH SPEED RAILWAY VEHICLES
Wickens, A. H., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 12, Dec. 1967, pp 781-803

Developments in theoretical and experimental aspects of lateral dynamics of railway vehicles are reviewed, with particular reference to problems of dynamic stability, guidance and response to track features. Influence of track and wheel geometry, suspension characteristics and overall vehicle configuration on dynamical behavior is discussed in relation to linear theory. Implications of linear theory for vehicle design are discussed both in relation to improved forms of existing railways and various possible new forms of guided, wheeled systems.

0689
ACOUSTICAL CONSIDERATIONS IN THE DESIGN OF THE SOUTHERN CALIFORNIA RAPID TRANSIT SYSTEM
Wilson, G. P., Wilson, Ihrig and Associates, Inc., Berkeley, California, Preliminary Rpt., Aug. 1967

0690
STRENGTHENING FILL SLOPE BY THERMAL TREATMENT
Yamada, G., Moriyama, S., Owaki, Y., and Nishio, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 8, No. 1, Mar. 1967, pp 22-27

Procedure of thermal treatment to strengthen soil around boreholes by burning oil for long time to improve stability of the fill slope is discussed. Field experiment was carried out to develop a burning device and to determine effective range of strengthening soil by burning. On a fill slope of an embankment of cohesive soil, 45 burning boreholes of L type were excavated at intervals of 1.5 m over a length of 90 m. Combustion lasted 10 days, keeping the temperature between 900 and 1000 C. The excavating method and burning device are described.

0691
APPLICATION OF SCALING DATA TO MODEL TESTS TO OBTAIN FULL-SCALE RESULTS
Institute for Rapid Transit, Washington, D. C., Mar. 1971, 18 p

The purpose of this document is to consider at the beginning of the Subway Environmental Research Project, the methodology for relating the experimental scale modeling data to full-scale predictions. The similitude laws being developed at CIT/JPL are considered in terms of their application to the geometrically-scaled experiments to be run at DSI-AT. A procedure for scaling the DSI-AT data at full-scale is discussed and examples are given.

0692
SLAB TRIALS COULD HERALD RAIL TRACK REVOLUTION
Construction News, Nov. 14, 1968

0693
LONGLASTING RAIL CROSSINGS
South African Mining Engineers Journal, Vol. 81, No. 4045, Aug. 14, 1970, p 567

A simple but ingenious system for building long lasting and easily maintained railway crossings has been recently introduced in Switzerland under the name of "Bodan". It consists of concrete slabs craddled in a wedge of Du Pont neoprene synthetic rubber, inserted in the concave part of the rails, and it transmits the load dirctly to the rail itself, in exactly the same way as when a train passes over the rails.

0694
INVESTIGATION OF WELDED RAILS AT AAR RESEARCH CENTER
American Railway Engineering Association Proceedings, Vol. 65, 1964, pp 615-629

Report covers investigation of failed butt welds submitted to Research Center during the period from Jan. 1963 to Oct. 1963. Failures submitted were all service failures; two were oxyacetylene pressure butt welds and 11 were clash butt welds. In cases of failures due to pipe from heavy segregations and those due to fishtail, macrographs of etched cross sections of both rails adjacent to weld were obtained.

0695
VIBRATOR ASSURES LENGTH ADJUSTMENTS IN LONG RAILS
Railway Track & Structures, Vol. 67, No. 6, June 1971, pp 26-27

A machine developed by the Union Pacific is designed to vibrate rail strings while they are being laid to facilitate changes in length in response to being heated or cooled. The vibrator is a track-mounted machine which has two rail vibrators, one for each rail, which are independent of each other. In each case the vibration is created by an eccentrically counterbalanced shaft in a hydraulic motor.

0696
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965
Department of Transportation, Washington, D.C., FRA-RT-73-8, Annual Rpt. No. 5, Oct. 1, 1970-Sept. 30, 1971, 200 p, Available: NTIS, PB 212694/4

The report is required by the High Speed Ground Transportation Act of 1965, and forms a status report on activities within the preceding year in R and D and demonstrations programs carried on under authorization of the Act. Progress is reported on: rail technology including track structures and development of the Rail Dynamics Laboratory; the Metroliner and Turbo train demonstrations; Advanced Systems including tracked air cushion vehicles and magnetically levitated vehicles; and advanced technology including electric propulsion with linear motors and wayside power collection, controls and tunneling.

0697
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965
Department of Transportation, Washington, D.C., Rpt. No. 4, 1970, 159 p, Available: NTIS, PB 196799

Coupled with the Northeast Corridor Transportation Project, the high speed program was sought to: determine transportation demand in a most heavily populated and industrialized intercity corridor region; analyze engineering systems alternatives for meeting that demand; demonstrate traveller response to selected transportation improvements; and undertake research and development in fields of entirely new systems as well as stimulating that in existing systems.

0698
MATERIALS CHARACTERIZATION AND PAVEMENT DESIGN FOR UTACV GUIDEWAY AT HSGTC - PUEBLO, COLORADO
Austin Research Engineers, Inc., Rpt. AB-3/2 and 3/3, Sept. 1972

The objective of the soil testing program was to provide soils data for characterizing the soils in the guideway pavement structure considering the dynamic loading of an air cushion vehicle and environmental conditions. All of the soils at the UTACV guideway site have good strength characteristics when confined. Compaction does not appear to materially increase the soil strength, but sets the stage for a considerable increase as the calcareous fines react with moisture to set up cohesive bonds between the grains of sand. The soils from all proposed borrow areas compact readily near optimum moisture content and provide very satisfactory enbankment materials. The apparent lack of moisture sources reduces the probability of frost heave to near zero; however, where a source of moisture is deemed possible, use the A-3 or nonplastic A-2-4 soils for enbankments. There is no danger of sliding in either cuts or embankments at the 3 to 1 slopes selected for construction.

0699
SYNTHETIC RESIN BONDING
Railway Gazette, Vol. 122, 1966, pp 861-865

Solventless adhesives do not require heat or pressure to provide sound joints, and therefore, have proved useful in railway engineering for they are amenable to site application. Two types of adhesive in particular have permitted these advances: polyesters and epoxides. A sleeper which has been made good with epoxide resin mortar is illustrated. Repair of E4 concrete sleepers under chaired track is carried out by displacing the sleeper and drilling holes, so that fastenings may be made good by using a polyester resin to secure rubber inserts in the concrete. Resins have been used to repair manganese steel crossings. Limitations on the use of adhesives for fixing chairs and baseplates to concrete sleepers appeared to be the difficulty of surface preparation of the metal, large glue line thickness, and low resistance to impact and peeling forces of the adhesives used. Cable hangers have been attached to a tunnel wall using an epoxide adhesive.

0700
VIADUCTS ON SINGLE COLUMNS
Railway Gazette, Vol. 122, No. 6, Mar. 18, 1966, p 228

0701
HOW P&S 'TRAFFIC' MEN HELP MOPAC CUT ITS COSTS
Railway Age, Vol. 161, No. 3, July 18, 1966, pp 22-23

Annual savings increased 400,000 dollars by setting up purchases and store department with card file containing up-to-date information for various store points. It is possible to make either spot purchases or a broad market analysis.

0702
NEW TIE SPACER PROVES POINT
Railway Age, Vol. 157, No. 18, Nov. 9, 1964, pp 18-19

Tests for studying advantages and possibilities of new tie spacer introduced by Nordberg Manufacturing Company on Chicago & North Western are described. Tests showed the advantages of having cross-ties uniformly spaced and square with rails.

0703
SAL MAKES MORE CONCRETE TIE TESTS
Railway Age, Vol. 157, No. 8, Aug. 31, 1964, pp 70-71

New techniques used at Seaboard Air Line concrete tie construction and test installations are described. The panel method is used for constructing passing-track extensions and sidings, effecting substantial savings over conventional method of track building. Panels were built in piles, six tiers high.

0704
AUTOMATED TURNOUT SURFACING ON SANTA FE
Railway Track & Structures, Vol. 63, No. 1, Jan. 1967, pp 25-27

Main-line turnouts are being tamped with switch tamper using newly developed attachment that "sights" raise and controls jacks on machine. Plassermatic WE-275 switch tamper has two tamping heads mounted at end of track car, one over each rail. Each tamping head moves laterally. Jacking is automated by infrared beams. Two cross-level indicators are mounted on tamper placed in convenient view of one of operators. The machine produces better-riding turnouts than those that were tamped with hand-held tools.

0705
AUTOMATED PROCESS 'CASE-HARDENS' RAILS WITH NATURAL GAS
Railway Track & Structures, Vol. 60, No. 9, Sept. 1965, pp 38-39

Electronically controlled flame hardening method used by Hammon Precision Equipment Co., Oakland, California, and designed to treat rails of various lengths, including welded strings is described. Production of flame-hardening plant is amounting to 24 double rail lengths per 8-hr day.

0706
IN-TRACK SURGERY FOR CROSSTIES
Railway Track & Structures, Vol. 60, No. 7, July 1964, pp 18-19

Features of one-man machine in operation on Chicago & Northwestern that closes splits and applies steel spiral dowels diagonally from top corners of ties are described. The machine is reported to apply about one dowel per minute.

0707
FOR CONTRETE TIE--WHAT KIND OF FASTENING
Railway Track & Structures, Vol. 62, No. 5, May 1966, pp 21-23

Mechanical problems are discussed that must be overcome in selection of fastenings to be used with various concrete ties. Descriptions are given of some of fastenings being offered include Uniclip, Pandrol, Fair-Flex, "economy assembly", Flexi-clip, DE spring clip, Roger Sonneville assembly, and Fist fastener.

0708
LASER BEAM SIGHTS TRACK FOR LINING MACHINE
Railway Track & Structures, Vol. 67, No. 1, Jan. 1971, pp 25-27

0709
CANADIAN ROADS NOW LAYING HEATED RAILS
Railway Track & Structures, Vol. 65, No. 12, Dec. 1969, pp 22-23

The heater developed uses propane gas and consists of six pairs of burners mounted in a rig that operates on the rails. The liquid propane is vaporized at the burner heads. The burners can be selected in pairs to give the temperature rise desired. The heater is self-propelled and has a trailing truck carrying the propane fuel supply. It is designed to raise the temperature of the rail from 30 to 75 degrees when operating at a speed of 40 lin ft/min.

0710
RAIL GRINDER IS USED TO PROLONG RAIL LIFE TO MAINTAIN TRACK SURFACE
Railway Track & Structures, Vol. 66, No. 12, Dec. 1970, pp 14-16

0711
SPUR THAT TURNED OUT TO BE A TEST TRACK
Railway Track & Structures, Vol. 67, No. 9, Sept. 1971, pp 22-23

The paper describes a 3-mi spur track on the Louisville and Nashville which is a test track for two devices. One is the Huck fastening which was used in lieu of bolts in the joints. The other is the Armco Rail-Anchor spike, a single-piece device that is designed to serve both as a line spike and a two-way anti-creeper for the rail.

0712
DETERMINING INCREASE IN BALLAST DENSITY UNDER TRAFFIC BY MEANS OF GAMMA ABSORPTION METHOD
Birmann, F., and Cabos, P., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 3, Mar. 1967, pp 229-249

Measuring arrangement by application of gamma absorption method for determining compaction of coarse-grained ballast materials is described. Volume weight measurements were carried out before the track was handed over to traffic, and were repeated, always at the same measuring points, marked by test tubes, of 2 km long test section, 1, 3, 8 and 14 days and 1, 2 and 7 mo after track was taken into operation. Tests showed an increase in track resistance to transverse and longitudinal displacement.

0713
DETERMINATION OF THE SNAKING EFFORT IN TRACK LAID WITH LONG WELDED RAILS BY MEANS OF A NON-LINEAR CALCULATION
Bijl, F., International Railway Congress Association Bulletin, No. 625.143(0), Aug.-Sept. 1965

0714
TRANSPORT WORK ON THE SWEDISH RAILWAYS
Carlstedt, A., The Dynamics and Economics of Railway Track Systems Conference, RSMA, Paper No. 5, Feb. 1970, pp 53-70

Elastic spike fastening, the Hey-back fastening and concrete tie/sleeper Type 101 Fist fastening are discussed. Maximum track tolerance with regard to acceptable ride quality is given.

0715
LES ATELIERS S.N.C.F. DE PREPARATION DES BOIS SOUS RAILS
Chollet, Rev Gen des Chemins de Fer, Vol. 83, Dec. 1964, pp 707-717, 735-736

French National Railroad workshops for preparing timber laid under rails are described. Improvements described in manufacturing wood ties include procedures of seasoning, binding, adzing, drilling, impregnation and loading for dispatch. Equipment is described that enables ties taken from stacks to be sorted and strengthened in single highly-mechanized shop.

0716
SLEEPERS IN NEW ZEALAND
Clark, C., Railway Gazette, Vol. 120, No. 22, Nov. 20, 1964, pp 935-937

Increased use of locally grown softwood ties by New Zealand Government Railways is discussed. Preservation of ties, and development of bedplate with offset ribs are discussed.

0717
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS
Cramer, R. E., American Railway Engineering Association Proceedings, Vol. 65, 1964, pp 525-529

Data are presented on failed control-cooled rails examined between Oct. 1962 and Aug. 1963. Transverse fissures from shatter cracks, from hot torn steel and compound fissure from overheated ingot were studied.

0718
INVESTIGATION OF FAILURES OF WELDED RAILS AT UNIVERSITY OF ILLINOIS
Cramer, R. E., American Railway Engineering Association Proceedings, Vol. 65, 1964, pp 611-614

Failures of Welds 1089, 1090 and 1093 are described. Thirteen bend tests are included in this report. Tests are made on full-section rails on supports 48 in. apart and loaded at two places 6 in. on each side of weld lines. Results of bend tests are presented in a table.

0719
STRENGTH, LIFE AND RELIABILITY OF METAL FOR RAIL TRANSPORT (VOPROSY PROCHNOSTI, DOLGOVECHNOSTI; NADEZHNOSTI METALLA DLYA ZHELEZNODOROZHNOGO TRANSPORTA)
Dazarnovskii, S. D., Stal, No. 8, Aug. 1968, pp 682-685

0720
WEAR AND CORROSION OF RAILS
Dearden, J., Railway Gazette, Vol. 121, No. 1, Jan. 1965, pp 18-21

Research on corrosion conducted by various investigators and rail-wear data obtained by British Railways Research Department staff using contourograph are reviewed. Influence of steel composition, axle load, braking, and lubrication were studied. The study shows that life of continuous welded rail is affected to greater extent than jointed rail.

0721
FEASIBILITY OF DIRECT FIXATION ON UNBALLASTED STRUCTURES
De Leuw, Cather & Company, Chicago, Ill., Prepared for Washington Metropolitan Area Transit Authority, Washington, D.C. June 1968

0722
THE GERMAN FEDERAL RAILWAY ON THE WAY TO A MODERN SUBSTRUCTURE
Delvendahl, H., Der Eisenbahningenieur, Jan. 1972, p 15, In German

Within the framework of the 1985 horizon, the plan discussed provides for the installation

of automatic block on 11,500 KMS of lime, construction of 1150 free-level signal cabins, and replacement of conventional ballast by concrete slabs.

0723
STRESSES ACTING ON RAIL--RECENT FINDINGS
Eisenmann, J., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 7, July 1967, pp 537-550

Tests were conducted to study shearing stresses in rail head and sub-soil, flexural tensile stresses at the rail head, and guiding efforts. Results showed that increased axle pressures and reduced wheel radii give rise to higher stresses in rail head. If permissible shearing stress is exceeded fatigue fractures occur in rail head. This can be counteracted by using steel of greater strength and purity.

0724
INSTITUTE FOR THE BUILDING OF OVERLAND TRANSPORT ROUTES
Eisenmann, J., Munich Technical University, Munich, Germany, Die Holzschwelle, Sept. 1971, p 24, In German

The author describes some of the Institute's most outstanding testing equipment: test under different stresses, of rail-fastening systems; and test of the fastenings and sleepers, measurements on the track of pressures, deformation, and displacement. The Institute has prepared more than 500 research reports, and 16 works have been published.

0725
GLEISANALYSE
Erismann, T., Glasers Annalen, Vol. 91, No. 2, Feb., 1967, pp 34-45

0726
THE DYNAMICS AND ECONOMICS OF RAILWAY TRACK SYSTEMS
Fastenrath, F., German Federal Railways, Sept. 1969

0727
BEEINFLUSSUNG DER MECHANISCHEN EIGENSCHAFTEN VON SCHIENESTAEHLEN DURCH ABBRENNSTUMPF- UND THERMITSCHWEISSEN
Heller, W., Jaeniche, W., Archiv fuer das Eisenhuettenwesen, Vol. 36, No. 5, May 1965, pp 351-363

Effects of flash butt and thermit welding on mechanical properties of different types of steel rail with 60, 70, and 90 kg/sq mm minimum tensile strength were studied by experimental welding. Temperatures at different locations of rails were measured during welding and during cooling and coordinated with hardness, tensile properties, fatigue and notch impact values, and with structure. TTT diagrams for continuous cooling were plotted. Results are discussed with reference to welding standards of German railroads.

0728
A SUMMARY OF DISCRETE-ELEMENT METHODS OF ANALYSIS FOR PAVEMENT SLABS
Hudson, W. R., Treybig, H. J., and Ayyash, A. A., Center for Highway Research, University of Texas at Austin, Rpt. 56-27, Aug. 1972

0729
BARTD TEST TRACK--PROVING GROUND FOR NEW IDEAS IN TRACK, STRUCTURES
Irvin, L., and Stanske, G. P., Railway Track & Structures, Vol. 61, No. 6, June 1965, pp 24-29

Tests conducted on various sections of test track built by San Francisco Bay Area Rapid Transit District (BARTD) to determine comparative worth of new rapid-transit design concepts are described. Track incorporates a variety of advanced concepts of design, including new materials, fastenings and other components. Under test are three types of concrete ties, concrete-slab roadbed construction, eight types of rail fasteners, sound and vibration-deadening materials such as elastomer pads, and several types of modern concrete and steel bridge spans.

0730
RAPID-TRANSIT TEST TRACK FOR SAN FRANCISCO
Irvin, L. A., Civil Engineer, New York, Vol. 35, No. 8, Aug. 1965, pp 48-52

New rapid-transit technology, developed by San Francisco Bay Area Rapid Transit District, by constructing double-track test track 4.4 mi long to test variety of new concepts in structural design, continuous welded rail, noise control, vehicles, a-c and d-c distribution and propulsion and automatic train control. Gage of 5 ft 6 in. has been chosen to improve stability of light weight cars weighing 800 lb per linear foot.

0731
HOW TO PREVENT RAIL FAILURES WHICH CAUSE TRAFFIC DISTRUBANCE
Ito, A., and Kurihara, R., Permanent Way Society of Japan, Vol. 8, No. 2, 1965, pp 1-16

Rail failures of short- and long-life types and failures having their origins inside head of rail are discussed. Types of rail-failures which have highest probability to cause traffic disturbances are transverse fissure and transverse break with origin at rail-base. Reasons for this type of failure is that there is no time between finding of fine crack on running surface of rail caused by fatigue flaw inside head of rail and complete rupture of rails. Rules to follow regarding spreading angle of fatigue flaw inside head of rail and at time when complete rupture of such rail happens. It is recommended to utilize these rules in non-destructive inspection for such rail failure

0732
SICHERHEIT DES SCHIENENVERKEHRS AUS DER SICHT DES BAUINGENIEURS
Kessler, E., Glasers Annalen, Vol. 90, No. 8, Aug., 1966, pp 277-284, In German

Safety of rail traffic from viewpoint of constructional engineer is shown. Examples are discussed in terms of new investigations on rail stress that have produced knowledge about permissible stress in dependence on wheel load, wheel diameter and rail material. Measurements of principal forces occurring in rail curves, and new methods of design in bridge construction; and safety facilities affecting signaling and telecommunications are discussed.

0733
TEST FOR WHEEL BURNS OF RAILS BY D-TYPE AC LOCOMOTIVES
Kimura, S., Ito, A., Ueda, T., and Shiba, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 8, No. 1, Mar. 1967, pp 48-50

In gradient traction test of ED-75 a-c locomotive wheel slip was forced to occur by various operating conditions, and wheel burns of rails were examined. Objective of test was to find optimum operation method for heavy trains and to improve practical adhesive capacity as preventive measure of wheel slip, by analysis of adhesion on various rail conditions.

0734
INTRODUCTION TO RAIL WEAR AND RAIL LUBRICATION PROBLEMS
Kilburn, K. R., Wear-Usure-Verschleiss, Vol. 7, No. 3, May-June 1964, pp 255-269

Experience in effects of long, heavily loaded, bulk-materials carrying trains on rail life was studied on Quebec North Shore and Labrador Railway over past 8 yr of its ore-haul operations. Survey is made of types of wear observed such as plastic metal flow, cold working, surface and subsurface metal rupture and metal fatigue developments. Analysis of these developments indicate that they arise from intimate interrelation of magnitude of wheel-loading to load carrying capacity of rail. Remedial measures are suggested.

0735
ADHESION AND FRICTION IN RAIL TRACTION
Koffman, J. L., Journal Institute of Locomotive Engineers, Vol. 38, No. 205, Paper 479, 1948, pp 593-640

0736
PAVEMENT EVALUATION BY WAVE PROPAGATION METHOD
Nair, K., Transportation Engineering Journal ASCE, Feb. 1971

0737
AN APPRECIATION OF THE PRACTICAL PROBLEMS: A SURVEY OF THE PROBLEMS AND THEIR IMPORTANCE
Koffmann, J. L., and Bartlett, D. L., Joint Convention on Interaction Between Vehicle and Track, London, 1965, pp 1-14

0738
A STRENGTH CRITERION FOR REPEATED LOADS
Larew, H. G., and Leonards, G. A., Proceedings of Highway Research Board 41, 1962, pp 529-556

0739
REPEATED LOAD TESTS ON RAIL-SLEEPER ASSEMBLIES
Loach, J. C., Railway Gazette, Vol. 121, No. 7, Apr. 2, 1965, p 274

Using special baseplate that makes it possible to measure vertical loads and lateral forces transmitted from rail to tie, laboratory tests which closely reproduce severe service conditions of loading are described. Test rig incorporates hydraulic jack capable of imposing repeated loads in one direction only, jack being connected to pulsator.

0740
RESIDUAL STRESSES IN RAIL
Machii, K, Permanent Way Society of Japan, Vol. 8, No. 1, 1965, pp 1-11

Method for determining residual stresses in rail distributed over cross section, which is in right angle to rail axis is discussed. Results are compared with various methods of trepanning or cutting. Calculation was made of residual stress. Data are given on relation between cut rail length and relaxed stress. Relaxation modulus of strain and residual stresses in various types of rail were studied.

0741
WOOD RESEARCH IN RAILROAD INDUSTRY
Magee, G. M., ASCE Proceedings, Journal of the Structural Division, Vol. 93, No. ST2, Apr. 1967, Paper 5178, pp 105-120

Extensive research was conducted on two principal causes for wood cross tie replacement, abrasion from tie plates, and tie splitting. Repeated laboratory loading tests correlated with service tests in track have shown that tie abrasion can be reduced 50% with tie plate fastenings and almost eliminated with tie pads. Research has shown that dowels are effective means of controlling tie splitting. "Proving Ground" project for protection of wood against termite attack has indicated most effective treatments. Work was done leading to performance acceptance test for freight car flooring.

0742
A COMPUTER PROGRAM TO ANALYZE BEAM-COLUMNS UNDER MOVABLE LOADS
Matlock, H., and Taylor, T. P., Center for Highway Research, University of Texas at Austin, Rpt. 56-4

0743
DESIGN OF FISHPLATED JOINTS IN RAILS
Morse, W., Assembly & Fastener Methods, Vol. 4, No. 11, Nov. 1966, pp 36-37

Design and application of suspended and supported types of fishplated joints is discussed. Section modulus of fishplate joints, and composition and strength of steel for fishplates are given. Details are presented of tight-bolting of rail joints with high-tensile steel bolts known as 'frozen joints', which eliminate expansion allowance.

0744
PRELOADING METHOD--EXPERIMENTAL INVESTIGATION AND ITS APPLICATION TO FILL CONSTRUCTION
Muromachi, T., and Watanabe, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 4, No. 4, Dec. 1963, pp 27-31

Tests of preloading method to study its application to embankment construction on soft foundation soil are discussed. Results of tests for determining rebound curve after release of preload are outlined and specifications for method use proposed. Experiments on preloading were conducted using standard consolidation apparatus for clay and peat soils.

0745
CONCRETE RAILWAY SLEEPERS
See 0149

0746
THE FRENCH RAILWAYS' TRACK (III) THE FRENCH SOLUTION FOR THE RAILWAY PROBLEM
Prud'Homme, A., Eisenbahning, Mar. 1969, pp 140-142, In German

0747
THE SELECTION OF AN ECONOMICAL RAIL SECTION
Reiner, I. A., and Law, C. W., B&O - C&O Research Services Planning Department, Baltimore, Md., Rpts. 1 and 2, 1963

0748
EXPERIMENTS ON SLOPE FAILURE AND ITS PREVENTION BY DRAINAGE FOR SANDY EMBANKMENTS UNDER ARTIFICIAL RAINFALL
Saito, M., and Uezawa, H., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 10, No. 3, Sept. 1969, pp 142-148

0749
KAGIYAMA
Saito, T., Yawata Technical Report, No. 247, June 1964, pp 143-148

Method described is said to be highly reliable as compred with other welding methods, if suitable welding conditions are obtained. However, 50 m rails being constructed from 25 m sections meet standards of Japanese National Railways. Specifications for specially designed welding equipment, welding conditions, weld strength tests, heat affected zone, hardness, and welding flaws are given.

0750
UNTERSUCHUNGEN AN THOMASSCHIENESTAHL
Schmedders, H., Hammer, R., and Schrape, U., Archiv fuer das Eisenhuettenwesen, Vol. 37, No. 7, July 1966, pp 551-560

Basic Bessemer rail steels were studied to determine reason for black spots and vertical shatter cracks in rails. A connection was found with oxygen and therefore with the inclusion content of steel as affected by melting and pouring practice. Remedies are suggested. Further investigation concerned internal stresses, role of hydrogen in rail failures, and surface defects is suggested. Results of ultrasonic testing are critically evaluated.

0751
AIR SPRINGS OF RAIL VEHICLES AND CONTROL OF CAR MOVEMENT DUE TO THE TRACK CURVATURE
Schmuecker, B., Glasers Annalen, Vol. 95, No. 7-8, July-Aug. 1971, pp 271-282, In German

The vibrational relationships between riding qualities and vehicle suspension are discussed with special reference to light vehicles required to deal with heavy loads. The advantages of air springs in such applications are outlined. The article reports on the suitability of air springs for controlling the car body movements due to the track curvature to raise the speed.

0752
BEITRAG ZUR STEIGERUNG DER SPEZIFISCHEN HOECHSTGESCHWINDIGKEIT IM GLEISBOGEN
Schmuecker, B., and Kirchlechner, H., Glasers Annalen, Vol. 89, No. 7, July 1965, pp 271-278, In German

Increase of specific high running speed on rail curves is presented. Possibility of driving over rail curves at higher speed was studied and diesel multiple unit train was modified so that its middle car despite increased speed on curve

transmitted no more centrifugal force to passenger than has been permitted. Test results are described. By additional incline of coach to inside of curve, additional downward pressure acting on passengers is completely equalized or maintained on admissible limit value by centrifugal force increased by higher running speed.

0753
HOW BRITISH RAILWAYS USE PLASTICS
Scollay, I. J., SPE, 22nd Annual Technical Conference, Vol. 12, Mar. 1966, Paper XVII-1, 5 p

Applications of polyethylene and nylon as rail fasteners, PVC as distribution ducts for air and gas, fiber glass reinforced plastics as seat sheels and as structures with metal subframes in British Railways, United Kingdom, are discussed. Considerations are described of strength, weight, noncorrosive qualities and flexibility of plastics. Reinforced plastics are also applied in trackside buildings built from standard self-supporting modules.

0754
PREDICTION OF FLEXIBLE PAVEMENT DEFLECTION FROM LABORATORY REPEATED LOAD TEST
Seed, H. B., Mitry, F. G., Monismith, C. L., and Chan, C. K., NCHRP Rpt. No. 35, 1967

0755
ADVANCED MECHANICS OF MATERIALS
Seely, F. B., and Smith, J. O., John Wiley and Sons, Inc., New York, Second Edition, 1966

0756
ENGINEERING MECHANICS
Singer, F. L., Harper Brothers, New York, Second Edition, 1954

0757
PERMANENT WAY OF THE FUTURE
Sonneville, R., Railway Gazette, No. 18, Sept. 18, 1970, pp 710-711

Ballastless track was installed on the Paris Metro with RN fastenings laid in concrete with elastomer slippers for the line through the Bozberg tunnel. Track bed with concrete slabs supported on rubber mats was used to provide adjustment in line and level.

0758
WHAT PRECAUTIONS WHEN WORKING CWR TRACK
Sorrels, B. D., Railway Track & Structures, Vol. 67, No. 11, Nov. 1971, pp 26-27

Report on the subject of when and how to timber and surface locations having continuous welded rail to avoid or minimize expansion or contraction. Preparatory measures taken to tie the renewals under continuous welded rail are discussed.

0759
THE CIVIL ENGINEERS POCKETBOOK
Trautwine, J. C. Trautwine Co., Philadelphia, Pa., Twentieth Edition, 1922

0760
CONTINUOUS LAYING OF SLAB TRACKS
Uenoyama, K., Railway Technical Research Institute-Quarterly Report, Vol. 11, No. 1, Mar. 1970, pp 1-2

0761
CIVIL ENGINEERING HANDBOOK
Urquhart, L. C., McGraw Hill Book Co., Inc., New York, Fourth Edition, 1959

0762
CORROSION AND PROTECTION OF RAILS IN TUNNELS
Vedenkin, S. G., and Dobrolyubov, V. V., Protection of Metals, No. 1, 1965, pp 92-98

Atmospheric corrosion tests were made on specimens in form of cross rail templates produced from experimental heats of eight low-alloy steels containing 0.1% copper, 0.18% vanadium, about 2.5% chromium and 0.9% nickel. Steels hardened and tempered to high hardness are prone to corrosion cracking. In order to protect rails against corrosion due to leakage of traction current in tunnels, rails are fastened with separate "K" type fasteners using rail chairs coated with films of insulating polymers.

0763
HIGHWAY ENGINEERING HANDBOOK
Woods, K. B., et al., McGraw Hill Book Company, New York, First Edition, 1960, pp 25-4, 25-5

0764
FATIGUE STRENGTH TESTS ON RAILS
Yamanaka, Y., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 5, No. 2, June 1964, pp 44-50

Data from fatigue strength tests and qualitative studies on rails using Ono's rotating-bending fatigue testing machine performed on Japanese National Railroads in connection with adopting 0.5, 1.0, 1.5 or 2.0 km long rails are summarized.

0765
PRINCIPLES OF PAVEMENT DESIGN
Yoder, E. J., John Wiley & Sons, Inc., New York, 1959

This book is concentrated on the design of pavement for highways and airports; however, the sections on subgrades and soil stabilization are of interest to rail track design.

0766
THEORY OF DERAILMENT OF WHEELSET
Yokose, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 7, No. 3, Sept. 1966, pp 30-34

Certain assumptions are made concerning creep coefficients of flange surface and wheel tread, and relation between static frictional coefficient at contact point and attack angle, between vertical load and eccentricity of wheel in lateral direction, and between slip ratio and tangential force, led to derivation of formula to determine the value of allowable limit of derailment quotient of the wheel being acted by stationary side thrust, for securing running stability of high speed railway vehicles. Experiments using 1 to 10 and 1 to 5 scale model wheel set were made to prove the theory. Results of theoretical studies and tests are summarized.

0767
TEST INSTALLATION OF HIGH-SILICON, HIGH-SILICON-VANADIUM AND HIGH-SILICON-VANADIUM-CHROMIUM STEEL RAILS, SECTION 1360, SOUTHERN PACIFIC COMPANY
Zadra, J. R., American Railway Engineering Association--Proceedings, Vol. 65, 1964, pp 534-536

Test rails were compared with new Hi-Si rails laid at same time in same curves. Comparison is for flange wear, head metal flow, and gage corner shelling. Curve lubricators are used, and heavy sanding is applied as indicated by grade and pull. Details of inspection made on curves 19, 33, 59, and 109 are presented.

0768
VIADUCTS TO CARRY RAILROAD TRACKS MOUNTED ON PADS IN CONCRETE DECK
Engineering News-Record, Vol. 187, No. 13, Sept. 23, 1971, p 20

Techniques employed by New York State for replacing 11 Long Island Railroad grade crossings with viaducts that have ballastless, tieless tracks on prestressed concrete I-beams spanning up to 104 ft are presented. The all-concrete design is expected to reduce maintenance costs. The three viaduct sections each have a pair of single-track structures. An elevated platform runs between the tracks at stations.

0769
DEVELOPING THE ADVANCED PROJECTS LABORATORY
Woodyard, D., Engineering, Vol. 210, Oct. 30, 1970, p 444

0770
NEW STANDARD FOR N RAILS
Takahara, K., Permanent Way Society of Japan, Vol. 9, No. 3, 1966, pp 1-18

Report introduces Standards established by Japanese National Railways and purpose of revision of those standards for new 40 N and 50 N type rails. Highlights of the revision are adoption of pure oxygen converter change in chemical composition, and addition of inspection by means of sulfur print test. Scope classification materials, manufacturing process, section and dimension of rail, and items of quality are discussed. The test, inspection, and markings are given.

0771
AIR VALVES SENSE POSITION FOR HYDRAULIC CROSSTIE INJECTOR
Ramm, E. C., Hydraulics & Pneumatics, Vol. 21, Sept. 1968, pp 102-103

0772
TRANSPORTATION NOISE SOURCES
Potter, R. C., Audio Engineering Society Journal, Vol. 18, Apr. 1970, pp 119-127

0773
CITY TO CITY BY 100 MPH TRAINS
Nock, O. S., Engineering, Vol. 210, Sept. 25, 1970, pp 311-312

0774
FASTER TRAINS; ENGINES AND TRACK
Nock, O. S., Engineering, Vol. 209, June 5, 1970, pp 568-570

0775
OVERLOADS ON JAPANS 130 MPH RAILROAD STRUCTURES
Nishiki, T., and Shiraishi, S., American Society of Chemical Engineers Proceedings, Vol. 96, ST 6, No. 7325, June 1970, pp 1017-1023

0776
ISOLATION OF RAILROAD/SUBWAY NOISE AND VIBRATION
Miller, L. N., Progress in Architecture, Vol. 46, Apr. 1965, pp 203-208

0777
TRANSPORTATION NOISE PROBLEMS
Krigman, A., Instrument & Control Systems, Vol. 45, May 1972, pp 112-113

0778
NEW AND NOVEL PASSENGER TRANSPORTATION SYSTEMS: A LIST OF SELECTED REFERENCES
Klieber, M. C., and Vance, L. L., Institute of Transportation and Traffic Engineering, University of California, Berkeley, Apr. 1971

0779
MASS TRANSPORTATION FOR 1967 WORLD EXHIBITION
Heffernan, J. J., ASCE Proceedings, Journal of Urban Planning and Development Division, Vol. 93, No. UP 4, Paper 5638, Dec. 1967, pp 97-117

0780
MASS TRANSIT
Dickey, J. W., Council of Planning Librarians, Sept. 1969, 96 p

0781
DYNAMIC ANALYSIS OF A HIGH-SPEED TRACK
Crandall, S. H., AFMDC-TR-59-8, Apr. 1959, pp 55-78

0782
RAPID TRANSIT SYSTEM ENVIRONMENT
Bratkowski, W. V., Journal of Environmental Science, Vol. 10, Apr. 1967, pp 20-27

0783
STRUCTURES FOR HIGH SPEED
Bramall, B., High Speed Ground Transportation Journal, Vol. 4, No. 2, May 1970, pp 273-282

0784
RAISING TRACK STANDARDS TO CATER FOR HIGH SPEEDS
Beatty, W. F., Railway Gazette, Vol. 126, No. 6, Mar. 20, 1970, pp 225-228

0785
HIGH-SPEED INTERURBAN TRANSPORTATION SYSTEMS
Beckman, S., and Chilton, E. C., Mechanical Engineering, Vol. 92, Dec. 1970, pp 30-34

0786
ATTENUATION OF NOISE AND GROUND VIBRATIONS FROM RAILWAYS
Grottenhuis, P., Environmental and Human Factors in Engineering, Technical Meeting, Apr. 10-14, 1967, University Southampton, England, 1967, pp 57-74

Methods and attenuating noise and ground vibrations are discussed in general. Specific description is given of tracks mounted on suspended deck running into Moorgate Station in London. Figures show cross and longitudinal sections of tracks. Method for damping deck is described in detail, including design and materials. Results are given of tests for damping by sandwich layer, for vibration buildup at center of span, and for attenuation of structure-borne vibrations when diesel trains run over track.

0787
RAILWAY TRACK STABILITY IN RELATION TO TRANSVERSE STRESSES EXERTED BY ROLLING STOCK. A THEORETICAL STUDY OF TRACK BEHAVIOR
Amans, F., and Sauvage, R., International Railway Congress Association--Monthly Bulletin, Vol. 46, No. 11, Nov. 1969, pp 685-716

0788
EFFECT OF WHEEL UNBALANCE, ECCENTRICITY, TREAD CONTOUR AND TRACK GAGE ON RIDING QUALITY OF RAILWAY PASSENGER CARS
AAR Central Research Laboratory, AAR Operations & Maintenance Department, (M.E. Division), Chicago, Illinois, First Progress Rpt. by Joint Committee on Relation Between Track & Equipment, Apr. 1950

0789
JAPANESE NATIONAL RAILWAYS
Railway Technical Research Institute--Quarterly Report, Vol. 7, No. 3, Sept. 1966, Available: NTIS, PB 173548

0790
COPTER HELPS LAY A RAILROAD TRACK
Electrical World, Vol. 177, Feb. 1, 1972, p 58

0791
IMPROVING STEEL WHEEL ON STEEL RAIL ADHESION
Engineering, Vol. 205, Jan. 12, 1968, p 61

0792
TRACK PANELS YIELD INSTANT RAIL LINE
Construction Methods, Vol. 54, Feb. 1972, pp 86-87

0793
PRESTRESSED CONCRETE RAILROAD TIES
Mechanical Engineering, Vol. 85, Dec. 1963, p 53

0794
SMOOTH SAILING OVER RAIL CROSSINGS
Modern Concrete, Vol. 34, No. 10, Feb. 1971, pp 32-33, 36

0795
PLASTIC COMPOUND
Iron & Steel Engineering, Vol. 40, Apr. 1963, p 263

0796
PASSENGER RIDE COMFORT ON CURVED TRACK
AREA, American Railway Engineering Association Bulletin 516

Tests were carried out to obtain data for making recommendations for the permissible speed on curves and the length of transition curves for passenger comfort, and for establishing clearance requirements on curved track. The first test was run on the Louisville and Nashville, May 10, 1950, using the Chesapeake and Ohio track inspection car and making use of 20 observers. Results of this test indicated the importance of the roll of the car body in reducing the effective elevation of the track insofar as passenger comfort was concerned. A second test on the Kansas City Southern developed gyroscope and recorder techniques to show the angle of the car body from the vertical. From the results of these tests it was possible to establish a very satisfactory relationship between passenger reaction and the amount of lateral acceleration so that in subsequent tests it was not necessary to use passenger observers. To obtain data on the various types of modern passenger cars being used, running tests were subsequently made on 7 railroads. The tests have indicated that for types of modern equipment having soft springs and no provision for restricting the roll of the car body on curves the present AREA limitation of 3-in unbalance should be continued. For cars having stiffer springs, outside swing hangers (and springs) or roll stabilizers reducing the amount of roll with unbalanced elevation, the tests have shown that a permissible unbalance on curves of over 4 in can be tolerated by the more favorable types of equipment. A new and different procedure is recommended for determining the length of transition curves, based on the rate of change of lateral acceleration entering and leaving the curve rather than on the rate of change of elevation. With respect to clearance the test data gives displacement characteristics due to roll of the car body on the springs of the various types

of passenger cars. The records indicated that an allowance of plus or minus 1 deg in car body roll will provide for irregularities in line and surface for representative main-line track for speeds up to 90 mph.

0797
TOMORROW'S TRAIN DESIGNED FOR TODAY'S TRACK
Railway Track & Structures, Vol. 65, No. 10, Oct. 1969, pp 26-27

0798
MECHANISED TRACK MAINTENANCE
Railway Gazette, Vol. 121, No. 2, Jan. 15, 1965, pp 66-67

The mechanical means of ballast cleaning, ballast tamping and consolidation, and automatic track realignment are discussed. Features of Plasser & Theurer high-speed ballast cleaning machine, RM62, Plassermatic leveling and tamping machine, and Plasser & Theurer model AL203 automatic track lining and consolidating machine are given.

0799
SANTA FE TEST TRACK. WHAT IT WILL LOOK LIKE AND WHY
Railway Age, Vol. 169, No. 6, Sept. 28, 1970, pp 42-44

0800
A STATUS REPORT ON WHEEL SPALLING
Walsh, R. F., Massachusetts Bay Transportation Authority, Apr. 1967

0801
EXPLORATORY SOIL BORINGS AT TWO LOCATIONS FOR THE U. S. DEPARTMENT OF TRANSPORTATION. DESIGN STUDIES
Eidt, J. T., Marks, B. D., and Stewart, J. F., Hemphill Corp., Tulsa, Okla., FRA-RT-72-13, Final Rpt., Aug. 1971, 75 p, Available: NTIS PB 202271

Exploratory borings and soil classification studies are reported on for two locations; southeast Kansas and northeast New Mexico. The objective of the work was the revelation of sufficient sub-soil information to enable a decision on the part of the sponsoring agency as to where to most appropriately install a railroad test track. Duplication of physical conditions most representative of present railroad track support conditions and economics of construction were important considerations.

0802
FATIGUE CRACK GROWTH AND SUDDEN FAST FRACTURE IN A RAIL STEEL
Evans, P.R.V., et al., Iron & Steel Institute Journal, Vol. 208, June 1970, pp 560-567

0803
WHEEL-RAIL ADHESION
Marta, H. A., and Mels, K. D., Journal of Engineering for Industry, Vol. 91, Aug. 1969, pp 839-846, Discussion, pp 846-854

0804
CAUSE OF WHITE ETCHING MATERIAL OUTLINING SHELL-TYPE CRACKS IN RAIL-HEADS
Henry, R. J., Journal of Basic Engineering, Vol. 91, Sept. 1969, pp 549-551

0805
FACTORS INFLUENCING SURFACE DEFECTS ON RAILS PRODUCED BY THE ACID BESSEMER PROCESS
Morgan, E. L., Iron & Steel Institute Journal, Vol. 206, Jan. 1968, pp 39-46

0806
CONCRETE TIES CAN BE INTERSPERSED
Railway Age, Vol. 169, No. 3, Aug. 10, 1970, pp 36-37

0807
EXTRUDED RAIL GUIDES, HELPS PROPEL NEW TRANSIT TRAIN
Modern Metals, Vol. 27, Oct. 1971, p 38

0808
MILE-LONG WELDED RAILS ARE BOOSTING EFFICIENCIES AT HOMESTAKE'S MINE
Engineering and Mining Journal, Vol. 169, Sept. 1968, p 155

0809
BROKEN RAILS
Engineering, Vol. 201, May 6, 1966, p 851

0810
RAILWAY TRACK AFTER HITHER GREEN TRAIN ACCIDENT
Engineering, Vol. 206, Sept. 20, 1968, pp 417-418

0811
RAIL BREAKAGE EXTRAORDINARY
Engineering, Vol. 205, Mar. 29, 1968, p 468

0812
MENANCE OF BROKEN RAILS
Engineering, Vol. 204, Nov. 1967, pp 781-782

0813
CONTROLLING SLIP OF WHEEL ON RAIL
Engineering, Vol. 202, Dec. 2, 1966, p 979

0814
FISHPLATES, FANCIES AND FAILURES
Engineering, Vol. 204, Dec. 8, 1967, p 910

0815
THE TEST ON BUCKLING OF CURVED TRACK
Permanent Way, Permanent Way Society of Japan, No. 1, pp 1-15

Utilization of a rail of long length for railway business is a necessary requirement. Application of long rail track differs from that of short rail in the following points. (a) The danger due to its buckling and breaking caused by the internal stress accumulation as the result of its temperature change. (b) The increase of elongation and contraction at the rail joint. In case of buckling of the rail, radius of rail curve attains several meters, and not only suspension and running train,

but also restoration procedure by rail bender becomes inevitable. Resistances of ballast bed and pile against creeping of rail increase with displacement of rail in some degree, the entire rail was heated to such a temperature that any buckling does not occur and consequently sleepers were preliminarily shifted by some amount. Lateral displacement and lifting of rail were very slow until they have reached to a few millimeters but after that they began to increase rapidly with subsequent buckling. It was experienced that, just before buckling, creaking sound of ballast was heard. Very complex movement had been experienced during original curve was transformed to buckling one. For example, some point in a rail seems to move, at the first stage, to swelling direction and then moves to reverse direction, or vise versa.

0816
A SYSTEMS APPROACH APPLIED TO PAVEMENT DESIGN AND RESEARCH
Hudson, W. R., McCullough, B. F., Scrivener, F. H., and Brown, J. L., Texas Highway Department, Texas Transportation Institute, Texas A & M University, and Center for Highway Research, The University of Texas at Austin, Research Rpt 123-1, Mar. 1970

0817
SYSTEMS APPROACH TO PAVEMENT DESIGN, SYSTEM FORMULATION, PERFORMANCE DEFINITION, AND MATERIAL CHARACTERIZATION
Hudson, W. R., Finn, F. N., McCullough, B. F., Nair, K., and Vallerga, B. A., National Cooperative Highway Research Program, Highway Research Board, National Academy of Sciences - National Research Council, Interim Rpt. Project 1-10, Mar. 1968

0818
DISCONTINUOUS ORTHOTROPIC PLATES AND PAVEMENT SLABS
Hudson, W. R., and Matlock, H., Center for Highway Research, The University of Texas, Austin, Research Rpt. 56-6, May 1966

0819
PAVEMENT RECOMMENDATIONS FOR THE DALLAS/FORT WORTH REGIONAL AIRPORT
Hudson, W. R., McCullough, B. F., and Treybig, H. J., Austin Research Engineers, Inc., to Forrest and Cotton-Carter and Burgess, Rpt. FC-1/4, Sept. 1971

0820
ELECTRONICS TO TEST HIGH-SPEED TRAIN TRACKS
Electro-Tech., Vol. 82, Dec. 1968, p 17

0821
RAIL FLAW DETECTOR REALLY MOBILE NOW
Welding Engineer, Vol. 49, June 1964, p 52

0822
MECHANICAL AIDS TO PERMANENT WAY ENGINEERING
Conrad, D.A.S., Institute of Mechanical Engineering Proceedings, Vol. 177, No. 23, 1963, pp 617-628, Discussion pp 629-637, Reply pp 637-638 13

0823
DEVELOPMENT AND USE OF A TRACK QUALITY INDEX
Crane, L. S., et. al., Journal of Engineering for Industry, Vol. 91, Aug. 19. 1969. pp 801-807, Discussion pp 867-868

0824
LASER SYSTEM MONITORS HIGH-SPEED TRAIN TRACKS
Electro-Tech, Vol. 83, June 1969, p 42

0825
ARC JET SPEEDS TRAIN STARTS/STOPS
Electro-Tech, Vol. 84, Oct. 1969, pp 40-41

0826
WHAT KIND OF RAILWAY TRACK?
Livesey, R., Engineering, Vol. 208, July 11, 1969, pp 29-30

0827
TRACK-LAYING EQUIPMENT MAKES GOOD TIME AGAINST TOUGH SPECS
Drossel, M. R., Construction Methods, Vol. 51, Oct. 1969, pp 54-59

0828
STABILITY OF TRACKS LAID WITH LONG WELDED RAILS
Prud'Homme, M. A., and Janin, M. G., International Railway Congress Association--Monthly Bulletin, Vol. 46, No. 7-8, July-Aug. 1969, pp 459-487, Oct. 1969, pp 601-620

0829
FROM EXPERIENCE GAINED FROM NEW TOKAIDO LINE TO RAILROAD OF THE FUTURE
Sonneville, R., Genie Civ, Vol. 147, No. 2, Feb. 1970, pp 70-82

0830
COST METHODOLOGY AND COST MODELS FOR HIGH SPEED GROUND TRANSPORT-PART IV
Massachusetts Institute of Technology, Cambridge, Mass., Contract C-85-65, Sept. 1964

0831
PERFORMANCE RESULTS OF HIGH SPEED RUNNING INVESTIGATIONS CARRIED OUT ON GERMAN FEDERAL RAILWAYS
Nefzger, A., Glasers Annalen, Vol. 93, No. 11, Nov. 1969, pp 337-346

0832
FEC'S NEW MAIN-TRACK DESIGN - CONCRETE TIES, WELDED RAIL
Railway Track & Structures, Vol. 62, No. 7, July 1966, pp 25-27, 29, 33-34

0833
WHAT'S DIFFERENT ABOUT EUROPEAN TRAINS
Lewis, R. G., Railway Age, Vol. 161, No. 16, Oct. 24, 1966, pp 24-26, 32

This report about railroad transportation in Switzerland, Italy, France, Holland and Germany is in the form of questions and answers. Passenger transportation use of passenger car-sleeper service, and comparison of European rates and fares are discussed. European trains ride better than United States trains due to improved track structure.

0834
PENNSY GETS ITS TRACKS READY FOR HIGH-SPEED TRAINS
Railway Age, Vol. 161, No. 6, Aug. 8-15, 1966, pp 26-28

Placing a 1400-ft welded track lengths is discussed. All rails are surface ground. Addition of ballast was made. Four bridges were replaced. Catenary items were strengthened due to higher speeds. Grade crossings require extension of track circuits.

0835
CHARACTERISTICS OF CORRECTING METHODS OF TRACK IRREGULARITIES--REALIGNMENT OF TRACK CURVES BY VERSINE METHODS
Suzuki, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 8, No. 1, Mar. 1967, pp 38-39

Two methods are examined for realignment of track curves with constant radii, to determine how they reduce degree of malalignment of track, depending on wavelength of malalignment. Basic relation of versine method on curved track is discussed.

0836
HOW HIGH CAN TRAIN SPEED BE INCREASED
Matsudaira, T., International Railway Congress Association--Monthly Bulletin, Vol. 44, No. 1, Jan. 1967, pp 93-99

Problems associated with obstacles preventing speed-up, and measures to overcome them are given. Obstacle by wave formation, limit due to adhesion, vibrational disturbance, and problems relating to curve track are discussed.

0837
TERMITE CONTROL INVESTIGATION--INSPECTION OF SPECIMENS AFTER 100 MONTHS OF EXPOSURE
American Railway Engineering Association--Bulletin, No. 601, Sept.-Oct. 1966, pp 13-35

A progress report of 15-year investigation to determine most effective wood preservative, with minimum retention, for treating oak, pine or fir species to reduce decay and termite attack. Results of 2000 treated and untreated specimens, in exposure test plot of University of Florida, showed among other things that chromated zinc chloride and tanalith afford less protection against decay and termite attack than other preservatives. Fir specimens treated with most of preservatives are subject to less decay and termite attack than oak and pine.

0838
LA RESISTANCE DE LA VOIE AUX EFFORTS TRANS-VERSAUX EXERCES PAR LE MATERIEL ROULANT
Prud'homme, A., Rev Gen des Chemins de Fer, Vol. 86, Jan. 1967, pp 1-23, In French

Resistance of track to transverse forces exerted by rolling stock and results of theoretical analysis made on track of different types are given. Results are applied to determine running conditions of vehicles.

0839
PRICINY VZNIKU VLOCEK V KOLEJNICICH
Vondrasek, F, and Duchon, J., Hutnicke Listy, Vol. 21, No. 12, Dec. 1966, pp 852-858, In Czech.

Cause of flakes in rails of open hearth steel is explained by combined effects of hydrogen and internal stresses. Method of manufacture to avoid defect is described in detail. This includes steel composition, possible vacuum treatment of melt, precautions in handling ingots, ingot treatment, and rail treatment.

0840
LE RAIL DEVANT LES EXIGENCES D'UN RESEAU MODERNE
Feybrabend, Rev Gen des Chemins de Fer, Vol. 83, Sept. 1964, pp 469-477, 525

Standards are given of rails required on modern railroad. Properties required of metal for rails including resistance to wear and to crushing, high resilience and aptitude to welding are studied. It is shown that high quality Thomas steel meets these requirements. Research is continuing to develop properties required for special operating conditions and to select ordinary quality rails for lines carrying heaviest traffic.

0841
PROTECTION OF RAIL JOINTS FROM CORROSION TO PREVENT RAIL END BREAKS
Kose, Y., Permanent Way Society of Japan, Vol. 6, No. 3, Sept. 1963, pp 1-13

Effect of corrosion on rail end breaks is studied and anticorrosion tests of rail joints conducted systematically on Japanese National Railroads are described. Practical protection methods for prevention of end breaks are given.

0842
NEW FLAME PROCESS PRODUCES HARD-CASE RAIL
Railway Track & Structures, Vol. 60, No. 7, July 1964, pp 24-25

Method developed by Linde Division, Union Carbide Corp., gives ball of rail hardened case with Brinell of about 375. Three plants for producing hardened rails by process were constructed at strategic points in vicinity of existing rail-rolling mills. A new process is reported to produce hardened case from 3/8 to 5/8 in. in thickness in ball of rail.

0843
VOSPROIZVEDENIE USTALOSTNYKH POPERECHNYKH ZLOMOV REL'SOV V LABORATORNYKH USLOVIYAKH
Kislik, V. A., and Karmazin, A. I., Zavodskaya Laboratoriya, Vol. 31, No. 3, 1965, pp 354-356,

Reproduction of transverse fatigue failures of rails under laboratory conditions is discussed. Transverse fatigue failures of rails were obtained under laboratory conditions on rail steel specimens mounted in special holder imitating rail-tie square with eight supports. Tests were carried out with alternate reversing stresses on four-roller machine.

0844
SOUTHERN RAILWAY SYSTEM'S USE OF SLIDING JOINTS
Beaver, J. F., American Railway Engineering Association--Proceedings, Vol. 65, 1964, pp 632-635

Effect of anchorage of rail on open and ballast bridge decks is considered. Temperature effects in rail, and transfer through ties and ballast, or through ties and tie fastenings to supporting structure are discussed and approach suggested to consider effect on supporting structure. Layout of welded rail on bridges on Southern Railway System is shown.

0845
RAIL FAILURES ON BRITISH RAILWAYS
Dearden, J., Railway Gazette, Vol. 121, No. 4, Feb. 19, 1965, pp 148-150

Methods of reporting, analysis and prevention of rail failures are described. Data on distribution of failures according to type and cause, and of longitudinal failures in plain rails are listed.

0846
DURABILITY OF ELASTIC RAIL FASTENING DEVICES
Satoh, Y., and Otsuki, T., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 5, No. 4, Dec. 1964, pp 31-35

Distribution characteristic of lateral force under rolling stock is analyzed. Investigation of design conditions of elastic rail fastening devices shows that load repetition numbers of normal load and extreme load taken as design loads are to be set at 10^6 and 10^5 respectively. Model of elastic rail fastening device, named A-ton (extreme load) fastening device, is proposed.

0847
DESIGN OF NEW TIE-PLATES
Onishi, A., and Ichikawa, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 5, No. 4, Dec. 1964, pp 38-43

Summary of results of theoretical calculations, performance tests, lateral pressure tests by lateral pressure testing car, fatigue tests, etc., on rail fastenings which are designed for wooden-block embedded in concrete-bed and for long rails laid on bridges is given. Description of features of rail fastenings is shown.

0848
RAIL FAILURES--SOME OF CAUSES
Dearden, J., Railway Gazette, Vol. 121, No. 5, Mar. 5, 1965, pp 195-197

Influence of composition, bolt holes, welded joints and rail section on failures is described. Some of less frequent modes of failure are illustrated. Detection of failures is discussed.

0849
DIE STABILISIERUNG VON DAMMRUTSCHUNGEN DURCH ZEMENTMOERTELINJEKTIONEN
Wagner, O., Tiefbau, Vol. 6, No. 10, Oct. 1964, pp 805-810

Stabilization of embankment slide by concrete mortar injection is discussed. Methods applied on British and French railroads are outlined and experiences of German practice discussed.

0850
GRADING AND ROCK PROBLEMS ENCOUNTERED DURING MAJOR RAILWAY RELOCATION
Stane, R. A., National Research Council--Highway Research Board--Research News, No. 13, June 1964, pp 71-75

Forty-four mile double-track mainline relocation through northern Arizona's volcanic clays, cinders, "solid" basalts, cross-bedded Coconino sandstones, and badly jointed Kaibab limestones under pressure was made in cuts of 13,000 ft having depths of 115 ft. Roadbed embankments, some more than 100 ft in height, were successfully made of plastic common and granular common materials, and excavated rock, without benefit of compaction water.

0851
SOIL MECHANICS APPLIED TO RAILWAY EARTHWORKS
Rauch, H. P., South African Institute of Civil Engineers--Diamond Jubilee Convention--Proceedings, 1963, pp 155-161

Quantity of pressures applied to formation by track loading and types of formation failure occurring are discussed. Blanketing principle for constructing stable formation is outlined and required thickness of blanketing layer considered. Procedures for constructing new railroad formations in areas of forming, in cuttings and on banks, are described. Particular reference is made to adverse effect of excessive moisture content on formation soils.

0852
TRACK STRUCTURE FOR STEEP SLOPE SECTION ON SHINETSU MAIN LINE (REPORT 2)
Ohnishi, A., and Nagata, M., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 5, No. 2, June 1964, pp 34-37

Study of track structure to cope with creep of track, naturally expected in slope section with gradient of 66.7 is discussed. It resulted from observations that system of concrete cross-ties was suitable for general section, while use of fastening device with wood block having initial fastening force of more than 0.6 of longitudinal force of rail was suitable for long tunnel section.

0853
CONSOLIDATION DU REMBLAI DE WIMEREUX
Trede, C., and Alias, J., Rev Gen des Chemins de Fer, Vol. 84, Jan. 1965, pp 24-30, 66

Stabilization of embankment of Wimereux (Paris-Calais Line) is shown. Reinforcement was made by injection of cement mortar. Work, carried out in two phases, provided for injection of more than 3000 cu m of mortar made up of three parts of fine sand, one part of portland cement, one part of water and small quantity of air primer.

0854
METHOD OF ISOLATED CONSOLIDATION BY SHEET PILING FOR PARTIALLY SUPERPOSED RAILWAY EMBANKMENT
Muromachi, T.,. Komine, T., and Yasuda, Y., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 1, Mar. 1965, pp 27-30

Construction of railway embankment of adjacent to newly constructed one in case of double tracking is discussed. The former will be subjected to consolidation settlement and lateral displacement, both having serious influence on track irregularities owing to load distributed from new embankment, especially on soft layer. The application of method of isolated consolidation designed to eliminate these disadvantages is described.

0855
STUDIO STATICO DI ARMAMENTI ELASTICIZZATI COSTITUITI DA DIVERSI ELEMENTI IN PARALLELO
Macchi, G., Ingegneria Ferroviaria, Vol. 19, No. 11, Nov. 1964, pp 895-901

Static study of resilient permanent way formed of different elements in parallel is discussed. The experimental system carried out on Italian metropolitan type railroads to study static problem of track made resilient with respect to longitudinal ties, latter also isolated from fixed support by means of second resilient intermediary, is described. Equations for deformation and bending moments of rail and ties are described.

0856
SPATKRACHT IN VOEGLOOS SPOOR VOLGENS NIET GELINEAIRISEERDE BEREKENING
Bijl, F., Ingenieur, Vol. 76, No. 39, Sept. 25, 1964, pp V119-123

Buckling force in continuous track calculated by nonlinear method is shown. Lateral resistance of tie in ballast and resistance against torsional movements of rail to tie are considered in their nonlinear form. Results of computer method show critical wavelength that is shorter than that obtained by other theoretical methods.

0857
DER VERKEHRSLAERM UND SEINE BEKAEMPFUNG
Zboralski, D., Glasers Annalen, Vol. 88, No. 10, Oct. 1964, pp 341-347

Combating traffic noise, and problems associated with reducing noise of transport confined to permanent way are discussed. The necessity of uniform system of measurement and binding noise limit on international level is emphasized.

0858
ZUR FRAGE DER EINWIRKUNG VON LAENGSKRAEFTEN AUF DAS LUECKENLOSE GLEIS UND DIE GLEISBETTUNG
Siekmeier, E., Glasers Annalen, Vol. 88, No. 8, 9, 10, Aug. 1964, pp 278-284, Sept., pp 328-337, Oct., pp 361-368, (see also International Railway Congress Association--Monthly Bulletin, Vol. 42, No. 7, July 1965, pp 446-489

Effect of longitudinal forces on long section rails and rail beddings and characteristics of track ballast under influence of longitudinal forces or longitudinal tensions in track without interruption, are discussed. Values for line resistance are obtained from theoretic considerations and experiments. Results of investigations made by other authors are discussed. Measurements of rail tensions appearing in through lines are dealt with.

0859
PREFAB TRACKS SPEED CONSTRUCTION OF SWAZILAND RAILWAY
Warden, W., World Construction, Vol. 18, No. 9, Sept. 1965, pp 68, 70, 74, 76, 91

Technique involves mobile jig platform which permits assembling of track in 240 ft lengths at railhead. The jig accurately clamps rails at correct gage above sole plates and sleepers which are positioned in channels slots on mobile platform. Supply gantry, operation sequence, mechanized ballasting, tracing of route with tunnels and bridges through difficult terrain in detail, savings with nestable type Armco culverts of 60-in. ID are given. Foolproof operation, despite unskilled labor, was aided by electronic centralized traffic control signaling.

0860
MAIN LINE GETS WELDED RAIL ON CONCRETE TIES
Railway Age, Vol. 160, No. 23, June 13, 1966, pp 16-18

Program to rebuild segments of track to new standards adopted by Florida East Coast for construction of track using long strings of welded rail laid on prestressed concrete ties is discussed. Parts of the main line are being converted to single track. Concrete ties are shipped on flat cars on which they are spaced at 15 in. centers. Special tie picker is used for unloading ties and placing them on roadbed. This device picks up eight ties at a time, selecting every other one, and sets them down at 30-in. centers.

0861
NYC LEARNS TRACK CONDITIONS--FAST
Railway Age, Vol. 160, No. 14, Apr. 11, 1966, pp 21-22

A cross-level measurement system developed by New York Central to help solve the problem of programming track surfacing is discussed. The system, which is designed to count and furnish printed read-outs by miles, is mounted on business car. A recorder console also was installed in the car's dining room. When the switch is turned on the instrument shows cross-level variations as they occur by three light indicators, one for each of levels selected. It also has a meter dial for registering magnitude of variations in cross level. Uneven cross level of track, which causes poor riding, is measured by transducers, using car body as reference.

0862
TESTS WITH ASPHALT-TREATED BALLAST ON SOBU LINE
Satoh, Y., and Hirata, G., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 4, Dec. 1965, pp 19-21

Experiments carried out on test track sections at Tsudanuma Experiment Station, Japan, with asphalt-treated ballast are discussed. Manufacture and execution of asphalt-treated ballast and results of subsequent inspection are outlined.

0863
SOIL PROBLEMS IN RAILWAY TRANSPORTATION ENGINEERING
Ireland, H. O., AREA Bulletin, No. 594, Sept.-Oct. 1965, pp 7-19

Soil problems are discussed encountered in cut and fill of line changes, in daylighting of tunnels, in performance of track, in foundations of structures, and in soil-structure interaction problems such as retaining walls, bulkheads and culverts. The paper deals with some of the soil problems that may not be widely recognized. New ways are presented of dealing with old problems, and some of the more unusual problems are touched upon. Geometry of cut slopes, construction of filter blanket and relationship between water content and dry density are discussed.

0864
STUDY OF LARGE COMPACTED CLAY EMBANKMENT-FILL FAILURE
Insley, A. E., Canadian Geotechnical Journal, Vol. 2, No. 3., Aug. 1965, pp 274-296

Failure occurred during construction of proposed 70 ft high railway embankment fill. The fill was uniform clay of medium plasticity which was used at average moisture content of 3% greater than had been provided for in design. Three test holes were drilled in fill and soil samples were recovered. Properties of field compacted and laboratory compacted soil samples are compared. Age of both types of samples has significant effect on test results.

0865
CHICAGO GETTING TWO MORE MEDIAN-STRIP TRANSIT LINES
Railway Age, Vol. 163, No. 21, Dec. 4, 1967, pp 28, 30, 45

Chicago Transit Authority experience with 9-yr-old Congress Street line vindicates concept of highway median-strip transit lanes. Traffic corridor containing both roads and transit is highly efficient land use that saves cutting up real estate unnecessarily. Track will be ballasted, and both wooden and concrete crossties will be bid. Cab signals based on AF circuits with four aspects and providing for overspeed control will be installed. Structures will be ballasted concrete deck, with steel stringers and concrete bents. Power will be 600-v d-c, with remote control automatic substations and silicon rectifiers.

0866
STUDIES TOWARD NEW BALLASTLESS TRACK STRUCTURES
Satoh, Y., and Higuchi, Y., Proceedings of the Japan Society of Civil Engineers, No. 184, Dec. 1970, pp 91-104, In Japanese

0867
TENTATIVE STUDY OF STRESSES IN A RAIL BY PHOTO-ELASTIC AND STRAIN MEASUREMENTS
Rail International, Vol. 1, No. 6, June 1970, pp 438-439

ORE Reports C 53/RP2 and RP 5 are part of a wide study concerning the behavior of the metal in rails and wheels at the contact zone, which depends largely on the magnitude and distribution of the stresses in the vicinity of the contact surface. The two reports discussed in the present article deal in detail with the photo-elastic study supplemented by a brief study of strains measured in both a simplified steel rail and a real rail.

0868
STRUCTURAL DESIGN OF BAY AREA RAPID TRANSIT SYSTEM
Kuesel, T. R., Civil Engineering, New York, Vol. 38, No. 4, Apr. 1968, pp 46-50

Unusual structural design problem in 22 mi of aerial structures was to avoid resonant vibrations by limiting girder dead load deflection. New earthquake design criteria were developed. Cut-and-cover construction and tunnel boring methods were used to construct subways, which are all in soft ground. The use of tunnel boring machines allowed progress rates of over 70 ft/day. 3.5 mi Trans-Bay Tube consists of 57 prefabricated steel and concrete sections. The tube is considered continuous, flexible pipe, floating in soft alluvial soils of Bay bottom, with sliding universal joint at each end where it joins relatively rigid subway tunnels embedded in firm soils on both shores.

0869
DIABLO TEST TRACK NOISE AND VIBRATION MEASUREMENTS
Wilson, Ihrig & Associates, Inc., Berkeley, Calif., Technical Rpt., 1967, 51 p

Results of sound and vibration level measurements taken at Test Track of San Francisco Bay Area Rapid Transit System are shown. Tests were conducted to compare performance of two modified versions of prototype rail fasteners with regard to wayside noise level and mechanical vibration isolation. Ground vibration level beneath and to the side of aerial structure was measured. The measurements intended to show relative contributions of wheel-rail system and propulsion system to wayside noise and to show effect of different types of roadbed on noise.

0870
PROPERTIES OF ISOTHERMALLY QUENCHED CARBON AND ALLOY STEEL RAILS
Kazarnovskii, D. S., Pridantsev, M. V., Babich, A. P., Gurenko, V. D., Biryukova, V. N., and

Aref'ev, B. V., Stahl, No. 5, May 1970, pp 465-468

In laboratory and production-scale trials, rails were subjected to austenitizing temperature 850 to 900 C (holding for 1 1/2 hr), cooling for 35 to 40 min in a molten bath of 50% KNO_3 and 50% $NaNO_3$ with a water addition of 9.68% to increase cooling efficiency. The temperature of the molten bath varied between 280 and 320 C according to the chemical composition of the steel. The rails are rinsed in hot water (50 C) after quenching. Properties were investigated on sections from carbon, silicon, chromium and Cr-Si-Mn steel rails. The isothermally quenched rails had a high tensile (130 to 160 kg/sq mm) and fatigue strength (53 to 68 kg/sq mm) and, with optimum structure, showed good resistance to brittle failure. Ductile and impact properties were satisfactory and a more favourable pattern of internal residual stresses was obtained.

0871
BALLAST CONSOLIDATION AND DISTRIBUTION ON THE TRACK
Railway Gazette, Vol. 125, No. 17, Sept. 5, 1969, pp 670-671

Two machines were introduced by Robel & Co., in Great Britain to complement the range of track maintenance equipment available. Features of 60.21 hydraulic ballast plow, designed to work in conjunction with a 32-tool ballast tamper, and of track stabilizing machine 63.11, for compacting the track formation after final alignment and tamping are described.

0872
PROTECTIVE METHOD OF EMBANKMENT SLOPE WITH CHEMICAL MATERIALS. THE TILE-ROOFING KAWARAZUMI METHOD
Kurosawa, A., and Kobashi, S., Railway Technical Research Institute--Quarterly Report, Vol. 11, No. 2, June 1970, pp 74-77

The report describes the effect of a tile-roofing method of protection of the embankment slope examined by using a testing apparatus for artificial rainwater. It is reported that method is effective for prevention of slope rupture.

0873
ULTRASONIC 'EYES' ABOARD BRITISH TESTING TRAIN LOCATE RAIL DEFECTS
Materials Evaluation, Vol. 39, No. 6, June 1971, pp 16A-18A

Ultrasonic "eyes" capable of detecting and recording hidden flaws in railroad tracks have been placed in use in Great Britain aboard a new rail testing train which travels as it works at speeds up to 25 mph. This paper reports the technique.

0874
COMPUTER SPOTS RAIL DEFECTS FAST
Railway Age, Vol. 169, No. 1, July 13, 1970, pp 32-33

Survey of applications of computer complex in the computerizing of rail-defect information developed by a fleet of rail detector cars and a variety of portable ultrasonic testing instruments. Monthly printout from Penn Central computer presented shows rail defects found by special cars and ultrasonic devices. Computers data are also shown to be useful in programming rail renewals.

0875
TRACKING DOWN JOINT-AREA RAIL DEFECTS
Railway Track & Structures, Vol. 66, No. 7, July 1970, pp 21-23

How by using hand-held testing devices Santa Fe is testing joint-bar areas with ultrasonic devices for detecting bolthole cracks and head-and-web separations. A mirror is used to reflect light into joint gap to reveal presence of defects. Stepped-up method of joint-area inspection has produced big increase in detected defects.

0876
STUDY OF HIGH SPEED RUNNING ON A CURVED TRACK
Nishio, A., Nishimura, S., Kikuchi, I., Shirane, Y., and Yamada, J., Sumitomo Search, No. 4, Nov. 1970, pp 106-114

High speed running on a curved track is the actual important problem to be solved for railroad vehicles in order to shorten the time required for transportation. In cooperation with Odakyu Electric Railway (OER), the authors have studied the pendulum car with air springs, the bearing type pendulum car and the automatic roll control with air, and also the reduction of the lateral force by the link mechanism.

0877
NOW, STEEL-TIE TRACK PANELS, MACHINE PRODUCED
Railway Track & Structures, Vol. 66, No. 5, May 1970, pp 14-17

The system is described that uses special wedge-type fastening and mechanized production line for making sections of track.

0878
SPECIAL REPORT ON HIGH-SPEED RAIL TRANSPORTATION
O'Sullivan, W. B., American Railway Engineering Association Bulletin, No. 629, Sept.-Oct. 1970, pp 9-71

Contemporary experience in the United States, France, Japan, Soviet Union, Great Britain and Canada is summarized. Domestic high-speed rail research is discussed together with potential future system costs.

0879
SOILS ENGINEERS AND TRACK-LAYING MACHINE BUILD SPUR LINE IN THE FAR NORTH
Burpee, C. M., Wood Preservation, Vol. 48, No. 6, June 1970, pp 8-9, 11, 14

Sixth miles of railroad built in marsh country use 194,000 pressure creosoted wood crossties and steel rails.

0880
NEW SANYO LINE
Matsubara, K., Permanent Way, Vol. 12, No. 1-2, 1970

A special issue outlining the plan, track layout and the track construction of the new Sanyo line, which is the extension of the new Tokaido line westward to Okayama. The adjustable ballastless track of the latest development which is scheduled to be put in partial use over the new line is discussed. The structural features of an adjustable ballastless track of the mat type, asphalt type, and the mat type for steel bridges. Examples of the adjustable ballastless track design are given.

0881
STABILISING HIGH EMBANKMENT
Railway Gazette, Vol. 122, No. 9, May 6, 1966, pp 368-369

Methods of reinforcement of retaining walls, cement grouting and use of steel-wire ties on Paris-Toulouse main line of French National Railways are described.

0882
MEASURED PORE PRESSURES USED FOR CONTROL OF TWO-STAGE CONSTRUCTION OF EMBANKMENT
DeLory, F. A., Gass, A. A., and Wong, W. W., Canadian Geotechnical Journal, Vol. 2, No. 3, Aug. 1965, pp 216-233

Because of soft foundation soil it was necessary to use two-stage construction for double-track railway embankment varying in height from 21 to 33 ft. Effective stress methods of analysis were used and piezometers were installed in foundation soil to indicate pore pressures. Pore pressures measured during first-stage loading indicated that second stage could be added to complete embankment about year after first stage.

0883
EMBANKMENT SLOPE TAMPING WITH WATER ADDED AS METHOD OF PREVENTING SHRINKAGE CRACK BY RAINFALL
Saito, M., Uezawa, H., and Imai, S., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 3, Sept. 1965, pp 24-27

Relation between volume change of compacted soil and moisture-density condition when compacted, was investigated. Results of experiments on relations of cohesion and angle of internal friction to moisture content at molding are given. The relation between expansion or contraction under equivalent rainfall of 30 mm/hr and dry densities with different moisture content at molding, and between dry density and moisture content at molding when specimen shows no shrinkage under rainfall are presented.

0884
CONSOLIDATION DU REMBLAI DE MALHERBE SITUE PRES DE SOUILLAC SUR LA LIGNE DE PARIS A TOULOUSE
Hennequin, M., and Cambefort, H., Rev Gen des Chemins de Fer, Vol. 85, Feb. 1966, pp 78-86

Reinforcement of Malherbe embankment on Paris-Toulouse lines is discussed. A large dimension embankment was built between 1882 and 1887 and the main part of it consists of stony chalk mixed with debris and clayey substance resting on substratum of cavernous chalk interspersed with clayey soil. The measures taken to stabilize surface movements, and to create rock-based buttress wall, serving as support for gabioned facings are described. A fast wall was built with pit foundations, anchored to rock by means of sheathed cables, set in inclined borings and stressed at 35 tons. In French.

0885
VIBRATION OF GROUND AROUSED BY TRAINS AND OTHER DYNAMIC LOADS
Ikeda, K., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 4, Dec. 1965, pp 15-16

Correlation between vibration amplitude, acceleration generated by dynamic loads, properties of dynamic loads, medium surrounding loads, and travel distance of elastic wave are explained. An experiment in which trenches were excavated to reduce ground vibration is discussed.

0886
ANALIZA AKTUALNYCH BADAN STATECZNOSCI TORU BEZSTYKOWEGO W ROZNYCH ZARZADACH KOLEJOWYCH
Grobicki, W., Archiwum Inzynieril Ladowej, Vol. 10, No. 1, 1964, pp 87-110

A survey is presented of recent investigations of stability of jointless rails in various railway administrations. A survey is given of theoretical and experimental investigations concerning stability of jointless tracks which have been carried out in England, USSR, Hungary, and East Germany during the last decade. Various methods of numerical analysis of stability criteria are presented, and experiments carried out on test stands and working tracks are discussed.

0887
DYNAMIC MEASUREMENT OF RAIL PROFILE AND RELATED LOCOMOTIVE TRUCK MOTIONS
Spangler, E. B., and Marta, H. A., ASME-Paper 66-RR-1, presented May 4-6, 1966, 9 p

A method developed for rapid measurement of loaded-rail profile is presented. This paper includes some typical rail profiles and related truck motions resulting from these profiles. Instrumentation resulting from this work appears to have immediate application in day-to-day

railroad operation and in high-speed rail transportation studies. Testing conditions and typical results are given.

0888
GENERAL CONSIDERATIONS CONCERNING DESIGN OF CHANGE-OF-GRADIENT POINTS
Henker, H., International Railway Congress Association--Monthly Bulletin, Vol. 42, No. 6, June 1965, pp 410-429

Permanent way engineering aspects of change-of-gradient points in railroad tracks in connection with permissible maximum speed are dealt with. Influences which affect design of change-of-gradient points, change of gradient without transition curve, change-of-gradient points with transition curve on through tracks, and in sidings are discussed.

0889
MECHANICAL LINING OF TRACK
Schubert, E., Railway Gazette, Vol. 121, No. 15, Aug. 6, 1965, pp 617-619

Methods used for mechanical lining of curved tracks are given. Lining circular curve by correcting quarter point and by using two chords, use of two chords to correct transition curve, and different arrangement of chords for lining any curve are shown in schematic diagrams. Features are described of Plasser automatic lining machine AL203 which has 80 ft chord and another 40 ft chord, a-c or d-c, for running in reverse direction, and Plasser Duomatic 06-32L, which tamps two sleepers at once. Simpler arrangement is used. Chords are 50 and 22 ft, and detecting forks are in middle of each wire. Principles of operation of machines are given.

0890
EFFECTS OF LATERAL FORCES WHEN PROPELLING ROUND SHARP CURVES
Pocklington, A. R., Railway Gazette, Vol. 121, No. 23, Dec. 1965, pp 942-945

Tests to investigate the effects of lateral forces arising from propulsive effort in train and to determine whether speed restrictions on certain turnouts would have to be reduced for propelled trains are described. Composition of the test train was 12 coaches of multiple-unit stock (weight 450 tons) with tractive force provided by two electro-diesel locomotives used as electric locomotives. They weighed 150 tons and developed total of 3200 hp. Test records obtained from vehicle were transformed from time basis to distance basis and three samples are reported.

0891
ADZED SLEEPERS
Yamana, S., and Matsumura, H., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 2, June 1965, pp 40-43

Experiments to obtain data for design of adzed ties which are used without tie-plate, with rails directly fastened to ties by means of dog spikes are described and behavior of ties in service test is discussed. Data showed conclusively that some adequate means to protect notches of ties and to increase holding power of elastic spikes, are required to obtain adzed ties with higher strength and greater durability.

0892
MACHINE 'NAILS' SPLIT TIES
Railway Track & Structures, Vol. 62, No. 6, June 1966, pp 26-27

Splits are closed by hydraulic clamps while special antisplitting plates are applied in ends by hydraulic pressure. First model of machine was built to be used primarily for demonstration and testing at any timber treating plant or railroad location where electric power is available. Machine is designed to press Gang-Nail plates of proper size in ends of ties and also to close any splits before plates are applied. Pressures needed for both operations are supplied by hydraulic power package powered by 25 hp electric motor.

0893
HIGH LATERAL FORCES ON SHARP CURVES WITH PROPELLED TRAINS
Pocklington, A. R., and Brown, T. P., Railway Gazette, Vol. 121, No. 24, Dec. 17, 1965, pp 993-996

Tests were carried out on British Railways in connection with investigations into operation of propelled express trains planned by Southern Region for Bournemouth services. Six special baseplates were installed on adjacent ties under outer rail of curve selected for test. Each was capable of measuring vertical loads and lateral forces between rail and tie. It is shown how by adding together forces recorded by individual baseplates as wheel passes over them, it is possible to determine loads and forces exerted by wheels on rails and construct diagrams showing these vertical loads and associated lateral forces.

0894
LA TRAVERSE EN BOIS EN FRANCE ET DANS LE MONDE
Peyresaubes, R., Genie Civil, Vol. 142, No. 22, Nov. 15, 1965, pp 469-473, In French

Wood railroad ties are described in France and the world. A discussion is given on mechanical resistance, dimensions, and choice of timber for wood ties which still constitute about 90% of world-wide railroad tie consumption. Mechanical, physical, and biological deterioration as well as preventive measures are examined. It is noted that world speed record (331 km/hr) was established in 1955 on Bordeaux-Dax railway line section equipped with wood ties.

0895
CONCRETE CROSSTIE
Portland Cement Association--Concrete for Railways, No. 60, 1964, 26 p

History and development, general characteristics, and description of concrete crossties and cross tie fastenings in United States, Great Britain, Japan, West Germany, Sweden and France are reviewed.

0896
ON TEST OF PRESTRESSED-CONCRETE SLEEPER FOR FROST-HEAVING SECTIONS
Miura, I., and Iwasaki, I., Permanent Way Society of Japan, Vol. 8, No. 3, 1965, pp 1-16

Results of laboratory and field tests are analyzed. Reinforced type No. 3 Type 5 prestressed-concrete tie was tested. Assuming that the amount of frost heaving in section where trial tie was intended to be used for test was to be about 10 mm, it was decided to increase resisting moment of tie by increasing prestressing force slightly. Number of strands of two prestressing steel wires of 2.9 mm in diam was increased from 16 to 20 and central part of tie was reinforced. Carlson strain gages were embedded in 30 ties during manufacturing process. One tie with strain gages is for measuring stress loss due to creep of concrete.

0897
IN JAPAN--NEOPRENE SHEETS KEEP MUD OUT OF BALLAST
Railway Track & Structures, Vol. 60, No. 9, Sept. 1965, p 42

New method of dealing with problem of track subsidence caused by mud seeping up through ballast after heavy rains or because of water in road-bed is described. Method involves use of neoprene sheets to block water and mud. Application of method was made on 2000-ft stretch of double-track line of Japanese National Railway.

0898
MECHANICAL CLEANING OF BALLAST
Railway Gazette, Vol. 121, No. 11, June 4, 1965, pp 455-456

Self-propelled unit that screens and replaces ballast on 110 yd of track/hr is described. Combined ballast cleaning and ties renewal machine developed by Kershaw Manufacturing Company is linked in two sections by beam. Front part removes ballast from under track by chain cutter. Device for replacing ties is mounted on beam connecting two machines.

0899
HOW TO RELIEVE SOFT SUBGRADE
Miyako, J., Takeshita, S., Otani, T., and Akahane, M., Tokyo, Railway Technical Research Institute--Quarterly Report, Vol. 6, No. 2, June 1965, pp 35-40

New methods of subgrade stabilization are devised which take into consideration traffic loading, moisture within ballast and subgrade, and physical and physico-chemical properties of subgrade soil. Study included laboratory experiments on chemically stabilized specimens. Durability tests on various synthetic resin films laid with sand beneath ballast and repeatedly loaded with mechanical vibrator mounted on full-size model track, and application of stabilization methods to actual tracks for prevention of mud pumping and various field investigations. Methods tried on soft subgrades of Japanese National Railroads are given.

0900
SLEEPERS FOR MODERN PERMANENT WAY
Hawtry, J.H.P., Railway Gazette, Vol. 120, No. 20, Oct. 16, 1964, pp 857-858

A review and comparative evaluation is made of concrete, wood and steel cross ties used by the British Railways. A cost comparison is given.

0901
PLASTICS IN RAILWAYS (KUNSTSTOFFE IM SCHIENEN-FAHRZEUGBAU)
Lockau, H., and Lohr, J., Kunststoffe, Vol. 60, No. 10, Oct. 1970, pp 732-737

This is a review of plastics applications in West German railway systems which comprises railroad rolling stock as well as railroad tracks, stations and other railroad structures. Applications fields for specific polymers which include both thermoplastics and thermosets are tabulated and briefly discussed. Particular attention is given to plastic foam used in acoustic damping of passenger railroad cars. In German.

0902
UP SOLVES A TEMPERATURE PROBLEM
Railway Age, Vol. 168, No. 1, Jan. 5-12, 1970, p 26. See also Railway Track & Structures, Vol. 66, No. 1, Jan. 1970, pp 16-17,45

Equipment for reducing the incidence of pull-aparts in winter and kick-outs in summer in continuous welded rail was developed at Teleweld, Inc., in collaboration with Union Pacific. The equipment is comprised of heating and cooling units mounted on track cars. Welded rail is brought to selected anchoring temperature by heater-cooler.

0903
SAFE SPEED OF TRAINS ON RAILWAY CURVES
Jain, R. K., Institution of Engineers Journal (India), Vol. 47, No. 9, Pt. CI5, May 1967, pp 849-882

Special ad hoc formulas recommended for safe speed on fully transitioned curves in broad gage and narrow gage Indian Railways practice are discussed. The author arrives at different expressions for various gages based on a more rational approach. A revision of existing formulas is suggested.

0904
AEROTRAIN, REALITY OR UTOPIA
Bertin, J., Transpo '69, Environmental Aspects of Transportation. 3rd Symposium of the Society of Environmental Engineers, Apr. 15-18, 1969, S. Kensington, London, England, SEE, 1969, Vol. 2, Paper 16, 12 p

This article on Bertin and Cie's Aerotrain is a generalized systems description, including rolling stock, track and suspension, economic aspects of operation, and a demonstration of the Aerotrain as an operational reality in inter-urban, suburban, and urban locales.

0905
EXPERIMENTAL RESEARCH ON EFFECT OF VEHICLES ON RAILWAY TRACK AT HIGH RUNNING SPEEDS
Verigo, M. F., International Railway Congress Association, Monthly Bulletin, Vol. 45, No. 1, Jan. 1968, pp 39-70

Methods adopted by Soviet railroads for testing effect of ultra-high-speed vehicles on track are discussed. Determination of conditions of safe speed is based on the evaluation of extensive statistical data obtained by measurements on track and on vehicles. Test technology and methods of evaluating test results are discussed along with results of tests concerning effect of ultra-high-speed electric and Diesel locomotives and vehicles on track.

0906
VEHICLE DYNAMICS AND WHEEL-RAIL INTERFACE PROBLEMS
Wickens, A. H., British Railways Board, Derby, England, High Speed Ground Transportation, TRI Research Rpt. 3, Proceeds of the Carnegie-Mellon Conference, Pittsburgh, Pa., May 13-15, 1969, pp 157-171

0907
STEADY-STATE MOTION OF RAILWAY VEHICLES ON CURVED TRACK
Boocock, D., Journal of Mechanical and Engineering Science, Vol. 11, No. 6, Dec. 1969, pp 556-566

A simplified linear theory of steady-state curve traversing is developed for truck and two axled vehicles. The approach is based on providing guidance by creep forces in conjunction with wheel conicity, so that flange contact is normally avoided. It is shown that this approach is realistic for wide range of vehicle and track parameters. However, steering by creep forces is limited by the onset of wheel slip. Representative experimental results for a two-axled vehicle are presented.

0908
FAST TRACK FOR FAST TRAINS. THE METROLINERS
Diffenderfer, J. W., Railway Track & Structures, Vol. 66, No. 5, May 1970, pp 18-20

The Penn Central is operating a fleet of high-speed passenger 'Metroliner' trains over its line between New York and Washington, part of the Northeast Corridor. The trains are being operated in accordance with an agreement between the company and the United States government. Included in the report are comments about the road's experience in preparing and maintaining the tracks for the high-speed service.

0909
ANALYSIS OF THE VIBRATIONS IN THE RAILWAY TRACK
Ono, K., and Ito, Y., Proceeds of the Japanese Society of Civil Engineers, Vol. 179, 1970, pp 69-80

0910
HOW IC INCREASES THE LIFE OF CURVE RAILS
Railway Track & Structures, Vol. 66, No. 9, Sept. 1970, p 23

After experimenting with two heats of rail steel in which the percentage of manganese was increased, the Illinois Central was able to obtain the prolonged service life of a rail on curves at a reasonable cost. By adding to the manganese content of the rail steel, a life expectancy four times greater than conventional rail on curves is expected.

0911
CENTRAL SECTIONS OF FROGS AT THE S.N.C.F.(NATIONAL SOCIETY OF FRENCH RAILROADS) (LES COEURS d'AIGUILLAGE a la S.N.C.F.)
Gence, P., Rev de Metallurgie, Vol. 66, No. 11, Nov. 1969, pp 779-786

The paper deals with the problems of improving and maintaining the switches, since increased tonnage carried by the railroads has increased wear and failure. The switches are cast in high Mn Hadfield steel now containing Mo for increased weldability. It was found that before weld repair, the entire work hardened layer must be removed, and extreme caution must be used when rails that are to be welded are explosive-hardened.

0912
SERVICE EXPERIENCE IN BELGIUM WITH BOLT-SECURED RAIL FASTENINGS
Gunst, G., Railway Gazette, Vol. 126, No. 18, Sept. 18, 1970, pp 708-709

Improvements have been made to a well-tried base-plate assembly using a double-spring clip in place of fasteners with helical-spring washers. Under normal tightening, the clip applies a load of 750 to 850 kg on the foot of the rail. If loosening occurs due to the unscrewing of the nut by as much as a complete turn (about 2.5 mm) the load is reduced to 400 or 500 kg.

0913
QUENCHED CARBON STEEL JOINT BARS. ASTM A 49-68 (USAS G57.1-1968)
1969 Book of ASTM Standards, Pt. 4, pp 79-81

Standard specifications are given which cover heat-treated carbon steel joint bars for general use in standard railroad tracks. The steel is made by open-hearth, basic-oxygen, or electric-furnace process.

0914
HIGH-CARBON STEEL JOINT BARS. ASTM A 5-68 (USAS G57.9-1968)
1969 Book of ASTM Standards, Pt. 4, pp 18-20

Standard specifications are given which cover high-carbon steel joint bars for general use in standard railroad tracks. They may be used for joint bars of insulated joints.

0915
LOW CARBON STEEL TIE PLATES. ASTM A 67-68 (USAS G57.4-1968)
1969 Book at ASTM Standards, Pt. 4, pp 86-88

Standard specification are given which cover low-carbon steel tie plates for use in railroad track.

0916
HEAT-TREATED CARBON STEEL TRACK BOLTS AND CARBON STEEL NUTS. ASTM A 183-68
1969 Book of ASTM Standards, Pt. 4, pp 104-107

Standard specifications are given which cover steel for bolts to be made by open-hearth, basic-oxygen, or electric-furnace process, and nuts to be made by open-hearth, basic-oxygen, electric-furnace, or acid-Bessemer process.

0917
STEEL GIRDER RAILS OF PLAIN, GROOVED, AND GUARD TYPES. ASTM A 2-68 (USAS G57.6-1968)
1969 Book of ASTM Standards, Pt. 4, pp 8-11

Standard specification are given which cover three classes of steel girder rails: unless otherwise specified by purchaser, girder-guard rails shall be Class A; plain and grooved-girder rails under 135 lb/yd in weight shall be specified as either Class A or Class B; plain and grooved-girder rails of 135 lb/yd in weight and heavier shall be Class C, unless otherwise specified.

0918
CARBON-STEEL RAILS. ASTM A 1-68
1969 Book of ASTM Standards, Pt. 4, pp 1-7

Standard specifications are given which cover carbon-steel standard Tee rails of nominal weights of 61 lb/yd and over and are intended primarily for export and industrial use. The steel is made by open-hearth or basic-oxygen process.

0919
FLAME HARDENING OF RAIL HEADS (FLAMMVERGUETEN VON SCHIENENKOEPFEN)
Geiss, A., and Rose, A., Werkstatt Betr, Vol. 103, No. 6, June 1970 pp 393-402

A heat treating method, derived from flame hardening, was developed at the West German Federal Railroads to improve the strength properties of rails in order to prevent damages caused by higher loads and increased speeds. This method is described and the results obtained on various standard rail steels are evaluated. In German.

0920
NEW IDEAS WHEN LAYING WELDED STRINGS ON MoPac
Railway Track & Structures, Vol. 66, No. 6, June 1970, pp 20-22. See also Railway Age, Vol. 168, No. 12, June 8, 1970, pp 57-58

Two unusual features in operation of a rail-laying crew on the Missouri Pacific Main track near Berger, Mo. are described. One was a spiking

machine specially developed by Nordberg Manufacturing Co., for use when laying rail. The other was the practice of making provision for stress control in the long welded strings by stretching them mechanically when the temperature is below 75 degrees.

0921
SOVIET TRACK RENEWAL AND ROAD-BED MAINTENANCE
Railway Gazette, Vol. 126, No. 3, Feb. 6, 1970, pp 102-104

Methods used in the Soviet Union for single-line track-laying and ballast cleaning on electrified lines with overhead conductors are given. An arrangement diagram is shown of Soviet YK-25 track-laying crane with track panel being lowered into position. The machine is loaded with a bundle of six panels.

0922
STABILIZATION OF SOFT SUBSOILS (REPORT 1). COMPARISON OF STATIC AND DYNAMIC BEHAVIORS OF SOFT SUBSOILS TREATED IN DIFFERENT METHODS
Watanabe, S., Komine, T., and Nasu, M., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 10, No. 4, Dec. 1969, pp 191-195

A series of test embankments built at a double-tracking site are described.

0923
TRACK FOR JAPAN'S 210 KM/H TRAINS
Matsubara, K., Permanent Way, Vol. 11, No. 3-4, 1970, pp 1-67

This report deals with maintenance of way of the New Tokaido Line. Planning, organization and personnel, inspection, track rectification, information network and train speed control, train protection, and protection against snow damage are discussed. Construction cost and major problems are outlined in the designing of track permitting 210 km/hr operation.

0924
SIGNIFICANCE OF A DETECTION OF DEFECTS IN RAILS
Johnson, P. C., Railway Technical Centre, Derby, England, and Wise, S., Non-Destructive Testing (London), Vol. 3, No. 2, Apr. 1970, pp 111-116

The articles describe the principal types of defects which may be found in rails, and indicates those which are inherent in the manufacturing processes and those which arise as a result of service loads. The principles of resonance and pulse-echo ultrasonic flaw detection as applied to rails are given, and the current ultrasonic testing practice at the British Railway is described.

0925
PULSATOR TESTS WITH ELASTIC RAIL SPIKES
Birman, F., German Federal Railway Directorate, Nurnberg, West German, Railway Gazette, Vol. 126, No. 7, Apr. 3, 1970, pp 271-272

Endurance tests conducted with Doerken elastic rail spikes on rail of different widths are described. Tests with double- and single-shank elastic rail spikes were conducted at the Munich Technical University in West Germany. In these endurance vibration tests, the track conditions in service are simulated by a special device in an accelerated laboratory trial, in that vertical loads corresponding to wheel-loads are applied simultaneously with the horizontal forces corresponding to the guiding forces of vehicles. The test loads were moderated for the investigation on the light rail section used.

0926
DEVELOPMENT AND USE OF TRACK QUALITY INDEX
Crane, L. S., Southern Railway Company, Alexandria, Va., Sullivan, J. L., and Kaelin, C. R., ASME-Paper 69-RR-2, Apr. 15-16, 1969, 10 p

Track inspection car currently used in the United States is described, and development of track quality index is discussed. Development of quality index makes it possible to obtain information describing ride quality of track to guide maintenance officers in funding and scheduling track maintenance. See also 0823.

0927
ANTICIPATION OF BEHAVIOR AND ESTIMATION OF FAILURE OF CUT SLOPES UNDER RAINFALL
Saito, M., Uezawa, H., Imai, S., Menjo, S., and Yasuda, Y. Y., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 10, No. 1, Mar. 1969, pp 13-19

Continuous observations of cut embankment slope were made at Morioka, Chibiki and Tara in Japan to investigate the behavior of seepage water. The results show that the rise in water table is proportional to the amount of rainfall and the drop in water table may be regarded as a function of only the water table at a given time point. It follows that the water table observation can reveal the water level fluctuation characteristic and that the critical rainfall can be estimated through stability analysis of slope.

0928
REALIGNMENT OF RAILWAY CURVES. ELECTRICAL MODEL
Ajgaonkar, R. B., International Railway Congress Association-Monthly Bulletin, Vol. 46, No. 7-8, July-Aug. 1969, pp 448-451

Method discussed shows how electrical equivalence can be practically used for solving field problems. The potential drop under current along uniform conductors is proportional to the length. In string-lining of station, versine's effect on slew at another station is proportional to distance between them. With suitable adjustments and calibration, current in circuit represents versines. Potential differences give slews. The model can be used as control unit-in machine designed for realignment of railroad curves.

0929
LATERAL BALLAST RESISTANCE AND STABILITY OF TRACK IN EARTHQUAKE
Sato, Y., Quarterly Report Railway Technical Research Institute, Vol. 11, No. 1, Mar. 1970, pp 3-6

The experiment was performed with a model track of full size in the reinforced concrete-box placed on the vibrational table of 5x5 sq m in dimensions. Results showed that against the earthquake acceleration with which railroad structures are designed 83% of the track on the Shin Kansen line and 78% in the track with prestressed concrete ties and crushed stone ballast on the narrow gage lines were effected. The long weld rail track holds the safety factor 1.15 for the buckling due to temperature rise in the earthquake with the same acceleration.

0930
INFLUENCE OF TRACK DYNAMICS ON THE DESIGN OF ADVANCED TRACK STRUCTURES
Meacham, H. C., Battelle Memorial Institute, Columbus, Ohio, Dynamics and Economics of Railway Track Systems, International Forum RSMA No. 902, Sept. 11-12, 1969, Chicago, Illinois, Railway Systems and Management Association, 1969, pp 87-100

The paper discusses certain aspects of the design of several experimental track structures to be installed and evaluated by the DOT and the Santa Fe Railroad, with particular emphasis on the influence of track structure dynamics on the final designs. The instrumentation developed and checked out during the computer program validation of the program allows data required for the accurate computer representation of track structures to be obtained.

0931
STABILITY OF RAILROAD TRACKS FROM POINT OF VIEW OF TRANSVERSE STRESSES GENERATED BY ROLLING STOCK (LA STABILITE DE LA VOIE FERREE VIS-A-VIS DES EFFORTS TRANSVERSAUX EXERCES PAR LES VEHICULES)
Amans, F., and Sauvage, R., Annales des Ponts et Chaussees, Vol. 139, No. 1, Jan.-Feb. 1969, pp 19-47

Expressed in terms of resistance of materials, this study leads to the resolution of the problem of vierendeel girder under longitudinal, vertical and horizontal stresses, node moments of which can be expressed by analytical expressions. Experimental results on selected section of track and mathematical formulation that approximates different reactions imposed on track by ballast, or on rails by ties are presented. Fourth-order differential equations represent equilibrium of a segment of track. In French.

0932
CONSTRUCTING BART TRACK INVOLVES SPECIAL PROBLEMS
Railway Track & Structures, Vol. 65, No. 6, June 1969, pp 24-27

Unusual techniques were developed for building 5' 6" gage track with 9' concrete ties and long welded rail strings at San Francisco, Calif. Special spreader-bar, handled by crawler tractor, places four concrete ties at a time to proper spacing. Tractor is operating on 8" layer of ballast 10' wide, which has been compacted by 9-ton vibratory rollers. Welded rails, 1518' long, are pushed off head end of the rail train by double-drum winch.

0933
PREVENTION OF EARLY STAGE CRACKING ON ZINC COATED SPRING CLIPS
Tomita, K., Watanabe, S., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 10, No. 3, Sept. 1969, pp 128-130

The experimental results of the cause of cracking and the methods of its prevention are described. Test was carried out to collect the data for factors affecting the early stage cracking on zinc coated clips. The test specimens, which were main leaves of zinc coated 102 type clips or circular leaves, were fastened for 7 days. The fatigue limit of zinc coated test pieces was 35% lower than that of painted test pieces under nonweathering condition. The early stage cracking of zinc coated clips was affected by the fastening torque over 1800 kg-cm, wrong setting, cold punching, and tempering for a short time.

0934
UNCONVENTIONAL RAILWAY TRACK SUPPORT SYSTEMS
O'Sullivan, W. B., U.S. Department of Transporation, Washington, D.C., Dynamics and Economics of Railway Track Systems, International Forum RSMA No. 902, Chicago, Illinois, Sept. 11-12, 1969, Railway Systems and Management Association, 1969, pp 71-85

Results of research study carried out to identify the most economic means for affording the mandatory track support stability for the high passenger train speeds are embodied in a set of performance specifications for four distinct reinforced concrete support structures and for a rail fastener possessing the capacity of lateral and vertical adjustment that will be used with these structures. The structures are readily grouped into slabs, continuous and precast, and beams, likewise continuously formed and precast.

0935
NEW WAY TO STOP SPLITTING IN TIMBERS
Railway Track & Structures, Vol. 66, No. 1, Jan. 1970, p 31

Experiments with the application of veneer "caps" to railroad ties, bridge timbers and other heavy wood members to keep the timbers from checking and splitting are described.

0936
SOME PROBLEMS OF WHEEL/RAIL INTERACTION ASSOCIATED WITH HIGH-SPEED TRAINS
Evensen, D. A., and Kaplan, A., International Railway Congress Association-Monthly Bulletin, Vol. 46, No. 9, Sept. 1969, pp 513-542

Study was carried out to identify and evaluate potential problems involving wheel-rail interaction which could limit the speed of High Speed Rail system. Several approximate calculations are given and an attempt was made to investigate possible wheel-rail speed limitations. Results and discussion are concentrated in areas of estimation of the dynamic loads; wheel behavior and structural integrity; rail dynamics and structural integrity; and adhesion, hunting, and related problems.

0937
CLOSED LINKAGE BETWEEN WHEEL AND RAIL (DER KRAFTSCHLUSS ZWISCHEN RAD UND SCHIENE)
Tross, A., Glasers Annalen, Vol. 93, No. 10, Oct. 1969, pp 310-320

It is outlined that the frictional connection between wheel and rail cannot be explained by adhesion but by energetic phenomena. Theory is supported by the increase of this effect up to a slip of a few percent. Reference is made to an extensive bibliography. In German.

0938
COMPUTERS IN THE DESIGN OF RAILWAY STRUCTURES
West, P. E., Computer Aided Design, Vol. 1, No. 4, Summer 1969, pp 25-33

The future of computers in design is determined by their acceptability to designers. Examples are given of the development of programs now available to railway engineering designers. These programs have applications in the analysis of three-dimensional structures, detailed component calculations via a remote terminal, and (using nonlinear programming techniques) in minimum cost and minimum weight designs.

0939
NEW CONSIDERATIONS FOR DETERMINING RAIL DURABILITY (NEUE ERKENNTNISSE ZUR ERMITTLUNG DER LEBENSDAUER DER SCHIENE)
Hanna, A. N., Oesterreichische Ingenieur-Zeit, Vol. 12, No. 11, Nov. 1969, pp 384-388

Method of calculation of the service life of rails up to occurrence of fatigue cracks in the rail head and in the rail base. The service life of rails by considering continuous load of various stress amplitude dependencies. In German.

0940
RAIL WELDING AT RUISLIP
Laird, E. E., and Faulkner, F. J., Railway Gazette, Vol. 125, No. 20, Oct. 17, 1969, pp 780-782

Fully-automated flashbutt welding plant established for welding bullhead and flat-bottom sections to meet all London Transport's requirements for running and conductor rails is described. Features of various rail welding machines, cutting and drilling machine used for the production of special-length rails, and press for correcting irregularities in alignment in both planes after welding are given.

0941
THERMOPLASTICS IN THE RAILWAY PERMANENT WAY
Drier, H., Eisenbahning, Nov. 1968, pp 319-323. In German

0942
TRACK MAINTENANCE TO ACCOMMODATE FAST, HIGH AND HEAVY LOADS
Railway Track & Structures, Roadmasters' Committee Reports, Special Committee No. 3, Oct. 1967

0943
YARD AND BRANCH LINE MAINTENANCE
Railway Track & Structures, Roadmasters' Committee Reports, Special Committee No. 4, Oct. 1967

0944
CONTINUOUS WELDED RAIL - INSTALLATION AND MAINTENANCE
Railway Track & Structures, Roadmasters' Committee Reports, Chicago, Illinois, Special Committee No. 1, Oct. 1967

0945
CONCRETE TIES FOR WELDED RAIL
Butland, A. N., Railway Track & Structures, Vol. 60, No. 5, May 1964, pp 27-29

Summary of progress on British railroads in standardization of welded track laid with concrete ties, together with mechanization of track analyzing cars and employee training; welded 110-lb rail is fastened with Pandrol clips to concrete ties.

0946
INFLUENCE OF SPEED ON CONSTRUCTION AND MAINTENANCE COST OF RAILWAY LINES
Delvendahl, H., International Railway Congress Association-Monthly Bulletin, Vol. 45, No. 5, May 1968, pp 533-553

Distinction was made between costs incurred for track formation and those incurred for line equipment; speeds included in survey were limited to the range from 60 to 200 km/hr. Cost investigations are related to conditions prevailing on German Federal Railway. Results of the investigations show that costs incurred for higher design speeds around 200 km/hr are approximately 40% higher than costs for line designed for speeds of 100 km/hr.

0947
KUNSTSTOFFE IM EISENBAHNOBERBAU
Doll, A., Glasers Annalen, Vol. 90, No. 2, Feb. 1966, pp 71-75

Plastics used in railway roadbeds, and structural units made of plastic and use of plastic adhesive in fastening of rails directly to concrete platform and with block-joint connections are discussed. Plastics used in railway roadbeds must have the following properties: good electrical insulation, long lasting strength, and chemical and water resistance. In German.

0948
COMPACTION OF THE CRIB AND SHOULDER AREAS OF THE BALLAST SECTION SUPPORTING THE LINEAR INDUCTION MOTOR RESEARCH VEHICLE TEST TRACK IN PUEBLO, COLORADO
Genton, D. L., Institut de Technique des Transports, Ecole Polytechnique Federale de Lausanne, Switzerland, IT-712, FRA-RT-72-09, Final Rpt., Aug. 1971, 38 p, Contract DOT-PR-10191, Available: NTIS, PB 203184

Observations concerning the problem of modifying a specifically identified unit of railroad ballast compacting equipment to achieve optimal working efficiency in one location are presented. The theories associated with the in-track compaction of railroad ballast are discussed and certain performance tests described. A comprehensive list of references is contained as an appendix. (Author)

0949
A BIBLIOGRAPHY OF PUBLISHED RESEARCH REPORTS
Federal Railroad Administration, Washington, D. C., Sept. 1972, 61 p, Available: NTIS, PB 213047/4

The bibliography presents abstracts of 302 major railroad research reports on contracted research and development, systems engineering, transportation surveys, and model development, along with intramural research reports and program summaries. (Author)

0950
PLASTICS IN BRITISH RAILWAYS
Hawthorne, B. J., Institute of Rubber Industries, Conference on Polymers in Transport, London, England, Feb. 18-19, 1969, Paper 12, 10 p

Scope of plastics applications includes not only tracks, trains and stations, but also large Civil Engineering Organization, which is responsible for the track structure, including bridges, service roads, stations, tunnels, embankments, etc. Review lists types of materials employed with special attention given to glass fiber reinforced plastics. Examples of replacement of conventional materials by plastics in many applications are presented. Several development programs are discussed and conclusions drawn with forecast for the future.

0951
RAILWAY SLEEPERS AND FASTENINGS ON SOUTH AFRICAN RAILWAYS
Hay, J. G., Civil Engineers in South Africa, Vol. 4, No. 6, June 1962, pp 103-113

Developments in application of wood and steel ties, long welded rails and track insulation on South African railroads, tests with concrete ties and gradual extension of their use, and development of new design of fastening to comply with modern conditions are discussed.

0952
AN INTRODUCTION TO TRANSPORTATION ENGINEERING
Hay, W. W., John Wiley & Sons, Inc., New York, Second Printing, 1965

0953
RAILROAD ENGINEERING
Hay, W. W., John Wiley and Sons, Inc., New York, Vol. 1, 1953

0954
BULLETIN OF THE INTERNATIONAL RAILWAY CONGRESS ASSOCIATION
International Railway Congress Association, London, England, Dec. 1965, 881 p

0955
RAILWAY ENGINEERING ABSTRACTS 1965. VOLUME 4, NO. 4
Japanese National Railways, Tokyo, Japan, Railway Technical Research Institute, Vol. 4, No. 4, Dec. 1965, 18 p, Available: NTIS, PB 169560

This publication is issued by the Japanese National Railways for the purpose of introducing the articles concerning railway technique written by the Japanese engineers and researchers. The abstracts prepared in English and carried by this publication represent the major periodicals in Japan as selected by the Center. The Japanese titles indicate that the originals are in Japanese.

0956
MECHANICAL PROPERTIES OF ASPHALT PAVEMENT MATERIALS
Kallas, B. F., and Riley, J. C., The Asphalt Institute, College Park, Maryland, Research Rpt. 67-1, Jan. 1967

0957
THEORETICAL STUDY OF THE SIDE THRUST OF TRUCK WHEELS RUNNING ON CURVES
Kunieda, M., Railway Technical Research Institute, Quarterly Reports, Vol. 11, No. 2, June 1970, pp 105-108

0958
SCHIENENGUETEN FUER BESONDERE BEANSPRUCHUNGEN IM GLEIS- UND WEICHENBAU
Laizner, H., Berg- u Huettenmaennische Monatshefte, Vol. 113, No. 3, Mar. 1968, pp 93-104

Types of rails used for heavy duty work in railroad track and switches, and results of years of testing of various qualities of rails in heavy duty operation in Germany and Austria including wear behavior of rails made of Mn, Mn-Ti and Mn-Mo steel alloys are given. Efforts to produce "shelling" resistant rails are discussed; wear data are tabulated and shown in graphs. In German

0959
SCIENCE AND TECHNOLOGY IN THE RAILROAD INDUSTRY
National Academy of Sciences, National Research Council, Washington, D. C., Aug. 1963, 133 p, Contract Cc6085, Available: NTIS, PB 166882

A study is made of the present use of science and technology in the railroad industry and the potential for further effort. This evaluation includes applications of the physical and social sciences, and considers the impact of research and development upon the physical, economic, and social aspects of the railroad and transportation industry, its labor forces, and the community it serves.

0960
CN TRUCKS PERFORM ON-THE-SPOT REPAIRS
Railway Locomotives & Cars, Vol. 145, No. 10, Oct. 1971, pp 20-21

The truck-mounted automotive equipment servicing workshop introduced by Canadian National can perform with all the versatility of a repair center. Mounted on a heavy-duty truck chassis, the car workshop is performing repairs on other CN trucks, as well as tractors, trailers, containers and container-handling equipment.

0961
NEW DEVICE ADDS LINING TO ONE-MAN TRACK SURFACING
Railway Track & Structures, Vol. 60, No. 12, Dec. 1964, pp 15-18

Attachment for production tamper is designed automatically to correct irregularities in alignment on both tangents and curves and to do it simultaneously with surfacing operation. The basic unit was an Autojack Electromatic production tamper manufactured by Tamper, Inc. In this unit infrared beams projected from front buggy establish reference line for automatic control of jacking and tamping operations.

0962
FRA - TRACK SAFETY STANDARDS
Railway Track & Structures, Nov. 1971, pp 30-35

The classification of tracks, and the regulations covering the maintenance of the substructures and the permanent way are discussed.

0963
INVESTIGATION OF DURABILITY OF IMPREGNATED TIES
Kakegawa, Y., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 5, No. 3, Sept. 1964, pp 41-44

Wooden ties of various species of wood were tested to select countermeasures for prevention of their deterioration, and to find service life for each species of wood. The method of investigation is described. The effect of species, tonnage passed, impregnation, cutting, and resistance to dog-spike pulling on average service life was estimated.

0964
ON HIGH FREQUENCY VIBRATION OF TRACK
Sato, Y., Permanent Way Society of Japan, Tokyo, Japan, Permanent Way, Vol. 5, No. 3, Sept. 1962, pp 1-15

A series of studies is summarized on high frequency vibration of track more than several hundred cps and exceeding 100 cps, conducted at Tokyo University. Characteristics of HF vibration of track, vibration of track caused by running of trains, and effect of each part of track are discussed.

0965
SETTING AND HARDENING OF HYDRAULIC MATERIALS-DETERMINATION OF OPTIMAL STEAM CURING OF PRE-STRESSED CONCRETE RAILWAY SLEEPERS BY CONDUCTIMETRIC METHOD
Szuk, G., Acta Technica (Budapest), Vol. 44, No. 3-4, 1963, pp 329-337

This article discusses test methods to determine optimal hour-degree for curing, measurements controlled by strength and sonic tests, and measured optimum boundary region of two physicochemical presses by electrical superposition.

0966
NONLINEAR VIBRATIONS IN VEHICLE ENGINEERING
DePater, A. D., Technische Hogeschool, Afdeling des Werktuigbouwkunde, Delft, Netherlands, Paper presented at the 4th Conference on Nonlinear Oscillations, Prague, Czechoslovakia, Sept. 1967, WTHD-4, Apr. 1968, 22 p, Available: NTIS, N68-35640

0967
STRENGTH OF FISH-BOLTS
Umekubo, S., Tokyo, Railway Technical Research Institute-Quarterly Report, Vol. 6, No. 2, June 1965, pp 23-26

Tests performed on fishbolts including comparison between hardened and nonhardened bolts, test on bending-free bolts and relaxation test of fish bolts by Vibrogir are described. Strengths of hardened and nonhardened bolts under tightening were compared to find out conditions for increasing fastening force through reducing diameter of bolt holes and increasing strength of the bolts. Bolt strength was examined mainly in terms of tensile fiber stress.

0968
DETECTION OF BASE SEAMS IN INLAID RAILS
Vezina, G. E., 6th International Conference on Nondestructive Testing, Hanover, West Germany, June 1-5, 1970, Vol. 3, Session H, Rpt. 4, pp 37-46

A description of a test apparatus that has made possible the detection of rolling mill defects in the seams, located at the base of new rails, installed less than 2 yrs is presented. A semi-automated ultrasonic rail test car, operated at 5 km/hr, is demonstrated.

0969
NEW MACHINERY AND RECENT DEVELOPMENTS
Railway Track & Structures, Roadmasters' Committee Reports, Standing Committee No. 1, Oct. 1967

0970
RALUS AUTOMATIC ULTRASONIC RAIL TESTING SYSTEMS
Beaujard, L., Mondat, J., and Vinat, J., Rev Gen Chemins Fer, Vol. 89, Feb. 1970, pp 141-152

0971
HIGH-SPEED RESEARCH TRAIN INSTRUMENTATION
Technical Paper, Source Unknown

The material presented in this paper describes the basic instrumentation packages currently used in high-speed rail research. The instrumentation for the test and research program was subdivided into four separate packages, i.e., body suspension, catenary-pantograph, track geometry, and track and roadbed dynamics. The task was to provide the necessary instrumentation for measurements, tests, and studies into the behavior and dynamic performances of rail vehicles, catenary, and supporting track structures at speeds up to 160 mph. The program was to be composed of four distinct but interrelated parts: instrumentation; computer programming; data collection, reduction and interpretation; and analysis and simulation. This presentation is concerned primarily with instrumentation. As a result of this program track geometry can now be determined at speeds in excess of 150 mph. Cross level, gauge, profile, alignment, warp, and rate of change of gauge can be measured at high speeds by using non-contact sensors.

0972
"SECONDARY CONDITIONING" EFFECT OF SURFACES AS OBSERVED ON STEEL RAILS
Andrews, H. I., Wear-Usure-Verschleiss, Vol. 6, No. 4, July-Aug. 1963, pp 262-275

A study was made of the effects of contaminants upon rail surface. In addition to normal effect produced by such substances, which could be removed by cleaning, minute traces are found of certain materials, notable oil which may produce further effect, described as "secondary conditioning", which could greatly alter adhesion values. This secondary effect was found to be independent of normal or "primary" effect, and strongly resistant to cleaning. Such "secondary conditioning" was apparently explained as a local reduction of rail adhesion experienced on track. A simple method is suggested for comparing measurements made on rails under different conditions.

0973
REPORTS OF THE ENGINEERING RESEARCH DIVISION, AAR
Association of American Railroads Research Center, Engineering Research Division, Chicago, Illinois

The following reports are cited: ER-7, "Investigation of Special Joint Bars and Rail Plugs for Use in Joining Lengths of Continuous Welded Rail"; ER-13, "Rail Wear Tests"; ER-15, "Engineering Aspects of Current Rail Sections"; ER-20, "Prestressed Concrete Tie Investigation"; ER-22, "Rail Slippage Tests-Concrete Ties", ER-24, "Report on Open Hearth Slag for Railroad Ballast"; ER-33, "Physical & Mechanical Test Results of Rails and Joint Bars Produced by the Basic Oxygen Steel Making Process", ER-34, "Description of the Flame Hardening of Rail and Physical & Metallurgical Test Results", ER-35 "Description of the Flame Hardening of Rail and Physical & Metallurgical Test Results of Flame Hardened Flash Butt Welded Rail Joints", ER-44 "Flame Hardening of Rail by the Hammon Continuous Process and Physical & Rolling Load Test Results; ER-51, "Investigation of Welding Techniques for Repair by Welding of Heat Treated and Flame Hardened Rail in Bolted Rail Crossings"; ER-54, "Hold-Down Fastenings for Tie Plates, Including Pads Under Plates: Their Effect on Tie-Wear"; ER-55, "Rail Study"; ER-58, "Prestressed Concrete Tie Investigation - 2nd Report"; and ER-77, "Capability of Fasteners to Resist Rail Overturning".

0974
A.R.E.A. PROCEEDINGS
American Railway Engineering Association, Chicago, Illinois, Vols. 9, 12, 13, 23, 24, 35, 46, 47, 50, and 56-69

0975
TESTS OF TRUE-TEMPER CLIPS
True-Temper Corporation, Mar. 1968, 2 p

Tests included load deflection and slipping of True-Temper spring clips.

0976
ABEX - INTERPACE PRESTRESSED CONCRETE RAILROAD TIE - DESIGN NO. 1. TECHNICAL DESCRIPTION
Inter Pipe and Ceramic Corporation, 1966-1967, 4 p

A technical description of Abex Corporation concrete tie design is given. Five other sketches are included.

0977
FRENCH CONCRETE TIE BEING INTRODUCED TO U.S. MARKET
Railway Track & Structures, Feb. 1966, p 51

This news item describes the RS Concrete Crosstie.

0978
THE ASSOCIATION OF AMERICAN RAILROADS RESEARCH CENTER REPORT (BIENNIAL REPORT 1965-1966) (TWELFTH REPORT)
Association of American Railroads, Research Center, Chicago, Illinois, 1965-1966

The Center's activities are described and the organization chart of the Research Department is given.

0979
TIELESS TRACK FOR SUBWAYS AND ELEVATED LINES
Meier, H., Portland Cement Association, Mar. 1964, 35 p

This translation of a German article deals with ways of fastening rails directly to tunnel floors or to elevated lines. Considerable discussion is given of vibrations and sound considerations in tunnels, and of vibration insulating devices in general. Noise and vibration aspects are emphasized.

0980
INSPECTION OF CONCRETE TIE INSTALLATION ON C & O
Magee, G. M., Association of American Railroads, Chicago, Illinois, 1968, 1 p

This inspection report discusses concrete tie track using slag ballast.

0981
CONCRETE TIES (JAPANESE)
Magee, G. M., Association of American Railroads, Chicago, Illinois, 1966

A collection of several letters written during the year of 1966 are presented from the Japanese National Railway, to AAR and Portland Cement Association. Drawings of spring clip fastenings are included.

0982
INSPECTION OF PRESTRESSED CONCRETE RAILROAD CROSS TIES ON THE U.S. STEEL CORPORATION RAILROAD BETWEEN WINTON JUNCTION, WYOMING AND ATLANTIC CITY ORE MINE
Ruble, E. J., McQueen, P. J., and Schoeneberg, K. W., Ben C. Gerwick Company, June 11, 1969, 4 p

These tracks had been inspected in 1962 and again in 1969. In general the condition of the concrete ties was about the same as in 1962.

0983
INVESTIGATION OF 140 LB/YD RAIL MADE FROM VACUUM DEGASSED STEEL (PROJECT 70-R-58)
Pennsylvania Railroad, R-101, June 1970, 42 p

0984
SIXTH PROGRESS REPORT OF COOPERATIVE RESEARCH ON WOOD TIES BY THE RAILWAY TIE ASSOCIATION AND THE ASSOCIATION OF AMERICAN RAILROADS RESEARCH AND TEST DEPARTMENT
Association of American Railroads, Research and Test Department, Chicago, Illinois, R-111, Progress Rpt. No. 6, Dec. 1971, 6 p

0985
SPECIFICATIONS FOR CONCRETE TIES
Association of American Railroads, Chicago, Illinois, T-11, May 1971, 14 p

Answers are given to specific questions from J. W. Winger (C&ORR), including preliminary specifications (Portland Cement Association) on pre-stressed concrete ties.

0986
COLLECTION OF PAPERS ON "WIRAND" REINFORCED CONCRETE PROCESS
Dickerson, R. F., et. al., Battelle Memorial Institute, 1972

These papers discuss the "WIRAND" patented process for reinforced concrete. The concrete solidifies and sets with a multitude of fine high-strength wires or filaments dispersed throughout the concrete matrix. Excellent properties are obtained.

0987
MASS PRODUCTION OF CONCRETE TIES
Fowler, W. E., Letter, Mar. 28, 1972, 3 p

0988
CONCRETE TIE CONCEPT
Ply Concrete International, Jan. 11, 1973, 7 p

A "new concept" tie is formed in place, with use of a synthetic bag of porous material to maintain the cement which is squeezed in under pressure. Appropriate hardware is discussed.

0989
THESAURUS, TRACK-TRAIN DYNAMICS BIBLIOGRAPHY
Breese, R. F., Association of American Railroads, Research Center, Chicago, Illinois, 1973, 29 p

This thesaurus was prepared as a result of an extensive bibliography prepared on the railroad technology subject of Track-Train Dynamics.

0990

SUMMARY REPORT ON ACOUSTIC EMISSION WESL MONITORING IN THE WELDING OF RAIL Y-40647
Thompson, J. L., Battelle Northwest Labs., Richland, Washington, Sept. 1969, 26 p

Three welding techniques were investigated with prototype equipment during field trips to the Norfold & Western ribbon rail welding plants at Bellevue, Ohio and at Roanoke, Virginia. Data indicated acoustic emission weld monitoring is a feasible quality control method in all cases and especially in the thermite process.

0991
PROPOSED RESEARCH DIRECTED TOWARD DEVELOPEMTN OF A PROTOTYPE ACOUSTIC EMISSION INSTRUMENT FOR TESTING THERMITE FIELD WELDING OF RAILROAD RAIL
Pedersen, H. N., Battelle Northwest Labs., Richland, Washington, Proposal, Mar. 2, 1970, 6 p

0992
INVESTIGATION OF CS-5 RAIL FASTENER SLIP RESISTANCE FOR PROTEC, INC.
Association of American Railroads, Chicago, Ill., LT-249, Oct. 1970, 3 p

Results of the investigation are given on the CS-5 clip fastener.

0993
RAIL STRAIN MEASUREMENTS FRA PUEBLO TEST SITE TRACKAGE PUEBLO, COLORADO
Federal Railroad Administration, The Office of High Speed Ground Transportation, Washington, D. C., R-114, July 1972, 136 p

This is a supplement to the Association of American Railroads Research and Test Department Report No. R-109, Rail Strain Mesaurements.

0994
RAIL RESTRAINT MEASUREMENTS. FRA Pueblo Test Site Trackage, Pueblo, Colorado
Association of American Railroads, Research and Test Department, Chicago, Illinois, R-109, June 1971, 155 p

The purpose of this investigation is to measure the longitudinal (axial) strain changes which took place in the rails during construction of the Federal Railway Administration's 6.2 mile Linear Induction Motor (LIM) propelled vehicle test tract near Pueblo, Colorado.

0995
INVESTIGATION OF 132 LB. 1 YD. RAIL MADE FROM VACUUM DEGASSED STEEL
Association of American Railroads, Research and Test Department, Chicago, Illinois, R-110, Oct. 1971, 57 p

0996
INVESTIGATION OF RAILS MADE FROM CONTINUOUSLY CAST BLOOMS BY ALGOMA STEEL CORP.
Wisnowshi, J. J., Association of American Railroads, Research and Test Department, Chicago, Illinois, R-104, Oct. 1970, 51 p

0997
CAPABILITY OF FASTENERS TO RESIST RAIL OVERTURNING
Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-77, Nov. 1967, 8 p

The purpose of the investigation was to determine the overturning resistance of the rail fastened to either wood or prestressed concrete ties when subjected to various loading conditions. No effort was made to include the torsional resistance of the rail.

0998
OPTIMUM SAND AND EPOXY RESIN MIXTURES
Association of American Railroads, Research Department, Engineering Research Division, Chicago, Illinois, ER-62, Sept. 1965, 8 p

This report contains a description and analysis of data obtained in a laboratory investigation of the effect on certain physical properties by varying the amount of silica sand in an epoxy resin mixture.

0999
EPOXY RESIN COATINGS ON STEEL AND CONCRETE - 2ND REPORT
Drew, F. P., Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-65, Apr. 1966, 14 p

This report is a supplement to report ER-65, which uses the epoxy coating on the Huey Long Bridge, New Orleans, Louisiana, under a high humidity, heavy salt brine environment.

1000
FIELD INVESTIGATION OF PRESTRESS OF CONCRETE BEAMS AND PILES ON THE WESTERN PACIFIC RAILROADS
Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-61, Sept. 1965, 10 p

This report contains a description and analysis of data on two precast, prestressed concrete spans and a bent containing four, precast, prestressed, octagonal piles. The two spans are of 37 ft-7 in and 24 ft-11 in length and are composed of 5 beams each. The box beams have a circular void. The piles are 20 inches wide and also have a circular void.

1001
LABORATORY INVESTIGATION OF EPOXY RESIN BONDED BEAMS
Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-57, Apr. 1965, 5 p

This report contains a description and analysis of a laboratory investigation to demonstrate the effectiveness of an epoxy resin to transmit repetitive loads by bond between adjacent beams. Four prestressed concrete beams, 15 in wide, 18 in deep and 19 ft long were used.

1002
AN INVESTIGATION OF WELDING USED RAIL WITHOUT CROPPING
Association of American Railroads, Research Department, Engineering Research Division, Chicago, Illinois, ER-41, Dec. 1963, 6 p

At the request of the chief engineer of the Southern Pacific Railway an investigation was made at the AAR Research Center of welding used rail without cropping by the electric flash pressure process. If such a procedure were found to be satisfactory, it would save the cost of cropping the rail prior to welding and the scrapping of the cropped rail ends.

1003
PRESENT TRENDS IN THE METHODS OF MAINTENANCE AND RENEWAL...
Ozuka, H., Monthly Bulletin IRCA, Dec. 1965, p 821

Present trends in the methods of maintenance and renewal of the permanent way, with particular reference to: the influence of track thereon having regard to the demand for higher speeds; organization of the employment of labor and of mechanical equipment; costs, and safety measures for staff and trains and their effect on operational requirements.

1004
STUDY OF GLUED RAIL JOINT - AN EXAMPLE OF PLASTICS USED IN THE TRACK
Hayashi, Y., et. al., Tokyo, Railway Technical Research Institute, Vol. 5, No. 3, Sept. 1964, pp 45-46

1005
HIGHER SPEEDS THROUGH CURVES
Koffman, J. L., Railway Gazette, Vol. 126, May 1970, p 367

1006
TRACON - A NEW SYSTEM FOR TRACK ANALYSIS
Instrument Society of America, Preprint No. 23-1-TID-67

1007
DERAILMENT TEST WITH EXPERIMENT TRACK
Oki, H., Japanese Railways, Vol. 8, No. 4, Dec. 1967

1008
INTERACTION BETWEEN VEHICLE AND TRACK
Koffman, J. L., and Bartlett, D. L., Engineering, Vol. 220, Nov. 19, 1965, pp 832-833

1009
LATERAL LOADING BETWEEN LOCOMOTIVE TRUCK WHEELS AND RAIL DUE TO CURVE NEGOTIATION
Koci, L. F., and Marta, H., American Society of Mechanical Engineers, New York, New York, Paper 65-WA/RR-4, Nov. 7, 1965, 11 pp

1010
WHEEL AND RAIL WEAR
Mueller, C., Austrian Engineers Journal, July 1964

1011
THE STATIC AND DYNAMIC PARAMETERS OF RAILWAY COACHES - INTERACTION BETWEEN VEHICLE AND TRACK
Institution of Mechanical Engineers, London, England, Paper 10, Nov. 1965

1012
DYNAMIC LOADING AT RAIL JOINTS - EFFECT OF RESILIENT WHEELS
Bjork, L. J., Railway Gazette, Vol. 126, June 5, 1970

1013
INTERACTION BETWEEN VEHICLE AND TRACK
Institution of Mechanical Engineers, London, England, Nov. 9-11, 1965

1014
FRICTION ON RAILWAY RAILS
Lujnov, J. M., and Kossikov, S. I., Institution of Mechanical Engineers Proceedings, Vol. 178, Pt. 3E, 1963-64, pp 16-23

1015
CHEMICAL METHODS OF IMPROVING RAIL ADHESION
Andrews, H. I., Institution Mechanical Engineers Proceedings, Vol. 178, Pt. 3E, 1963-64, pp 172-184

1016
RECORDING RAIL TRACK GEOMETRY
Engineering, Vol. 201, May 20, 1966, p 968

1017
RESIDUAL STRESSES IN THE RAIL
Yasojima, Y., and Machi, K., Permanent Way, Vol. 8 No. 1, p 1

1018
BRITISH RAILWAY TRACK - DESIGN CONSTRUCTION AND MAINTENANCE
Permanent Way Institute, London, England, 1969, 507 p

1019
STRUCTURAL FATIGUE
Drew, F. P., Railway Track & Structures, Dec. 1966, p 19

1020
THE ULTRASONIC LOCATION OF DEFECTS IN FLASH WELDED RAILS
Kuz'mina, L. J., and Gurvich, A. K., Automatic Welding BWRA, Vol. 19, No. 9, Sept. 1966, p 74

1021
PERMANENT WAY
French Railway Techniques, No. 4, 1966, p 1

This is an entire issue devoted to all aspects of rails.

1022
HOW RAIL FACES UP TO THE DEMANDS OF A MODERN RAILWAY SYSTEM
Feybrand, C., French Railway Techniques, No. 4, 1964, p 177

1023
WHAT ARE THEY LEARNING ABOUT TRACK IN WASHINGTON?
Ward, E. J., Railway Track & Structures, Vol. 63, No. 6, June 1969, p 115

1024
WHEEL BURNT RAILS - THE CAUSES AND MEANS OF DETECTION
Banks, J., Permanent Way Institution Journal, Vol. 84, Pt. 3, 1966, p 210

1025
COUNTING TRACK DEFECTS AT TRAIN SPEEDS
Railway Track & Structures, Vol. 62, No. 4, Apr. 1966, p 30

1026
RAIL DEFECT TESTING IN THE U. S.
Railway Gazette, Vol. 125, No. 5, Mar. 7, 1969, p 180

1027
THE DYNAMICS AND ECONOMICS OF RAILWAY TRACK SYSTEMS
Railway Systems and Management Association, Chicago, Illinois

There are eleven reports in this brochure.

1028
SURVEY OF RAIL FAILURES ON JNR
Railway Gazette, Vol. 124, July 5, 1965, pp 505-508

1029
FLAW DETECTOR WAGON EXAMINES RAILS AT SPEEDS OF 100 KM/H
Vorobyev, A. I., Put i Putew Chosj, Oct. 1964, pp 17-19, in Russian

On the West Siberian line tests were carried out on runs with the flaw detector car at speeds of 100 km/h. A theoretical analysis is given of the possibility of detecting faults in rails at high speeds; there is also a report of the organizations of the test runs and of their results.

1030
REPORT OF COMMITTEE 31. CONTINUOUS WELDED RAIL
American Railway Engineers Association Bulletin, Feb. 1968, p 573

1031
SHELLINGS OF RAILS EXPERIENCED IN JAPANESE RAILWAYS
Permanent Way, Vol. 8, No. 2, Rpt. No. 27, p 17

1032
ULTRASONIC RAIL INSPECTION CAR
Nakamura, A, Japanese Railway Engineering, Vol 7, No. 3, Sept. 1966, p 14

1033
PREVENTING RAIL FAILURES IN TRACK
Magee, G. M., Materials Evaluation, Vol. 23, No. 10, Oct. 1965, p 508

1034
THE GAPLESS WELDED PERMANENT WAY AS SEEN FROM RAILWAY OPERATION/Hungary (Der luckenlos Geschweisste Oberbau aus der Sicht des Eisenbahnbetriebes)
Kerkapoly, E., (in German), Eisenbt, Rundschau, Jan/Feb 1965, pp16-24

Reduction of running resistance, joint gaps between the ends of the rails, and vertical and horizontal steps between the ends of the rails are discussed. Resistance measurements; proposal for the figure of rail joint resistance; noise tests on lines with fished joints and with gapless tracks; foundation with plastic foil sealing; prevention of damage to track foundation; and questions regarding the economic aspect are given. Extra costs and savings of the welded track are compared with the fish-plated track.

1035
EVALUATING THE ABRASIVE CHARACTERISTICS OF RAILS AND TYRES ON THE BASIS OF LABORATORY INVESTIGATIONS
Horejs, S., Hutnicke Listy, Dec. 1956, pp 721-728, in Czech

Specific conditions were laid down for these investigations so as to simulate actual service. Abrasion is heaviest on rails in curves. Dry adhesion friction has been chosen for this so as to obtain a clear picture of the microstructure, hardening and chemical composition. The test process used by the EMPA (Swiss Federal Physical Laboratory) in Zurich is explained in full. The individual test moments are then discussed, showing that the results are very close to the actual.

1036
RECENT TRENDS IN TRACK RESEARCH ON INDIAN RAILWAYS
Joseph, T. V., and Ramakrishna, H. S., Indian Railways Technical Bulletin, No. 154, Aug. 1964, pp 54-65

Part I is on track modulus and vertical bending stresses in rail.

1037
CONTINUOUS WELDED RAIL
AREA Bulletin No. 591, Feb. 1965, pp 508-517

Part 1 is a progress report on the development of specifications for fabricating continuous welded rail. Part 2 covers the examination of service and detected failures of butt-welded rail joints. Part 3 furnishes the results of rolling-load and slow-bend test of butt-welded rail joints.

1038
LAYING LINES WITHOUT TRIMMING THE ENDS
Koslovsky, V. A., and Krasovsky, S. N., Put i Putew Chosj., May 1965, pp 8-12, in Russian

In the course of some years at the PMS-75 long rails have been laid without trimming the hardened ends. Details are given in the article. New machines and equipment which are used by the track workers are described, and a sample calculation which is carried out before laying jointless track are examined.

1039
PROCESS FOR DETECTING RAIL STRESSES (VERFAHREN ZUR ERMITTLUNG DER SCHIENENSPANNUNGEN)
Gilber, E., Signal & Schiene, Mar. 1965, pp 95-99, and Apr. 1965, pp 150-151

After introductory observations on the longitudinal girder method of calculation, the transverse sleeper calculation is given in full as a method of calculation. Then the reason is given for introducing a new speed factor. Observations follow on the degree of safety and the permissible rail stressing, with examples of calculation.

1040
RAIL TESTING ON SOVIET RAILWAY LINES(SCHENENPRUFUNG AUF DEN STRECKEN DER SOWJETISCHEN EISENBALINEN)
Tutzschky, G., Signal & Schiene, Aug. 1965, pp 318-321, In German

Rail-testing conditions and principles of rail-testing methods are described (magnetic and ultrasonic rail tests). Construction and use of individual testing apparatus are discussed (detectoscope cars and small-size appliances). The economic aspect of, and conclusions from test investigations are given.

1041
LATERAL WEAR AND CRUSHING OF THE RAIL HEAD ON TRACK CURVES
Andrievykij, S. M., Vestnik CNII MPS, No. 3, 1960, pp 40-46, In Russian

The initial stage of the alteration in form of the head of the rail are described. Crushing represents the greatest danger to the durability of rails, as cracks gradually form under the metal outgrowths, leading to cracking of the rail heads and fracture of the rails. Crushing of rail heads dependent on various factors. The article shows how reducing the dynamic action of rolling on the track considerably increases rail durability. A table gives data on the wearing effect of the points of contact of the wheels included in six categories.

1042
LABORATORY INVESTIGATION OF RAILWAY PRESTRESSED CONCRETE BOX BEAMS
Drew, F. P., Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-53, Feb. 1965, 11 p

This report contains the description and analysis of a laboratory investigation of the static and repeated load strength of nine full-size box beams cast with regular mineral aggregates.

1043
HOLD-DOWN FASTENINGS FOR TIE PLATES, INCLUDING PADS UNDER PLATES: THEIR EFFECT ON TIE WEAR
Lamport, L. R., Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-54, Mar. 1965, 23 p

This test was primarily for the purpose of determining the effectiveness and economy of various types of hold-down fastenings, tie pads, etc., as related to tie life, re-gaging and re-adzing. The traffic density was approximately 20 million gross tons annually through 1953 with some reduction in both freight and passenger traffic since 1953. The line was completely dieselized in November 1956.

1044
SERVICE INVESTIGATION OF VARIOUS TYPES OF JOINT BARS ON SANTA FE AND NORTHWESTERN RAILWAYS
Lamport, L. R., Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-50, Oct. 1964, 6 p

This report covers the service investigation of various types of joint bars and variations of bolt spacing on the Atchison, Topeka and Santa Fe Railway near Streator, Illinois and on the Chicago and North Western Railway at Sterling, Illinois.

1045
AN INVESTIGATION OF VARIOUS WELDING TECHNIQUES FOR BUILDING UP BATTERED RAIL ENDS
Kannowski, K., Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-32, Mar. 1963, 3 p

The building up of battered rail ends by means of different welding procedures and the evaluation of welding rods and electrodes used in these procedures is of considerable importance to the railroads. An investigation on this subject using 12 in. stroke rolling load machines at the Research Center has been carried on under the general direction of G. M. Magee, and by the author.

1046
LABORATORY INVESTIGATION OF PRESTRESSED CONCRETE RAILWAY BRIDGE BEAMS
Association of American Railroads, Engineering Research Division, Chicago, Illinois, ER-36, June 1963, 17 p

This report contains a description and analysis of laboratory tests made during 1960, 1961, and 1962 on 23 full-size prestressed concrete beams. These beams are 18 in. deep, 15 in. wide, and 19 ft. long and were patterned after the full-size slabs reported in AREA Proceedings, Vol. 59, p 133.

1047
CALCULATED STRESSES IN CONCRETE TIES
Association of American Railroads, Chicago, Illinois, Aug. 1966-Feb. 1968, 30 p

The handwritten, unpublished report shows computations for several designs of concrete ties.

1048
SOVIET CONCRETE TIE SPECIFICATIONS
Brochure, 1964, 2 p, In Russian

This Russian brochure shows diagrams and specifications of concrete ties and fasteners.

1049
FASTENING CONCRETE TIES IN GERMANY
Aug. 1966

This item consists of six photos showing concrete tie fasteners used in Germany.

1050
TESTS ON MR3 CONCRETE TIES
Unpublished Rpt., 1966, 60 p

This collection consists of 60 pages of hand written sketches and calculations. Photographs of ties being tested are included.

1051
(PRELIMINARY) SPECIFICATIONS FOR PRESTRESSED CONCRETE TIES
June 7, 1966, 27 p

Twenty figures are included with these preliminary specifications.

1052
BRITISH CONCRETE TIE AND CLIP FASTENER TECHNOLOGY
1966

A collection of reports and correspondence is presented on British Concrete Tie Technology and clip fasteners. Some of the reports included are: "Service Trials and Performance of Concrete Sleepers, 1965"; "Progress in Prestressed Concrete Railroad Ties, 1958"; and "Class F Main Line Concrete Sleepers, 1960".

1053
VAN COURT TIE
Unpublished Rpt., 1966-1967, 37 p

A collection of correspondence with sketches regarding the Van Court Ties is presented. Costs are discussed.

1054
CONCRETE TIES SWEDEN
1966

The collection includes pamphlets and correspondence regarding Swedish Concrete Tie Technology.

1055
NOISE AND SOUND PROOFING: MOTIVE POWER, ROLLING STOCK, ON THE TRACK AND ON BRIDGES.
Railway Research Index C/1

1056
BITUMEN (ASPHALT) IN TRACK CONSTRUCTION
Railway Research Index C/4

1057
WHEEL SLIP AND SLIDE DETECTION
Railway Research Index C/8

1058
TUNNELS AND METRO TUNNELS/TRACK WITH SLEEPERS/TIES. CONSTRUCTION AND RENEWAL OF BALLAST AND TRACK.
Railway Research Index C/17

1059
GAUGE WIDTH AND GAUGE WIDENING SIX FOOT WAY/TRACK SPACING.
Railway Research Index C/18

1060
TRACK CURVES/CURVE CALCULATION, SURVEYING, CURVED TRACKS, LIMITS/RUNNING SPEEDS/TRACK BEHAVIORS.
Railway Research Index C/19

1061
RUNNING THROUGH CURVES/TRACK GUIDANCE AND RUNNING TECHNIQUE; BEHAVIOR; DERAILMENT; MAXIMUM SPEED; SPEED FORMULAE; SAFETY; RUNNING
Railway Research Index C/20

1062
RUNNING/RIDING/DYNAMIC STABILITY OF PASSENGER COACHES AND GOODS STOCK
Railway Research Index C/43

The items in this issue discuss riding quality, riding index, smooth running, vertical movements, lateral running stability and vibration process.

1063
RUNNING/RIDING/DYNAMIC STABILITY CALCULATIONS OF ROLLING STOCK/MOTIVE POWER, GOODS/FREIGHT WAGONS/CARS AND PASSENGER COACHES
Railway Research Index C/41

The items in this issue discuss riding qualities; riding index; smooth running; vehicle oscillation; vertical movements; lateral running; vibration process; rocking, hunting and pitching; and calculating dynamic behavior of rolling stock with computers.

1064
RAILWAY TESTING STATIONS/WIND TUNNEL TESTS, TEST BED TRIALS, TEST BENCHES, TEST TRACKS
Railway Research Index C/21

1065
CONTINUOUS BED OF CONCRETE ON PRECAST-SLAB TYPE OF PERMANENT WAY
Railway Research Index C/7

1066
RUNNING/RIDING/DYNAMIC STABILITY OF BOGIES
Railway Research Index C/42

The items in this issue discuss riding quality, riding index, smooth running, vertical movements, lateral running stability, and vibration processes.

1067
PERMANENT WAY WITHOUT SLEEPERS/TIES ON BRIDGES
Railway Research Index C/2

1068
UNDERGROUND (METRO)-TUNNEL TRACK CONSTRUCTION WITHOUT BALLAST AND/OR SLEEPERS/TIES
Railway Research Index C/3

1069
JOINTLESS TRACK ON NEW LINES
Lovyan, G. S., Putj i Putevoe Hoziaistvo, July 1967, pp 24-25. In Russian

On the new Bataisk-Starominsk line jointless track was laid on newly constructed earth foundation and a layer of ballast. On new lines R.50 rails are used, together with S.56 ferro-concrete sleepers, crushed stone ballast 25 cm. thick under the sleepers with a 20 cm. sand base, and K-2 individual fastenings. The construction of the new track is described.

1070
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAIL/ REPORT OF COMMITTEE 4
AREA Bulletin, No. 605, Feb. 1967, pp 409-417

Service and detected failures of control-cooled rail in the period Oct. 1, 1965-Oct. 1, 1966, are described.

1071
FOREWARNING AND ELIMINATION OF DEFECTS IN THE RAILS
Sukhikh, I. A., Putj i Putevoe Hoziaistvo, Jan. 1967, pp 21-23. In Russian

The track inspection depot checked new rails from different factories, as well as those welded on the lines. The irregularities were measured by means of a Shestopalov bogie and recorded on tape with a horizontal scale of 1:200 and a vertical scale of 2:1. A number of local distortions of the rail were detected as a result of the measurements. The length of the irregularity was 40-90 cm. as a rule. The wave-like wear which appears during service should be considered as another form of irregularity. The development of this type of wear also depends on factory flaws, as experiments have shown. The wavy form of wear and the metal spreading both have identical effects on the permanent way during the passage of rolling stock, but it is necessary to differentiate them because the wear in the cross section of the head is not identical, and the degree of damage is different in the two cases. A typical record of this form of irregularity is shown. Damage to rails due to locomotive slip is encountered at train stopping points and, in particular, on gradients. This damage develops into deep and short troughs. A table gives the results of measurements of welded lengths on the Donets and North Caucasus lines. The practice of machining rails in the track shows that the grinding capacity of the stones is still low and that the operation of the rail-grinding wagon remains unproductive, particularly on new rails. It follows from this report that there is an urgent necessity to develop grinding machines which could machine welded joints in welding undertakings in strict accordance with the established profile both in the length and the cross-section of the head.

1072
RAILS: SOME OBSERVATIONS ON THEIR QUALITY AND PERFORMANCE ON BRITISH RAILWAYS
Dearden, J., Railway Steel Topics, No. 1, Spring, 1967, pp 30-39

Factors influencing the incidence of failures in rails, particularly the influence of total trains carried, of different kinds of welded joints and the quality of the steel, are discussed. Broken rails are shown to be a very infrequent cause of derailments. Existing acceptance tests are discussed in regard to their intended influence on rail quality.

1073
RAIL FAILURE STATISTICS/REPORT OF COMMITTEE 4
AREA Bulletin, No. 605, Feb. 1967, pp 418-436

Rail failure statistics are presented covering the following: all failures; transverse fissures; and performance of control-cooled rail.

1074
PLASTIC DEFORMATION OF RAIL HEADS WITH CONTACT FATIGUE DAMAGE
Konyukhov, A. D., and Shur, E. A., Vestnik CNII MPS, No. 2, 1964, pp 52-55. In Russian

The role of plastic deformation in contact fatigue damage up to now has not been finally cleared up. Here the experiment is carried out of analyzing the distribution in the rail heads of the volume of the metal suffering from plastic deformation in the course of service and also comparison of this data with the position of the contact fatigue damage in the rails.

1075
DESIGN AND MAINTENANCE OF HIGH-SPEED PERMANENT WAY
Troyitzky, L. F., IRCA Bulletin, Aug. 1968, pp 837-853, Sept. 1968, pp 928-945, and July 1968, pp 807-824.

Heavier rails, rail wear, rail fastenings, concrete sleepers, types of frogs, coefficient of stability, track carrying optical instrument for track aligning are discussed. The camberograph for determining the exact location and dimension of irregularities or undulations in the horizontal plane is described. Experience, maintenance, design and labor problems are discussed.

1076
INHERENT STRAINS AND STRESSING OF THERMIT-WELDED RAILS (EIGENSPANNUNGEN UND BEANSPRUCHUNG DER THERMIT GESCHWEISSTEN SCHIENE)
Dobse, R. J., Archiv Eisenbahnt., No. 23, Dec. 1968, pp 1-18. In German

Resolution of the forces acting on the head of the rail for calculating the supplementary longitudinal strains at the lower edge of the head and at the outer edge of the base are given. Additional stressing occurs at the lower edge of the head of the rail due to vertical forces acting centrally. Super-imposition of the longitudinal stresses caused by operational loading on the inherent strains set up by thermit welding is

discussed. Maximum values for the shear stress distribution inside the rail head and on the surface under the rolling and starting or braking wheel, taking the bending stresses, temperature and inherent strains into account are given. The effect of inherent strains on the durability of rails and a summary of the results of tests of inherent strain measurements on rails are given.

1077
ON RESTORING RAIL LENGTHS OF JOINTLESS TRACK AFTER FRACTURE
Klinov, S. I., Vestnik CNII MPS, No. 1, 1966, pp 41-45. In Russian

This article gives the results of investigating the linear resistance of jointless track in Winter. The existing methods of calculating the amount of gap formed in a broken length is examined, and an analysis of the temperature-stress condition of a length restored after fracture is given.

1078
REPAIRING JOINTLESS TRACK BY WELDING
Sharov, I. F., Putj i Putevoe Hoziaistvo, Jan. 1968, pp 6-7. In Russian

The experimental work carried out by the welding department showed that broken and faulty jointless rail lengths can be effectively restored by contact welding. A description is given of this welding system.

1079
TEST ON REPAIR OF RAIL SLIP DAMAGE THROUGH HEATING CORRECTION
Aoyama, S., Railway Technical Research Rpt. No. 3, Sept. 1968, pp 182-183

Tests were made to establish the possibility of heating the top and web of a slip-damaged rail and correcting it as laid in the track without replacing it with a new one. The results proved the feasibility of this rail correction method. Test results are briefly described.

1080
WELDING AND BONDING PRACTICE IN THE MANUFACTURE OF NEW CROSSING FROGS AND ALSO IN THE REPAIR OF THEM (SCHWEISS- UND KLEBTECHNIK BEI DER NEUFERTIGUNG UND REPARATUR VON HERZSTUCKEN)
Zoll, W., Signal & Schiene, July 1968, pp 272-277

This literature and patent review discusses welding of crossing frogs, and bonding crossing frogs with high-tensile bolts. Results of the work in the laboratory and trials in service are given.

1081
RESULTS OF ROLLING-LOAD TESTS OF BUTT WELDED RAIL JOINTS
AREA Bulletin, No. 619, Feb. 1969, pp 699-711

Between Oct. 1967 and Sept. 1968, 15 butt welded rail joints were tested on the rolling-load machines. These joints were made by the oxyacetylene and thermit welding processes. During this period there were no slow bend tests conducted on butt welded rail joints. Results of the tests are given.

1082
a) INVESTIGATION OF SERVICE AND DETECTED BUTT WELDED RAIL JOINT FAILURES
b) INVESTIGATING OF FAILURES IN CONTROL-COOLED RAIL
c) CAUSES OF SHELLY SPOTS AND HEAD CHECKS IN RAIL; METHODS FOR THEIR PREVENTION
d) RAIL FAILURE STATISTICS
AREA Bulletin, No. 619, Feb. 1969, pp 681-698, 718-733, 755-780, 734-754

The first article discusses butt welded rail joint failures investigated during the period from Oct. 1967 to Sept. 1968. The second article presents results of tests conducted at the AAR Research Center on six service failures and one detected failure in control-cooled rail during the same period. The third article summarizes the head-treated and alloy rail service test installations on curves with shelly histories. Results of rolling-load and slow-bend tests are given. Statistics presented in the last article are on failures, transverse fissures, and performance of control-cooled rail.

1083
GRINDING RAILS INCREASES THEIR SERVICE LIFE
Shvarts, Y. F., Putj i Putevoe Hoziaistvo, June 1968, pp 19-21. In Russian

Failure of rails in service owing to defect 21 on straight and curved sections is discussed. Diagram for determining the magnitude of fault-free operation of rails is given. A nomogram of limit lines and a graph for carrying out rail grinding are given. The rate of development of contact fatigue defects is discussed.

1084
ON THE EFFECT OF RAIL HARDNESS ON ROLLING WEAR IN TEST BED TRIALS (COLLOQUY ON DRY METALLIC WEAR, WITH SPECIAL REFERENCE TO THE WHEEL AND RAIL PROBLEM, AUG. 1967)
Trebst, W., Wiss. Zt. Hochschule Verkw, No. 3, 1968, pp 689-695. In German

The test bed, test program and results are discussed. The wear on specimens of wheel and rail material is shown diagrammatically. Comparison of wear values is given.

1085
TRACING RAIL DEFECTS BY ULTRASONICS
Nyhien, G., Jarnvags Teknik, No. 4, 1969, pp 82, 84-86,88-89, No. 1, 1970, pp 2, 4, 6, 8-10, 12-13

This item deals with the ultrasonic nature of undulatory movement and the physical principles for ultrasonic testing. Ultrasonics in rail testing and how this work is managed by the Swedish Railways are described.

1086
LONGITUDINAL IRREGULARITIES IN THE RAILS
Lukyanov, A. V., Putj i Putevoe Hoziaistvo, Jan. 1969, pp 27-29. In Russian

All rails issued are in the form of straight lengths, but the rolling surface and the lateral edges of the head have longitudinal wave-like distortion. This distortion (corrugation) forms continuous irregularities of varying length and depth. The so-called individual irregularities and end distortions are the most noticeable in magnitude of the particular component corrugations. The failure of the rails as a result of contact fatigue defects reached 30 to 40%. Numerous observations have established very clearly that there is a connection between the rail corrugation processes and contact-fatigue damage in rails.

1087
RESULTS OF INSPECTIONS OF HEAT-TREATED AND ALLOY-RAIL SERVICE TEST INSTALLATIONS ON CURVES WITH SHELLY HISTORIES, 1964
AREA Bulletin, No. 591, Feb. 1965, pp 479-484

Service tests are described for 132-lb. fully heat-treated rail, 115 RE high-silicon rail, 140 RE and 155 PS high-silicon rails, and 140 RE 0.79/0.92 percent carbon rails.

1088
GAS PRESSURE WELDING OF RAIL JOINTS
Sarkar, N. K., Indian Railway Technical Bulletin, No. 171, Nov. 1968, pp 131-134

The process of gas pressure welding of rail joints is described. The economics of this process as compared with the flash butt and thermit welding processes are discussed.

1089
THE GENERAL CONCEPT OF THE CONTINUOUS METHOD OF WELDING RAILS USED ON THE SNCF (LA CONCEPTION GENERALE DES CHAINES DE SOUDAGE DE RAILS A LA SNCF)
Naucodie, SNCF Bulletin Information Technical Direction des Installations Fixes, No. 5, Jan. 1969, pp 67-75. In French

A description of this continuous process for welding rails, its results and future prospects are given.

1090
GRINDING OF RAILS IN TRACK
Schader, S. E., Jarnvags Teknik, No. 5, 1969, pp 115-116, 118. In Swedish

During the last few years, the Swedish Railways has used the Speno rail grinding train, type TM.815. Experience gained from grinding short and long waves (corrugation) and from gauge grinding with the Kiruna device is described.

1091
WELDING FROGS ON THE TRACK
Bykov, A. N., Putj i Putovoe Hoziaistvo, May, 1968, pp 26-27. In Russian

Vertical wear is discussed of the cores of frogs depending on the tonnage carried. Fatigue crack developed in the welded-up zone, and fatigue crack developed in the base metal. The effect of the width of the welded layer in the service life of a frog in the track is described. The methods of welding and cooling are also found to have a marked effect on the development of cracking in the neighborhood of the seam.

1092
NATURAL STRESSES AND THEIR INFLUENCE ON THE LIFE OF THERMIT-WELDED RAILS (EIGENSPANNUNGEN UND IHR EINFLUSS AUF DIE HALTBARKEIT DER A. T. GESCHWEISSTEN SCHIENE)
Dohse, R., Dissertation, TH. Munich, Nov. 1965. In German

This article discusses the following: the Thermit (pressure) welding method, with and without a weld reinforcement; natural stresses; determination of natural stresses in rails and in Thermit-welded rail-joints; stresses in rails as part of the track; and natural stresses and their influence on the rail life.

1093
THE PROBLEM OF RAIL CORRUGATION AND ITS EFFECTS ON THE PERMANENT WAY AND ROLLING STOCK (PROBLEM SCHIENENRIFFEL UND DIE AUSWIRKUNGEN AUF DEN OBERBAU UND FAHRZEUGPARK)
Neumann, R., Signal & Schiene, Nov. 1969, pp 451-454. In German

Theories regarding the formation of corrugations on the running surfaces of rails, and the effect of currugated rails on the permanent way and rolling stock are discussed.

1094
INVESTIGATIONS INTO THE WEAR BEHAVIOUR OF RAIL MATERIAL USED BY THE GERMAN STATE RAILWAYS (UNTERSUCHUNGEN UBER DAS VERSCHLEISSVERHATEN DER BEI DER DR VERWENDETEN SCHIENENWERKSTOFFE)
Mosken, K., Signal & Schiene, Nov. 1964, pp 372-375. In German

A description is given of investigations into wear carried out, with the result that the rail materials used show varying behavior as regards to wear.

1095
RAIL FAILURES
AREA Bulletin, No. 591, Feb. 1965, pp 454-470

Rail failure statistics are given which cover all failures, transverse fissures, and performance of control-cooled rail.

1096
REPAIRING RAIL WELDING MACHINES
Solodovnikov, S. A., Put i Putew Chosj., Dec. 1964, pp 36-38. In Russian

At the present time on almost all lines there are in service new mobile rail welding machines (P.R.SM). The welding head of these machines have a number of peculiarities compared with the stationary units. The report deals with the method to use with this machine in order to avoid a shut-down and how to eliminate various faults.

1097
IMPROVING THE METHOD OF PLANNING JOINTLESS TRACK
Volodin, A. M., Putj i Putevoe Hoziaistvo, May 1967, pp 28-29. In Russian

The method for planning is described. The lines on which jointless track is to be installed have to be broken down by the planners into separate sections, having established the temperature interval for each section, which is different for straight lines and curves and depends on the speed, the type of locomotive and the sleepers.

1098
THE STABILITY OF JOINTLESS TRACK DURING MAINTENANCE
Chirkov, N. S., Putj i Putevoe Hoziaistvo, July 1967, pp 9-11. In Russian

When repair work is carried out, the track is slackened and its stability is reduced. In order to ensure this, it is necessary to observe certain definite restrictions. Among these are the permissible drop in the temperature of the rails relative to the temperature at which they were fastened. The amount of the horizontal or vertical transverse displacement of the rail sleeper grid, the length of the slackened section and the extent of the slackening. The jointless track laboratory conducted an experimental study on a special test section. The experimental set-up was in the form of curved and straight sections of track. A description of the experiments, results obtained, and recommendations based on the experiments are given.

1099
INVESTIGATION OF CONTACT-FATIGUE DAMAGE OF RAIL HEADS
Vikker, I. V., Vestnik CNII MPS, No. 7, 1965, pp 45-48. In Russian

The results of investigating changes in the structural state of the metal in the heads of rails, both heat treated, and with natural hardness, and type II distortions are discussed.

1100
HOW TO INCREASE THE SERVICE LIFE OF RAILS
Angeleiko, V. I., Putj i Putevoe Hoziaistvo, Oct. 1967, pp 18-19. In Russian

Rails which were removed on account of contact fatigue damage from the other rail of a curve of 640 m radius on one of the load stressed sections were repaired by the Kryukov rail welding factory. Up to then they had carried 204 million tons gross of freight with an inter-repair life of 120 million tons. An examination of the rails showed that there were on the average of 17 defects on each of them. Only a small part of them could be laid on other tracks, and it was proposed to hand over the remainder as scrap. In the rail welding train, the damage metal was removed from the head with a MC-21 edge-planer. Then the places where the defects were more than 4 mm deep were cut out. After this the rail was welded and justified. They were planed up to a depth of 4 mm. In this way all the damaged places visible to the eye and found by the defectoscope were almost completely removed.

1101
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS
AREA Bulletin, No. 591, Feb. 1965, pp 447-453

During the period from Aug. 1, 1963, to Oct. 1, 1964, 13 failed control-cooled rails were submitted to the AAR Research Center for metallurgical examination. The failed rails are listed and include both service failures and detected failures.

1102
ANTICIPATING RAIL DEFECTS
Slivets, D. P., and Tretyak, V. A., Put i Putew Chosj., Feb. 1966, pp 9-10. In Russian

The staff of the track inspection station of the Pridnieper line carried out observations on the formation and development of defects of 64 and 82 types in heavy rails and have made recommendations for prolonging the service life of such rails.

1103
ANTICIPATING CONTACT DEFECTS IN RAILS
Kislik, A. I., Put i Putew Chosj., Mar. 1965, pp 7-8. In Russian

On curved track sections on the riding surface of the rails contact damage occurs. The author investigates the causes of the appearance of contact damage to the rails in respect of load carried by the track and the plan and profile of the line. Recommended methods for reducing the intensity of development of these defects are given.

1104
FOREWARNING OF CONTACT FATIGUE DEFECTS
Vakhenko, V. I., Put i Putew Chosj., Nov. 1965, pp 41-42. In Russian

An analysis of the causes of damage to rails by defects of contact fatigue origin and the increase of undulating wear. Results are given of observations carried out in the St.NII test track, and there is a discussion of methods of eliminating these defects in rails and prolonging their service life.

1105
FLAME-HARDENING PROCESS GETS NEW LOOK
Railway Track & Structures, Nov. 1965, pp 22-23

Improvements in the Linde method are designed to produce hardened rail capable of meeting the stiffest specifications

1106
MILWAUKEE RAILROAD BUTT-WELDS RAILS FOR SPECIAL LOCATIONS
Railway Track & Structures, Nov. 1965, pp 20-21

The use is described of alumino-thermic process to produce joint welds in rails at a station and for grade crossings.

1107
DYNAMICS OF RAIL FAILURES IN THE TRACK
ORE Bulletin, No. 25, July 1967, pp 33-35

A study of the dynamics of rail failures in the track, and methods for measuring transverse cracks in the head are discussed.

1108
RAIL HEAD STRESSING. A COMPARISON BETWEEN THEORY AND PRACTICE (SCHIENENKOPFBEANSPRUCHUNG. VERGLEICH ZWISCHEN THEORIE UND PRAXIS)
Eisenmann, J., Eisenbahnt. Rundschau, Oct. 1967, pp 355-361. In German

Model tests with a synthetic resin rail, calculation of the permissible wheel loading and wheel radius, and damage in practice are discussed. Rail head fractures are fatigue failures and may be attributed to shearing stress present close to the contact surfaces between wheel and rail. The shearing stress responsible for the fracture can be calculated by using the semi-space theory.

1109
REPAIRING RAILS BY CUTTING
Belousow, N. Z., Put i Putew Chosj., June 1966, pp 19-21. In Russian

Rails lying in curved sections of the track under high load stressing fail in service due to contact damage. An account is given of preventive maintenance of rails by cutting, and technico-economic calculation is given of the effectiveness of this method. It is shown that it is economically advisable to normalize rails since this prolongs their service life in curves without their having to be replaced between major overhauls.

1110
RAIL FAILURES AND THEIR ANALYSIS IN THE EASTERN RAILWAY
Sinha, H. S., Indian Railway Technical Bulletin, No. 166, Aug. 1967, pp 109-115

Rail failures during the period 1962 to 1965 have been analyzed, and compared with the British and Japanese Railways. Recommendation, for further analysis of rail failures on the Indian Railways, was wider use of ultrasonic flaw detectors and visual detection of hair cracks.

1111
RAIL FAILURES
AREA Bulletin, No. 598, Feb. 1966, pp 451-472

Rail failure statistics are given which cover all failures, transverse fissures, and performance of control-cooled rail.

1112
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAIL
AREA Bulletin, No. 612, Feb. 1968, pp 620-631

In the period between Oct. 1966 and Oct. 1967, there were seven failures in control-cooled rail, three service and four detected, investigated by the metallurgical laboratory of the AAR. A summary of the failures is given.

1113
INVESTIGATIONS OF FAILURES IN CONTROL-COOLED RAIL
AREA Bulletin, No. 598, Feb. 1966, pp 446-451

During the period from Oct. 1, 1964 to Oct. 1, 1966, 8 failures, including both service and detected failures, in control-cooled rail were submitted to the AAR Research Center for metallurgical examination. The failed rails are listed and include both service failures and detected failures.

1114
USE OF DEFECTSCOPY ON THERMIT-WELDED RAILS
Tutzschky, G., Signal & Schiene, Nov. 1966, pp 444-446, 456. In German

Considerably more rails are now thermit-welded since the change to gapless welded tracks, and one result has been that the number of breakages in the thermit welds has also increased considerably. These breakages occured in many cases in epidemic fashion, especially with newly-laid sections of line. Breakages also piled up in the winter months. Causes of breakages, checking possibilities and tests with defectoscopy are described.

1115
EXPERIMENTAL STUDY OF NEW-TYPE TRACK. TRACK LAID ON CONCRETE SLAB WITH ADJUSTING BLOCK
Tsumenaga, T., Railway Technical Research Institute, Vol. 8, No. 3, Sept. 1967

1116
PLASTICS IN TRACK CONSTRUCTION
Knauthe, C., Deutsche Eisenbahntechnik, No. 3, Mar. 1964, pp 134-138

1117
GLUED RAIL JOINT FOR INSULATION BY DRY METHOD
Umekubo, S., et. al., Railway Technical Research Institute, Vol. 8, No. 1, Mar. 1967, pp 60-61

1118
EXPERIMENTAL STUDIES OF CONCRETE-PAVED RAILWAY TRACK
Hoshino, Y., Railway Technical Research Institute, Vol. 1, No. 3, Sept. 1960, p 68

1119
MEASUREMENT OF LOCAL STRESSES ON OUTER RAIL HEAD
Sugiyama, T., et. al., Railway Technical Research Institute, Vol. 12, No. 1, pp 11-13

1120
PRESTRESSED CONCRETE TIES (PC TIES) FOR SHARP CURVES, STEEL GRADIENTS AND FROST-HEAVE SECTIONS
Ito, H., Japanese Railway Engineering, Vol. 10, No. 2, 1969, pp 25-27

1121
COMPREHENSIVE TRACK MAINTENANCE SYSTEM
Genton, D. L., Railway Gazette, Vol. 126, No. 12, 1970, pp 465-467

1122
RELATION BETWEEN TRACK IRREGULARITIES UNDER TRAIN LOADS AND NO LOADS
Ikemori, M., Railway Technical Research Institute, Vol. 4, No. 2, pp 48-50

1123
EXPERIMENT ON GRADING OF CRUSHED STONES FOR RAILWAY BALLAST
Satoh, Y., et. al., Railway Technical Research Institute, Vol. 3, No. 2, pp 26-30

1124
RAILWAY TRACK VIBRATION INDUCED BY TRAIN MOVEMENT
Sato, Y., et. al., Railway Technical Research Institute, Rpt. 85, Aug. 1959

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GEOPHYSICAL STUDY OF SOIL DYNAMICS
Bernard, R. K., Discussion from a New York meeting, Feb. 1938

1126
LAYING AND MAINTENANCE OF LONG RAILS
Ijichi, K., Railway Technical Research Institute, Vol. 3, No. 3, pp 20-22

1127
TRACK FOR HIGH SPEED RAILWAYS IN THE WORLD
Japan Railway Civil Engineering Association, Permanent Way, Vol. 12, No. 1-2, Special Issue, No. 42-43

1128
DYNAMIC RESPONSE OF CONTINUOUS BEAM ELEVATED GUIDEWAYS. VOL. II - THE COMPUTER PROGRAM
Lipner, N., et. al., TRW Systems, Rpt. to the Office of High Speed Ground Transportation, July 1970

1129
TRAIN/ELEVATED GUIDEWAY PARAMETRIC INVESTIGATION
Soux, A. L., TRW Systems, Rpt. to the Office of High Speed Ground Transportation, July 1970

1130
TEST CAR REPORT. SECOND REPORT
Hurley, F. J., et. al., Melpar, Inc., Rpt. to FRA, Sept. 1970

1131
A CALCULATION OF THE LATERAL HUNTING MOTION OF A TRACKED VEHICLE
Iguchi, M., Massachusetts Institute of Technology, Cambridge, Mass., Dpt. to the U.S. Commerce Dept., Available: NTIS, PB 173652

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DYNAMIC RESPONSE OF CONTINUOUS BEAM ELEVATED GUIDWAYS. VOL. I - ANALYSIS
Lipner, N., et. al., TRW Systems, Rpt. to the Office of High Speed Ground Transportation, July 1970

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THE EFFECT OF TRACK GEOMETRY ON RIDE QUALITY
Ullman, K. B., et. al., American Society of Mechanical Engineering, Paper 69-CP-355-IEA, Apr. 15-18, 1969

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EXPERIMENT OF HUNTING DERAILMENT WITH A ONE-FIFTH MODEL WHEELSET
Yokose, K., Railway Technical Research Institute, Vol. 2, No. 4, 1970, pp 228-231

1135
AN ANALYSIS OF BENDING STRESSES AND DEFLECTIONS IN RAILROAD RAILS
Butler, A. B., University of Illinois, Urbana, Illinois, Master's Thesis, 1969

1136
DYNAMIC TESTS ON RAIL FASTENINGS
Railway Gazette, Vol. 122, June 17, 1966, pp 496, 498

1137
THE TEST ON BUCKLING OF CURVED TRACK
Japanese National Railways, Publication Data Unknown

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NONLINEAR AND FINITE PAD LENGTH PERFORMANCE OF VEHICLE AIR CUSHION SUSPENSIONS
Wormley, D. N., et. al., Massachusetts Institute of Technology, Cambridge, Mass., Final Rpt., Feb. 1972

To illustrate the design information resulting from the transient performance and finite pad length study, the prototype designs of suspensions for interurban and intercity vehicles are discussed.

1139
STEADY-STATE VIBRATION OF BEAM ON ELASTIC FOUNDATION FOR MOVING LOAD
Kenney, J. T., Journal of Applied Mechanics, Dec. 1954, pp 359-364

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DETERMINING THE DEPTH OF THE BALLAST
Milosevic, B., International Railway Congress Association-Bulletin, Feb. 1969, pp 141-146

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SOME PROBLEMS IN VEHICLE RIDING
Cox, E. S., Institution of Locomotive Engineers Journal, Vol. 51, Pt. 5, No. 283, 1961-1962

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SOME EXPERIMENTS ON THE LATERIAL OSCILLATION OF RAILWAY VEHICLES
Davies, R. D., Paper No. 5158, Source Unknown

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HIGH-SPEED RAIL: PROBLEMS AND PROSPECTS
Ullman, K. B., Department of Transportation, Office of High-Speed Ground Transporation, Washington, D. C.

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VEHICLE SUSPENSION AND BOGIE DESIGN IN RELATION TO TRACK CONDITION
Hancock, R. M., Institution of Locomotive Engineers Journal, Paper No. 600, 1960, pp 457-565

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THE ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK
Satoh, Y., et. al., Railway Technical Research Institute, Vol. 4, No. 4, pp 42-46

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LATERAL FORCES BETWEEN WHEELS AND RAILS - AN EXPERIMENTAL INVESTIGATION
See 0594

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ON THE BRITISH RAILWAYS: TRACK PRACTICES. AIM FOR LOWER COSTS, HIGHER SPEEDS
Butland, A. N., Railway Track & Structures, May 1969, pp 18-21

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Koffman, J. L., Institution of Locomotive Engineers Journal, circa 1958, pp 549-686

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Scott, J. F., et. al. ASME Paper 72-WA/RT-11

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Batra, S. K., et. al. , Battelle Memorial Institute ASLE Transactions, Vol. 10, 1967, pp 294-301

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TESTS OF RAIL JOINT IMPACT EFFECTS ON THE CHICAGO & NORTH WESTERN
AREA Proceedings, Vol. 57, 1956, pp 865-882

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FATIGUE TESTS OF RAIL WEBS
Jensen, R. S., AREA Proceedings, Vol. 51, 1950, pp 640-647

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JNR's NEWLY DESIGNED RAIL SECTIONS
Sasaki, N., Permanent Way Society of Japan, Vol. 5, No. 1, Mar. 1962, pp 1-9

Investigations at the Japanese National Railways of fractures and weak points of rails are presented. New design of rail section 50N and 40N to improve present sections in use is discussed. Section 50T for New Tokaido Line, and comparative data on old and new rail sections and stress concentrations are given.

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SECTION PROPERTIES OF STEEL RAILS WITH VARIOUS WEAR PATTERNS
Kostecky, J. F., Bethlehem Steel Corporation, Rpt. No. 71-12-1, Apr. 1971

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NEW DEVELOPMENTS IN THE CONTROL OF RAILROAD WHEEL SCREECH NOISE
Kirschner, F., Inter-Noise 72 Proceedings, Washington, D. C., Oct. 4-6, 1972, pp 225-230

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Cain, B. S., Rail Vibration, Chapter 23, pp 236-256

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Nayak, P. R., Bolt, Beranek and Newman, Inc., DOT/FRA Project, July 1972

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DeLeuw Cather & Company, Chicago, Illinois, Oct. 1971, Available: NTIS, PB 206897

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Kaiser Engineers, Los Angeles, California, Sept. 1971, Available: NTIS, PB 205879

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Developmental Sciences, Inc., Aerospace Technology Division, Feb. 1971, Available: NTIS, PB 201882

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Lambe, T. W., et. al., Massachusetts Institute of Technology, Cambridge, Massachusetts, Nov. 1966

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Muromachi, T., et. al., Railway Technical Research Institute, Vol. 8, No. 3, 1967, pp 153-156

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Muromachi, T., et. al., Railway Technical Research Institute, Vol. 8, No. 3, 1967, pp 157-160

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Katayama, M., Japanese Railway Engineering, Vol. 9, No. 4, 1968, pp 17-19

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McLean, F. G., et. al., Westernhoff & Novick, Inc., NASA-TMS-2637, Sept. 1972

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Koffman, J. L., Bulletin of the International Congress Association, Sept. 1960, pp 756-766

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Volker, A., Bulletin of the International Railway Congress Association, Sept. 1969

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Tomonaga, K., Bulletin of the International Railway Congress Association, Mar. 1962

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New York Central System, Various Rpts.

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AREA Bulletin, Vol. 74, No. 641, pp 317-336

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AREA Bulletin, Vol. 74, No. 641, pp 311-316

1183
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PREVENTION OF DERAILMENT OF GOODS WAGONS ON DISTORTED TRACKS. WHEEL LOAD MEASUREMENTS AS A MEANS FOR TESTING TWO-AXLED GOODS WAGONS
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Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. C 9/RP 3/E, Interim Rpt. No. 3, Apr. 1961

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BEHAVIOR OF THE METAL OF RAILS UNDER THE REPEATED ACTION OF WHEELS, STUDY OF THE FIELD OF STRESSES IN THE ELASTO-PLASTIC ZONE. PRELIMINARY CALCULATIONS
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. C 53/RP 1/E, Interim Rpt. No. 1, Mar. 1964

1193
TESTS CONCERNING THE PROBLEM INVOLVED WITH THE KINEMATIC GAUGE. THEORETICAL INVESTIGATIONS CONCERNING THE POSITION OF VEHICLES IN THE TRACK
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. C 102/RP 1/E, Rpt. No. 1, Apr. 1968

1194
INCREASE OF THE PERMISSIBLE LOAD OF S AND SS WAGONS. INFLUENCE OF THE NATURE OF WAGONS, THE SPEED AND THE SUB RATED WHEEL LOAD ON THE FATIGUE OF THE TRACK
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. C 113/RP 1/E, Rpt. No. 1, Apr. 1970

1195
DISTRIBUTION OF AXLE-LOADS ON BALLASTED SLAB BRIDGES. PRELIMINARY INVESTIGATIONS AND MEASUREMENTS (V4 TESTS)
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. D 115/RP 1/E, Rpt. No. 1, Apr. 1971

This report covers the first of a series of 13 tests on ballasted solid double-beam slab bridge elements with a view to determining the transverse distribution of the axle-loads. It also contains the results of theoretical preliminary investigations and trials in connection with the test procedure.

1196
OPTIMUM ADAPTATION OF THE CONVENTIONAL TRACK TO FUTURE TRAFFIC. DESCRIPTION OF THE RESEARCH METHODS AND DEFINITIONS
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. D 117/RP 1/E, Rpt. No. 1, Oct. 1971

1197
STRESSES TO WHICH TRACK EQUIPMENT IS SUBJECTED - UNDULATORY WEAR OF RAILS
Dubus, P., Bulletin of the International Railway, Congress Association, Vol. 32, No. 11, Nov. 1955, pp 822-830

Many measurements of stresses have been carried out by means of strain gauges on the track on steel fishplates and the main components of rail fastenings, in particular, on concrete sleepers. These have resulted in very interesting conclusions. In this report, mention is made of the harmful effects of undulatory wear of the rails, which obliges certain railways to run special trains equipped to grind the rail heads.

1198
STUDY OF RAIL FAILURES IN THE TRACK. STANDARD RAIL FAILURE STATISTICS
Specialists Committee, Office for Research and Experiments, International Union of Railways, Document No. D 88/RP 1/E, Interim Rpt. No. 1, Apr. 1965

1199
ADAPTATION OF THE TRACK FOR HIGH SPEED TRAFFIC
Hojo, T., Bulletin of the International Railway Congress Association, Vol. 42, No. 1, Jan. 1965, pp 12-16

The Japanese National Railways made various measurements on a section of the new Tokaido line in 1962 in order to study the behavior of the track under high speed traffic. This report examines the results of the following tests which were conducted: high speed trials, long welded rails, rail fastening devices, and tolerances allowable for track maintenance. The high speed trials were run over ordinary track and track on a solid bed without ballast to analyze the dynamic behavior of the permanent way under train load.

1200
IS RAIL CORRUGATION DUE TO INTERNAL STRESSES?
Krabbendam, G., Bulletin of the International Railway Congress Association, Vol. 35, No. 3, Mar. 1958, pp 411-428

This report discusses the problem of rail corrugation and possible remedies. In order to combat the development of corrugation, it is suggested that internal tensions within the rail must be reduced. The idea of controlled-cooling and also cooling in the course of which the flange and the web would be covered with infusorian earth, given that new profiles are not thermically balanced, is considered.

1201
ELASTIC AND LATERAL STRENGTH OF THE PERMANENT WAY
Sonneville, R. and Bentot, A., Bulletin of the International Railway Congress Association, Vol. 32, No. 3, Mar. 1955, pp 184-208

Damage to the rail by an excessively high L/V value (laterial force divided by vertical force) is the main topic of this article. A specially-equipped car was used to supply both forces by means of an additional axle and mechanism operated by compressed air from the trainline.

1202
LATERAL STRENGTH OF PERMANENT WAY WHEN FREE FROM LOAD
Sonneville, R. and Bentot, A., Bulletin of the International Railway Congress Association, Vol. 33, No. 6, June 1956, pp 481-491

The lateral strength and displacements of rails while free from load are the topics of this study. The lateral force to the rail was applied by a winch mechanism, firmly anchored to both the ground and the rail. Various parameters, such as distance between the ties, type of ballast and its age, were studied.

1203
THE ENIGMA OF RAIL CORRUGATION ON RAILWAYS
Spaderna, K., Bulletin of the International Railway Congress Association, Vol. 33, No. 7, July 1956, pp 649-652

1204
CONTACT BETWEEN WHEEL AND RAIL. VARIATION OF CONTACT AREA AND MAXIMUM SHEAR WITH THE CURVATURES OF THE CONTACTING BODIES
Storey, C., Bulletin of the International Railway Congress Association, Vol. 34, No. 6, June 1957, pp 433-442

An investigation has been made into the variation of contact area and maximum shear stress with the four radii of curvature of the two bodies in contact. Results are given which cover the practical range of variation of these curvatures. It is concluded that curvature of the rail due to bending and variation of the angle between the wheel and the rail are unimportant. The results also strengthen the intuitive view that the effect of wear is generally to reduce the stresses.

1205
EFFECT OF FLAT WHEELS ON TRACK AND EQUIPMENT
Association of American Railroads, Chicago, Illinois, Research and Test Department Rpt., MR-113, May 1951

The Association of American Railroads has established rules governing the removal of flat wheels. Limitations have been established from the experience and judgment of those concerned with the operation and maintenance of equipment and track. This report relates to a comprehensive test program conducted on the Chicago and North Western Railway during the summer of 1947 to determine the effects of flat spots on both track and equipment. Impact effects on both the track and the vehicle were evaluated by stress measurements.

1206
SIXTH PROGRESS REPORT OF COOPERATIVE RESEARCH ON WOOD TIES BY THE RAILWAY TIE ASSOCIATION AND THE ASSOCIATION OF AMERICAN RAILROADS RESEARCH AND TEST DEPARTMENT
Association of American Railroads, Chicago, Illinois, Research and Test Department Rpt., R-111, Dec. 1971

The Railway Tie Association and the Association of American Railroads entered into a cooperative agreement on March 18, 1965 for the AAR Research Center to conduct an investigation, both analytical and in the laboratory, for the purpose of ascertaining criteria for the most effective system for supporting rail of various sections on wood railway ties, taking into account tie spacing, length, and size of cross section. This report presents the progress in the study of the effects of tie size and spacing on the development of an effective supporting rail system.

1207
A STUDY OF RAIL PRESSURES AND STRESSES IN TRACK PRODUCED BY DIFFERENT TYPES OF STEAM LOCOMOTIVES WHEN ROUNDING VARIOUS DEGREE CURVES AT DIFFERENT SPEEDS
Stetson, E. E., Proceedings of the American Railway Engineering and Maintenance of Way Association, Vol. 10, Part 2, 1909, pp 1432-1455

A study of the different kinds of track forces that result from steam locomotives with different wheel arrangements run at varying speeds over tracks with different degrees of curvature. Fastenings of the track structure are also described.

1208
RAIL FAILURES DUE TO BURNS AND CRYSTALLIZATION CAUSED BY SLIPPING OF ENGINE DRIVERS, BALTIMORE AND OHIO RAILROAD
Thompson, A. W., Proceedings of the American Railway Engineering and Maintenance of Way Association, Vol. 11, 1910, pp 552-559

An investigation of two wrecks showed that slipping drivers of steam locomotives caused service failures in rails, resulting in serious derailments. The detailed chemical analysis of the broken rail samples is also presented.

1209
CURVATURES
Howard, C. P., Proceedings of the American Railway Engineering and Maintenance of Way Association, Vol. 11, 1910, pp 678-684

The cost of train operations for various track curvatures and the associated equations are given. The condition of maximum curvature and when to use it, is discussed.

1210
WHEEL WEAR
Webb, W. L. , Proceedings of the American Railway Engineering and Maintenance of Way Association, Vol. 11, 1910, pp 695-708

Rail wear due to track curvature, age of the rail, and traffic tonnage, is documented. An equation for determining the additional wear of the outside rail on a curve is also presented.

1211
FIELD TESTS FOR WHEEL LOADS
Thomas, H. R., Proceedings of the American Railway Engineering Association., Vol. 42, 1941, pp 692-696

It was found that the minimum wheel load which would cause a rail shatter crack to grow in size and become a transverse fissure was approximately 40,000 lbs. The purpose of this study was to determine the frequency of such wheel-rail loadings on regularly travelled-railroad lines.

1212
STRESS MEASUREMENTS IN THE WEB OF RAIL ON THE DENVER AND RIO GRANDE WESTERN
Magee, G. M. and Cress, E. E., Proceedings of the American Railway Engineering Association, Vol. 44, 1943, pp m5-m18

A study by the Association of American Railroads of the stresses in rail webs and what factors cause them to become abnormally high. Wheel loadings and degrees of track curvature were found to be most important variables.

1213
INVESTIGATION OF THE IMPACT EFFECT OF FLAT WHEELS - PRELIMINARY REPORT
Magee, G. M. and Cress, E. E., Proceedings of the American Railway Engineering Association, Vol. 45, 1944, pp 9-23

The Association of American Railroads conducted tests to determine the effects of wheel flat spots on the track. From these tests, track stresses and strains were determined at varying operating speeds.

1214
DETERMINATION OF LATERAL OUTWARD FORCES ON EACH RAIL OF A TURNOUT
Durham, H. E., Proceedings of the American Railway Engineering Association, Vol. 47, 1946, pp 671-695

In these tests Chicago and North Western Railway passenger trains were run through a switch that was specially instrumented to measure the rail stresses and lateral rail forces.

1215
STRESS MEASUREMENTS ON 131 LB. RE RAIL IN TANGENT AND IN A SIX-DEGREE CURVE UNDER REGULAR TRAFFIC - NORFOLK AND WESTERN RAILWAY - 1945
Association of American Railroads, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 48, 1947, pp 768-794

Field tests on the Norfolk and Western Railway measured stresses in the rails resulting from typical wheel loadings of both regular mixed freight and unit coal trains. Particular attention was given to the rail web area.

1216
SUMMARY OF REPORT ON FILLET AND WEB STRESS MEASUREMENTS ON 90 LB ASCE AND 112 LB RE RAIL IN 18 DEGREE CURVES - DETROIT, TOLEDO AND IRONTON RAILROAD, JUNE 1946
Association of American Railroads, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 48, 1947, pp 794-804

The results from these tests showed that wheel loadings from typical trains on short radius curves had the capability of creating cracks in the web of the rails which could, in time, lead to destruction of the rails.

1217
INVESTIGATE RECENT DEVELOPMENTS AFFECTING RAIL DESIGN
American Railway Engineering Association, Committee on Track, Proceedings of the American Railway Engineering Association, Vol. 49, 1948, pp 464-485

Tests were conducted in the laboratory at the University of Illinois to study the effects of bolt tensions, applied wheel loads and bolt hole spacings, upon rail web stresses within the limits of the joint bar.

1218
MEASUREMENTS OF STRESSES IN 115 RE AND 132 RE RAIL IN CURVED TRACK, OUTSIDE JOINT BAR LIMITS
Association of American Railroads, Engineering Research Division, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 53, 1952, pp 921-940

Field tests were conducted to determine the stresses in 115 RE and 132 RE rail. Stress measurements were recorded under the wheels of regular steam freight and diesel passenger locomotives, under the wheels of passenger cars, and under a portion of representative freight car wheels.

1219
CLEARANCE ALLOWANCES TO PROVIDE FOR VERTICAL AND HORIZONTAL MOVEMENTS OF EQUIPMENT DUE TO LATERAL PLAY, WEAR, AND SPRING DEFLECTIONS
American Railway Eningeering Association Committee on Clearances, and Association of American Railroads, Mechanical Division, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 54, 1953, pp 834-838

This report discusses problems with equipment clearances, due to the forces generated when operating over superelevated curved track.

1220
MEASUREMENT OF SHOCK LOADS IN CROSSING FROG BOLTS
American Railway Engineering Association, Committee on Track, Proceedings of the American Railway Engineering Association, Vol. 54, 1953, pp 1002-1034

Field tests, involving measurements of the dynamic variations of tension in the main bolts of a bolted rail crossing, were conducted primarily for the purpose of determining the following: the most suitable initial bolt tension; the minimum tension required to avoid excessive looseness and wear; and the causes of unequal looseness in bolt tension and bolt wear. Stress measurements, resulting from the passage of several classes of diesel and steam locomotives powered trains were recorded and analyzed.

1221
STRESS MEASUREMENTS AND SERVICE TESTS OF MANGANESE STEEL CASTINGS IN THE CROSSINGS AT McCOOK, ILLINOIS
Association of American Railroads, Engineering Research Division, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 55, 1954, pp 1-36

The object of these tests was to evaluate the efficiency of two new casting designs by measuring the stresses in the critical areas under the movement of revenue trains, and determining the serviceability of each type of casting at a later time.

1222
CLEARANCE ALLOWANCES TO PROVIDE FOR VERTICAL AND HORIZONTAL MOVEMENTS OF EQUIPMENT DUE TO LATERAL PLAY, WEAR, AND SPRING DEFLECTION
American Railway Engineering Association Committee on Clearance, and Association of American Railroads, Mechanical Division, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 56, 1955, pp 559-564

Some of the problems with equipment clearance, due to the forces generated by superelevated curved track, are presented and discussed.

1223
THE TORSIONALLY-STIFF BOGIE WAGON
Koffman, J. L., Railway Gazette, Vol. 123, Aug. 1967, pp 629-632

1224
FINAL REPORT ON A THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF THE STRESS DISTRIBUTION IN THE HEAD OF A MODEL OF A RAILROAD RAIL ALONG LINES PARALLEL TO THE AXIS OF THE RAIL
Frocht, M. M., Proceedings of the American Railway Engineering Association, Vol. 60, 1959, pp 951-969

This report presents the stress distributions in photoelastic models of rails.

1225
RAIL WEAR TESTS ON THE ST. LOUIS-SAN FRANCISCO RAILWAY
Association of American Railroads, Chicago, Illinois, Proceedings of the American Railway Engineering Association, Vol. 62, 1961, pp 105-113

This study conducted on the St. Louis-San Francisco Railway, compared two track curves, one lubricated, and the other dry, under heavy locomotive sanding conditions, and studied the relationships of rail sanding to rail wear.

1226
A TECHNIQUE FOR EVALUATING TRACK CONDITION USING RAILCAR VIBRATIONS
see 0481

1227
COMPACTION OF THE CRIB AND SHOULDER AREAS OF THE BALLAST SECTION SUPPORTING THE LINEAR INDUCTION MOTOR RESEARCH VEHICLE TEST TRACK IN PUEBLO, COLORADO
see 0948

1228
VERTICAL OSCILLATIONS OF BOGIE WHEELS
Koffman, J. L., Railway Gazette, Vol. 113, July 1960, pp 73-80

1229
STAGGERED RAIL JOINTS
Railway Gazette, Vol. 110, May 1959, pp 612-613

1230
OPTIMIZATION OF A SIMPLE DYNAMIC MODEL OF A RAILROAD CAR UNDER RANDOM AND SINUSOIDAL INPUTS
Mixson, J. S., and Steiner, R., National Aeronautics and Space Administration, Langley Research Center, Langley Station, Virginia, for the Department of Transportation, Office of High Speed Ground Transportation, Rail Technology Division of the Federal Railroad Administration, Nov. 1969, Available: NTIS, PB 201620

1231
A NEW THEORY OF ROLLING CONTACT
Nayak, P. R. and Paul, I. L., Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Mass., for the Department of Transportation, Office of High Speed Ground Transportation, Rail Technology Division of the Federal Railroad Administration, Apr. 1968, Available: NTIS, PB 179433

1232
STUDY OF METHODS OF STABILIZING CONVENTIONAL BALLAST USING POLYMERS
see 0127

1233
AN INVESTIGATION OF THE RIDE QUALITY OF AUTO-TRAIN SERVICE
Ullman, K. B., Department of Transportation, Office of High Speed Ground Transportation, Rail Technology Division of the Federal Railroad Administration, Washington, D. C. Nov. 1967, Available: NTIS, PB 176044

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SIDE THRUST ON TRACK AT HIGH SPEEDS
Railway Gazette, Vol. 121, July 1965, pp 529-530

1235
WHEEL LOAD, WHEEL DIAMETER, AND RAIL DAMAGE
Code, C. J., AREA Bulletin, Vol. 61, 1960, pp 1219-1227

1236
BUFFER LOCKING ON REVERSE CURVES
Green, J.I.T., Railway Gazette, Vol. 123, Nov. 1964, pp 903-904

1237
WHEEL HUNTING AND IRREGULAR RAIL WEAR
Railway Gazette, Vol. 83, Dec. 1945, p 636

1238
RUNNING THROUGH CURVES
Railway Gazette, Vol. 96, June 1952, pp 682-684

1239
RULES FOR THE DESIGN OF CURVES
Railway Gazette, Vol. 97, Aug. 1952, pp 116-117

1240
WHEEL AND RAIL LUBRICATION
Railway Gazette, Vol. 106, Oct. 1957, p 413

1241
EXPERIMENTS ON LOCAL STRESSES OF RAILS IN PRINCIPAL USE IN SEVERAL COUNTRIES
Sasaki, N., et. al., Railway Technical Research Institute, Vol. 12, No. 3, pp 34-39

1242
RAILWAY TRACK VIBRATION INDUCED BY TRAIN MOVEMENT
Sato, Y., et. al., Railway Technical Research Institute, Vol. 1, No. 4, pp 28-31

1243
ON THE LATERAL STRENGTH OF RAILWAY TRACK
Sato, Y., Railway Technical Research Institute, Vol. 2, No. 1, pp 56-58

1244
RAILWAY TRACK STRUCTURE FOR HIGH SPEED TRAINS
Satoh, Y., Railway Technical Research Institute, Vol. 7, No. 1, pp 39-41

1245
DATA HANDLING MACHINE FOR THE NO. 2 TRACK INSPECTION CAR OF THE NEW TOKAIDO LINE
Nakamura, I., at. al., Railway Technical Research Institute, Vol. 7, No. 3, pp 47-50

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ROLLING STOCK FOR HIGH SPEED OPERATION
Miki, T., Railway Technical Research Institute, Special Issue, Apr. 1969, pp 7-12

1247
RESPONSE BEHAVIOR OF VEHICLE SYSTEMS SUBJECTED TO RANDOM EXCITATIONS
Wilson, J. T., McGill University, Montreal, Quebec, Canada, Thesis, Jan. 1969

1248
A SUMMARY BY THE NETHERLAND RAILWAYS OF A REPORT ABOUT TESTS CARRIED OUT WITH THE ZIG-ZAG TRACK IN THE LABORATORY OF THE WESTERN REGION OF BRITISH RAILWAYS
Netherlands Railways, Publication data unknown

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THE RIDING OF TWO PARTICULAR DESIGNS OF FOUR WHEELED RAILWAY VEHICLE
Gilchrist, A. D., et. al., Proceedings of the Institute of Mechanical Engineers, Vol. 180, Part 3F, 1965-66, pp 99-113

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ON THE RAIL CREEPAGE
Ono, K., Permanent Way, Rpt. No. 13, Vol. 4, No. 4, Dec. 1961, pp 20-28

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ON THE RELATIONS BETWEEN SUPERELEVATION AND CAR ROLLING
Nakannura, I., Permanent Way, Rpt. No. 14, Vol. 5, No. 1, Mar. 1962

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AN INVESTIGATION OF RAILROAD TRACK AND VEHICLE DYNAMICS AT HIGH SPEEDS
New York Central Technical Research Department, Sept. 1966

1253
METHODS OF TESTING AND EVALUATING LOCOMOTIVE RUNNING QUALITIES
Minden, I. W., Railway Technical Review, Apr. 1964, pp 149-165

1254
RAIL-VEHICLE INTERACTION STUDY, REPORT NO. 1- PRELIMINARY ANALYSIS OF SAMPLE DATA
Lynch, J. F., et. al., Southern Pacific Company, June 1970

1255
A WHEEL PROFILE, FOR BETTER RIDING AND LONGER WHEEL LIFE
List, M. A., Modern Railroads, May 1970, pp 61-62

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INTERACTION OF WHEEL AND RAIL WITH RESPECT TO TRACKING, WEAR, FREE ROLLING AND STRESS IN WHEEL SETS
Kurek, G., Railway Technical Review, Sept. 1966, pp 338-346

1257
THE STUDY OF THE FRICTION-CREEP PHENOMENON OF ADHESION BETWEEN STEEL WHEELS AND RAIL
Itami, G. S., General Motors Institute, Electro-Motive Division, Thesis, July 1968

1258
LOADING OF THE RAIL REGARDED AS BEAM
Eisenmann, J., Railway Technical Review, Aug. 1969, pp 306-312

1259
TRACK STRESSES AND VEHICLE MOTION AT HIGH SPEEDS
Birmann, F., Railway Technical Review, Aug. 1965, pp 335-351

1260
SERIAL MEASUREMENTS ON RAILS TO DETERMINE WHEEL LATERAL FORCES
Birmann, F., et. al., Railway Technical Review, May 1966, pp 155-164

1261
A TRACK MEASUREMENT SYSTEM FOR IDENTIFYING TRACK AREAS CAPABLE OF EXCITING ROLL MOTION OF HOPPER CARS
Battelle Memorial Institute

1262
EXTENSION OF THE NEW TOKAIDO LINE
Kato, M., ASME/ASCE Transactions of the Engineering Meeting, Preprint No. 1519, July 1971

1263
ROADBED CURVATURE LIMIATIONS ON THE SPEED OF WHEEL-RAIL VEHICLES
Carstens, J. P., ASME, Paper No. 67-TRAN-11

1264
METHODS OF RECONSTRUCTION OF RAIL GEOMETRY FROM MID-CHORD OFFSET DATA
Cohen, A., ASME, Paper 70-TRAN-24

1265
LONG WELDED RAILS SMALL RADIUS CURVES R.S. SLEEPERS
Sonneville, R., May, 1964

1266
THE ANALYSIS OF FOUR WHEEL TRUCK FORCES ON CURVED TRACK
Johnson, M. R., Apr. 17, 1957

1267
STABILITY OF LONG-WELDED RAILS
Railway Gazette, Vol. 115, Aug. 18, 1961

1268
TRACK SAFETY STANDARDS
Federal Railroad Administration, Washington, D.C. Docket No. RST-1, Notice No. 1, 49 CFR Part 213

The FRA proposes to amend Chapter II of subtitle B of title 49 of the Code of Federal Regulations by adding a Part 213 prescribing initial safety standards for track and track inspection. A - prescribes initial minimum safety requirements for railroad track that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation. B - prescribes minimum requirements for roadbed and areas immediately adjacent to roadbed with regard to drainage; embankments and excavations; vegetation; and removal of objects and correction of hazardous conditions. C - prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track. D - prescribes minimum requirements for ballast, cross ties, track assembly fittings, and the physical condition of rails. E - prescribes minimum requirements for tack appliances and track related devices, including derails, switch point protectors, bumping posts, wheel stops, equipment defect detectors, track obstruction detectors and expansion joints. F - prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.

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THE TRANSVERSAL STABILITY WHEN IN MOTION OF RAILWAY VEHICLES ON THE STRAIGHT
Vasteras, S. J., Bulletin of the International Railway Congress, Nov. 1959, pp 1058-1073

1270
ESTIMATING WEIGHTS OF RAILS IN THE TRACK
Brown, G. W., Railway Gazette, Vol. 73, Aug. 23, 1940, pp 203-204

1271
AUTOMATIC SUBMERGED-SLAG WELDING OF RAILS (PART 2)
Oi, I., et. al., Railway Technical Research Institute, Quarterly Rpt., Vol. 8, No. 4, pp 205-209

1272
DETAILS OF SOME RECENT TEST WORK ON THE S.N.C.F.
French Railway Techniques, No. 1, 1969

1273
FAA STANDARDS AIRPORT R&D PROGRAMS
American Society of Civil Engineering Newsletter, 1973-11, Feb. 1973, p 4

1274
BOUTET PROCESS FOR WELDING RAIL JOINTS
French Railway Techniques, Catalogue, Track Equipment-1967, pp 11-16

1275
VIBRATION OF SOILS AND FOUNDATIONS
Richard, F. E., Woods, R. D., and Hall, Jr., J. R., Prentice-Hall Series in Theoretical and Applied Mechanics, 1970, Prentice-Hall, Inc., Englewood Cliffs, N. J., 414 p

Chapter ten treats methods of analysis and design of dynamically loaded foundations. These methods depend on the design criteria, applied forces, soil response, and analytical procedures for relating these quantities. The design criteria were based on a failure criterion of a limiting amplitude of motion, or a limiting velocity or acceleration of the foundation. The analytical procedures for establishing the dynamic behavior of a foundation relate the applied forces, soil properties, and foundation weights and geometry to the response. By successive corrections of the design parameters, the analytical procedures provide a method for developing a dynamic response of the foundation which falls within the design limits. Several simplified methods of analysis have been discussed in Chapter ten; these have been found satisfactory when the prototype conditions correspond to the assumptions made in establishing the theory. Vibration from subways and a railway is reviewed in Table 10.6.

1276
GAS-SHIELDED ARC WELDING OF HIGH-MANGANESE STEEL RAILS
Ando, S., et. al., Railway Technical Research Institute-Quarterly Rpt., Vol. 8, No. 1

1277
TRACK MAINTENANCE
Permanent Way Society of Japan, Rpt. Nos. 23-24, Permanent Way, Vol. 7, No. 2-3, pp 55-69

1278
LONG WELDED RAIL IN NEW TOKAIDO LINE
Fukazawa, Y., Permanent Way Society of Japan, Rpt. No. 35, Permanent Way, Vol. 10, No. 2

1279
STRENGTH AND IMPREGNABILITY OF HOMALIUM SPP. AS RAILROAD SLEEPER
Shimizu, K., Railway Technical Research Institute-Quarterly Rpt., Vol. 8, No. 1, pp 33-37

1280
LOOK WHAT'S HAPPENING TO THE WOOD TIE
Railway Track & Structures, May 1973, pp 16-19

Numbers 1281-1399 are reserved for future expansion of the bibliography.

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INVESTIGATION OF THE RESPONSE OF TRACK SUPPORTED BY REINFORCED CONCRETE PLATE
Moscow Institute for Rail Transport Engineers, Transport Publishers, 1967

1401
DETERMINING THE INCREASE IN BALLAST DENSITY UNDER TRAFFIC BY MEANS OF THE GAMMA ABSORPTION METHOD
Birmann, F., Bulletin of the International Railway Congress, Mar. 1967

1402
RAILWAY RESEARCH AND ENGINEERING NEWS. SELECTED ITEMS ON DYNAMIC AND STATIC FORCES ON THE TRACK
Railway Research Index, Railway Research and Engineering News, Section C, C/71, No. 1

1403
SEVERAL PROBLEMS ABOUT ROLLING STOCK WHICH CAN RUN ON CURVES AT HIGH SPEEDS
Kunieda, M., Railway Technical Research Institute, Vol. 13, No. 1

1404
AN INVESTIGATION OF THE VEHICLE SUSPENSION AT HIGH SPEEDS
Nouvion, F. F., S.N.C.F., Proceedings of the First International Conference on Vehicle Mechanics, Wayne State University, Detroit, Mich., July 16-18, 1968, Swets & Zeitlinger, Amsterdam, Netherlands, pp 89-118

1405
WAGON RUNNING GEAR
Koffman, J. L., British Railways, Proceedings of the Institution of Mechanical Engineers, Vol. 184, Pt. 3D, 1969-1970, pp 45-59

1406
ANALYSIS OF WHEEL-RAIL LOADING OF FP-45 LOCOMOTIVE ON A 3'3" TRACK CURVE SANTA FE RAILROAD
Marta, H. A., General Motors Corporation, Rpt. No. 898-133, Feb. 8, 1968

1407
RETAINING GAUGE ON CURVES: THE L&N APPROACH
Dove, R. E., Railway Age, Jan. 8, 1973

1408
GP-9 LOCOMOTIVE WHEEL TO RAIL LATERAL LOADING TEST ON ILLINOIS CENTRAL RR OCT. 5-6, 1964
Klinke, W. R., General Motors Corporation, Rpt. No. 119, Mar. 25, 1965

1409
WHEEL AND RAIL LOADINGS FROM DIESEL LOCOMOTIVES
Koci, L. F., and Marta, H. A., General Motors Corporation, La Grange, Illinois, Rpt. to AREA Convention, Chicago, Illinois, 1971, 15 p

This presentation was prepared to review Electro-Motive Divisions's background, particularly regarding locomotives in the area of wheel-to-rail loadings as they affect maintenance, wear, and potential train derailments. This review is divided into the following six areas: sample derailment data; basic curve negotiation mechanics; experimentally determined wheel-to-rail forces; rail profile data; the effect of dynamic brake levels; and mechanical considerations.

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THE LATERAL FORCE CAUSED ON THE CURVED TRACK DUE TO STEAM LOCOMOTIVES
Ono, K., et. al., Kanazawa University, Memoirs Faculty Technology, Vol. 3, No. 3, July 1964, pp 26-44

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Caldwell, W. N., Canadian National Railway, ISA Transactions, Oct. 1963

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GEOMETRIC DESIGN COMPUTER PROGRAMS. USER MANUAL Z-810
Parsons Brinkerhoff-Tudor-Bechtel, San Francisco, California, Sept. 1964

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DESIGN OF CONVENTIONAL RAIL TRACK FOUNDATIONS
Heath, D. L., Shenton, M. J., Sparrow, R. W., and Waters, J. M., British Railways Board, Derby, England, Proceedings of the Institute of Civil Engineers, 1972, pp 251-267

Measurements of the distribution of vertical stress in the subgrade for given depths of ballast, track structural configurations and loading conditions are described. The mean maximum vertical stress in the subgrade can be predicted with reasonable accuracy by simple elastic theory. The results of laboratory work in which samples of soil were subjected to repeated triaxial loading are presented. For the cohesive soils tested a level of stress was found above which repeated applications of load caused large permanent deformations and below which permanent deformations were small and terminating. Based on these findings a method of track foundation design is developed in which the depth of ballast required to prevent excessive deformation of the subgrade can be predicted from the results of a simple laboratory repeated load test and a knowledge of the traffic loading to be carried. Small decreases in construction depth from the design depth produce large increases in deformation rate while large increases in construction depth over the design depth produce little return in terms of reduced rates of deformation. The proposed design procedure produces construction depths that are apparently close to the optimum for the fine grained soils so far investigated.

1414
GEOMETRIC DESIGN PROCEDUAL MANUAL FOR HORIZONTAL AND VERTICAL CURVATURE
Parsons Brinkerhoff-Tudor-Bechtel, San Francisco, California, Feb. 1964

Numbers 1415-1499 are reserved for future expansion of the bibliography.

1500
M/W EFFICIENCY ON UNION PACIFIC
Railway Age, June 11, 1973, pp 38-41

The best yardstick in measuring the success of a maintenance policy is to compare the quality of the track and roadbed strucutre, with the maintenance cost, based upon the tonnage of traffic and the speed. Charts are updated each year to compare UP maintenance-of-way operating expenses with those of six other major railroads which have comparable traffic volumes, operating conditions, and so forth. Equipment is updated each year with the latest generation of equipment available, without over-mechanizing. The quality of day-to-day track-maintenance work that is done between the periods of out-of-face heavy program work has more to do to insure the best track conditions at the lowest over-all cost than any other single factor. Section gangs are assigned over the entire railroad to do the day-to-day maintenance work. The section forces mark the bad ties. The number of ties marked in each area is tabulated before the annual tie-gang program is established. UP M/W department is having a problem getting adequate on-track time for its mechanized track gangs engaged in out-of-face work. The only solution to the problem is to maintain close communication with operating department people to get just as much time on the track as possible. UP is a relative newcomer in the use of continuous welded rail. The road has firm rules governing the heating or cooling of the long strings. By vibrating the rail at the same time that it was being heated or cooled, frictional resistance is overcome and the rail is permitted to expand or contract the desired amount at the end of the string. Another area of pioneering for UP is in the use of glued or bonded insulated and closure joints between CWR strings. UP hopes to purchase a self-propelled car capable of testing track at 35 to 45 mph.

1501
REINFORCED CONCRETE FUNDAMENTALS
Ferguson, P. M., University of Texas, John Wiley & Sons, 1958, 604 pp

This test emphasizes both the physical behavior of reinforced concrete members and the approved ultimate strength theory. Although this basic text on reinforced concrete emphasizes ultimate strength theory, it retains adequate coverage of the working stress method. Particular attention is drawn to the portions of Chapter 1, which discuss factors of safety and load factors, advantages and limitations of ultimate strength design, and calculation accuracy.

1502
AIRPORT PAVING
Federal Aviation Agency, Washington, D. C., Advisory Circular AD 150/5320-6A, May 9, 1967, 87 pp

This circular provides guidance for the design and construction of pavements at civil airports. A soil investigations and evaluation section is included. The following tests are required in order to correctly analyze the conditions on the site and to prepare design plans and construction specifications: mechanical analysis to show the percentage of coarse sand, fine sand, silt and clay, as well as the amount of material retained on the No. 10 sieve; liquid and plastic limit tests; and maximum density and optimum moisture content determination. Additional tests, such as those for shrinkage, permeability, and consolidation, should be performed in order to properly evaluate the performance of a soil.

1503
VIBROSEISMIC SURVEY, RAILROAD TEST EMBANKMENT, AIKMAN, KANSAS
Curro, J. R., U.S. Army Engineers, Waterways Experiment Station, Vicksburg, Miss., June, 1972, Final Rpt., S-72-36, 93 p, Available: NTIS, AD 757386

Refraction seismic tests indicated the existence of two distinct velocity zones, one for the embankment and one for the underlying limestone bedrock. The average compression-wave velocity range in the embankment was 1300 to 1600 fps to a maximum depth of 10 ft. True velocity range in the bedrock was 7,700 to 13,000 fps at depths varying from 6 to 10 ft. below the embankment crest. Results of the vibratory tests indicated that the shear-wave velocity of the embankment generally increased almost linearly with depth. Composite shear-wave velocity increased from 420 fps at 0.7 ft. to 710 fps at 8 ft. The shear-wave velocity of the bedrock increased from 710 fps at 8 ft. to 980 fps at 12.3 ft. Poisson's ratio for the embankment ranged from 0.45 near the surface to 0.29 at the bottom of the embankment; for the limestone was 0.49. Shear and compression moduli for the embankment also increased linearly with depth. The composite shear modulus increased from 4,600 psi at 0.7 ft. to about 14,000 psi at 8 ft. The shear modulus for the bedrock increased from 14,000 psi at 8 ft. to 31,300 psi at 12.3 ft. The compression moduli were about three times as great as the shear moduli. Attenuation test data exhibited an exponential decay trend. Average values of the logarithmic decrement ranged from 0.553 to 0.861 for the embankment, and the damping ratio of the embankment ranged from 0.086 to 0.136. Compression moduli were about three times as great as shear moduli. The values of logarithmic decrement and damping ratio determined from the laboratory tests were about a factor of 2 lower than those determined from the in situ tests.

1504
HIGHWAY ENGINEERING
Oglesby, C. H., Stanford University, and Hewes, L. I., U.S. Bureau of Public Roads, John Wiley & Sons, Inc., New York, 2nd Edition, 1963, 783 p (See Chapters 13-20)

The eight chapters of interest to railroad track design are on the following topics: highway subgrade structure, roadway construction, gravel and crushed rock road, base sources, bituminous pavement, Portland Cement pavements, and maintenance.

1505
LENGTH OF SLEEPERS IN RELATION TO GAGE
Ball, J.D.W., Railway Engineer, October, 1934, pp 320-321

Cross ties varying in length from 1.62 (Argentine 5 ft. 6 in. gauge) to 1.92 (British 4 ft. 8.5 in.) times the gauge are compared in this article and the characteristics of two other intermediate cross tie length ratios are also examined. The method of determining the pressure consists in finding a distribution which produces a proportional deflection, taking into consideration the actual depression of the cross tie into the ballast. This depression can be observed and for good stone ballasted tracks averages about 0.16 in. The total load borne by one cross tie is taken in each case as 10 tons, which is about the correct amount for the standard gauge and broad gauge although on the high side for the narrow gauge. The shear diagram is obtained from the load or pressure diagram, and the bending moment diagram from the shear diagram, by succesive stages of graphic integration. By a further process of graphic integration of the bending moment diagram the inclination of the cross tie is obtained.

1506
THEORY OF PLATES AND SHELLS
Timoshenko, S. P., and Woinowsky-Kreiger, McGraw-Hill, New York, 2nd Edition, 1959

1507
ANALYSIS OF STRUCTURAL BEHAVIOR OF AASHO ROAD TEST RIGID PAVEMENTS
Vesic and Saxena, National Cooperative Research Rpt. 97, 1970

A critical review is presented of existing theories of structural behavior of rigid pavements. Two principal models currently used are: the elastic-isotropic solid, characterized by a modulus of deformation, E_S, and a Poisson's ratio, v_S; and the Winkler subgrade, characterized by a coefficient of subgrade reaction, k. With a suitable selection of coefficient k, theories based on the Winkler model for the subgrade can furnish adequate answers also for slabs resting on a subgrade behaving as an elastic solid. However, there is no single value of k that can give perfect agreement of all statistical influences in a particular case, unless the subgrade thickness is limited to a maximum of 2.5 stiffness radii of the slab. Simple analytical expressions for evaluation of k in terms of known characteristics of the slab and the subgrade are presented. The over-all response of the AASHO subgrade to leads is comparable to response of an ideal isotropic-elastic solid. However, with proper selection of the coefficients of subgrade reaction, k, the Winkler subgrade model can also lead to good predictions of pavement stresses and deflections. The coefficient k for the AASHO pavement/subgrade systems is a variable quantity, which is inversely proportional to the pavement slab thickness. The combined tensile stress in pavement slabs represents the best indicator of pavement performance. A simple expression relating the ultimate number of axle-load applications to the flexural strength of the pavement material, the thickness of the pavement slab, and the magnitude of the axle load is derived, indicating that the pavement life should be proportional to the fourth power of strength and to the fifth power of slab thickness and inversely proportional to the fourth power of the axle load. This expression offers for the first time a rational basis for evaluation of equivalent number of axle-load applications for rigid pavements subjected to mixed traffic.

1508
SOIL MECHANICS FOR ROAD ENGINEERS
Maclean, D. J., Editor, Her Majesty's Stationery Office, London, 1952, pp 428-438

The present book is the first of three volumes which will suit the reader who may be concerned with only one of the three subjects. Most of the chapters in the present volume are based on the lectures delivered at the courses by the members of the staff of the soil mechanics section of the Road Research Laboratory. The main sources of the information have been the Laboratory's own researches into soil mechanics. But this information has been supplemented and broadened by a continuous study of technical literature from world sources, by the lessons learned from examining constructional problems, and by the very close personal contacts maintained by the research workers with practising engineers employed by highway authorities and contractors.

1509
VERTICAL PRESSURE DISTRIBUTION IN THE BALLAST SECTION AND ON THE SUBGRADE BENEATH STATICALLY LOADED TIES
Salem, M. T., and Hay, W. W., University of Illinois, Department of Civil Engineering, Urbana, Illinois, July, 1966

The purpose of this study was to make a modern determination of vertical pressure distribution through the ballast section to the subgrade beneath statically loaded ties and to determine the depth of ballast needed to attain a reasonably uniform pressure distribution under the rails on the subgrade for any particular tie spacing. An equation, based on theory and test results, was developed by means of which the vertical pressure below and to the right and left of the center line of a tie can be determined. The study concerned itself with wood ties placed on three different types of ballast and loaded with a static load. The depth of ballast needed to get a fairly uniform pressure on the subgrade equals the tie spacing minus three inches. The vertical pressure at this depth should be less

than the allowable bearing capacity of the subgrade deformation. Two equations used to determine the vertical pressure distribution below and to the right and left of the center-line of a tie are based on the theoretical elasticity, and on the geometry of a pressure bulb. These equations are limited to wood ties of 9 inch widths and to depths ranging from 6 to 30 incles. The three types of ballast behaved in a similar manner as regards the magnitude of vertical pressures.

1510
MODERN PERMANENT WAY
Srinivasan, M., Somaiya Publications, Bombay, India, 1969, pp 134-136

This book was written as a teaching aid; thus, it is a literature survey. The author considers track to be the most important single asset of the railways, in terms of the first cost, the large labor force and expenditure on its maintenance, frequency and costs of replacements, and above all, of its direct bearing on permissible speeds, riding comfort and safety. The subjects discussed include rail stresses, rail joints, rail to cross tie fastenings, ballast design and maintenance, soil preparation and properties, track assembly, welded rails, concrete cross-ties, effects of derailment on wooden, composite, steel and concrete cross-ties, maintenance, high speed track, economics, and safety.

1511
DYNAMIC TRACK COMPLIANCE
Kurzweil, L., TSC-GSP-067, DOT/TSC, Cambridge, Mass, May, 1972, pp 13-14

Analytical expressions for vertical and lateral track compliance are obtained from the solution of a beam on a visco-elastic foundation model. The equivalent foundation parameters were derived from the theory for a mass on a visco-elastic halfspace. The dependence of the overall track stiffness, damping, and natural frequency on the rail, tie, and roadbed parameters are evaluated. Upper and lower bounds for the overall track properties are obtained for existing types of at-grade track structures. A distinct advantage of the approach described is that it results in estimates for the effective damping due to both radiation of energy into the roadbed and energy loss due to internal soil friction. The damping due to internal friction can generally be neglected compared with the radiation damping.

1512
RESEARCH ON THE OPERATING STRESSES IN PATH RAILCAR AXLES, DRIVE SYSTEMS, WHEELS, AND RAIL JOINTS
Yontar, M., 9th Joint ASME-IEEE Railroad Conference, May, 1966, Paper No. 66RR-6

1513
CONTACT PRESSURE BETWEEN WHEEL AND RAIL AND ITS INFLUENCE ON MECHANICAL PROPERTIES OF RAIL STEEL
Ito, A., Japanese National Railway, Railway Technical Research Institute-Quarterly Rpt., Vol. 3, No. 1, Mar. 1962, pp 21-25

1514
A THREE DIMENSIONAL PHOTOELASTIC STUDY OF CONTACT STRESSES IN THE HEAD OF A MODEL OF A RAILROAD RAIL
Frocht, M. M., Proceedings of the S.E.S.A., Vol. 14, No. 1, Apr. 1955

1515
TWO DIMENSIONAL PHOTOELASTIC EXPERIMENT ON SEVERAL RAIL SECTIONS
Miyairi, M., and Sasaki, N., Japanese National Railways, Vol. 2, No. 3, Sept. 1961

1516
CONTACT VIBRATIONS
Nayak, P. R., Journal of Sound and Vibration, Vol. 28, No. 2, 1973, pp 277-293

When a wheel rolls on a rail with a randomly wavy surface, the random waviness gives rise to a displacment input to the wheel and rail with a significant high-frequency (f> 100 Hz) spectral content. This displacement input excites the contact resonance of the system, wherein the mass of the wheel and an "equivalent mass" of the rail vibrate on the nonlinear contact spring. The purpose of this paper is to develop an analytical model for these high-frequency contact vibrations. The wheel is assumed to undergo only rigid-body motions, apart from the localized elastic deformation near the contact region. The rail is modeled as an infinite beam on a continuous, point-reacting foundation. With the rail roughness being assumed to be a locally stationary, Gaussian random process, a complete solution is presented to the linearized problem. Three phenomena of interest are investigated in detail: plastic deformation, loss of contact, and the formation of corrugations on the rail. The effects of various wheel and rail parameters on these phenomena are explored.

1517
THE INFLUENCE OF WHEEL-RAIL CONTACT FORCES ON THE FORMATION OF RAIL SHELLS
Martin, G. C., and Hay, W. W., Transaction of the ASME, 72-WA/RT-8, 1972

This paper describes an analytical and experimental investigation of the problem of rail shelling; in particular the influence of the stresses resulting from wheel-rail contact forces is studied. These contact forces are due to the weight of the car, and the tracking of the wheel on the rail. An analytical analysis includes the yielding of the rail material, the subsequent development of residual stresses, and plastic flow due to a moving load. Explanations are given for the mechanics of shelling and other associated behavior that is found in rail. The analytical study indicated that the worst fatigue condition would occur where the normal load was accompanied by slip forces opposite to the direction of rolling motion and directed toward the gage corner. Two tests were performed. The first test was to simulate the high rail condition. At about 22,000 transverse cycles and 1,200,000 revolutions,

the specimen sounded as though a shell failure had occurred. At 24,000 transverse cycles and 1,400,000 revolutions, the specimen had failed. Another specimen was prepared. The pneumatic tripping mechanism was reversed so that load was applied as the specimen and lower bearing centerlines approached one another. At about 61,500 transverse cycles and 2,500,000 revolutions, the test was stopped. Although the specimen had pitted, it had not shelled. The rail steel used in the simulation of the high rail could have been of poor metallurgical quality leading to a premature failure. The steel used in the low rail test could have been very good, explaining why that specimen lasted 2,500,000 cycles.

1518
ROLLING LOAD TEST OF AN INTMA INTERNATIONAL I-BOND INSULATED RAIL JOINT
AAR Research Center Rpt. No. LT-323, Aug. 1972

An investigation was conducted on an adhesive bonded insulated rail joint. This investigation consisted of two million cycles in a 33 in. stroke rolling load machine. The rail joint consisted of two lengths of 132 lb. rail, two joint bars formed to the contour of the web of the rail, six high strength 1 in. bolts and a 5/32 in. end post. The joint was secured in a 33 in. stroke rolling load machine supported on 36 in. centers, and a wheel load of 44,400 lb. applied. The deflection of this adhesive bonded insulated joint indicates that its stiffness is nearly equal to that of a piece of 132 lb. rail. Its adhesive stood up well under the wheel load of 44,400 lb. and the four million passes of the wheel over the joint. The electrical resistance of 100 megohms is excellent. The end post with a thickness of 5/32 in. is rather narrow and might at times be bridged with brake shoe filings at locations where the rail ends are highly magnetized. The longitudinal alignment of the joint was excellent as was indicated by the smooth operation of the rolling load machine and the profile. The small amount of batter at the rail ends with no chipping indicates that the ends were properly heat treated and hardened.

1519
ADVANCED TRANSPORT TECHNOLOGY
British Railways, Paper presented to U. S. Department of Transportation, Mar. 1972

The R&D investment and marketing appraisal are described; however, the section of most interest to this bibliography discusses the software for the APT (Advanced Passenger Train). The vehicle portion of the software section describes the diesel engine and the various operating systems for the train. The Control Subsection describes the automatic warning system, continuous signalling and communications. The track subsection gives the track dynamics; rails, cross ties, fastenings and ballast for conventional track; design, soil research, loading and stress distributions for ballasted track; track fractures; electrification; and computer aided design. A subsection on applied sciences discusses polymers; fiber reinforced metals; adhesion, lubrication and wear; surface loading; pollution control; forensic aspects; and laboratory facilities, as the topics relate to APT.

1520
PROGRESS REPORTS OF THE SPECIAL COMMITTEE ON STRESSES IN TRACK
AREA Proceedings, American Railway Engineering Association, Chicago, Illinois, Vol. 19, 21, 24, 26, 31, 35, and 42

1521
FORCED VIBRATIONS OF RIGID CIRCULAR PLATE ON A SEMI-INFINITE ELASTIC SPACE AND ON ELASTIC STRATUM
Bycroft, G. N., Philosophical Transactions of the Royal Society of London, Series A, Vol. 248, 1950, pp 327-368

The impedance is determined for its four degrees of freedom. The solution of the dual integral equations arising from this mixed boundary-value problem is avoided by reference to Rayleigh's reciprocal theorem. This enables the functions of frequency to be located between two close bounds and lying much closer to one than to the other. These bounds appear as infinite integrals involving branch functions and are reduced to tractable finite integrals by integration in the complex plan. Dissipation of waves to infinity produces as effective damping, and the added effect of the inclusion of true damping in the medium is discussed. Experimental work to substantiate these theoretical results is being carried out, but is not discussed on the present publication.

1522
ANALYSIS OF RAILWAY SUPERSTRUCTURE
Zimmerman, H., Berlin, 1888, In German

1523
CONTRACT PROBLEMS IN THE THEORY OF ELASTICITY
Galin, Moscow-Leningrad, 1953, Available in English translation edition, I. N. Sneddon, North Carolina State College, NSF G16447, 1961

1524
ABC OF GAUGE GUIDING
Nothen, G., Glassers Annalen, Aug.-Sept. 1957

1525
GRUNDZUGE DER FUHRUNG DER EISENBAHNFAHRIZENUGEN (BASIC FEATURES OF THE GUIDING OF THE RAILROAD VEHICLES)
Heumann, H., Lectures at T. H. Munich, Verlag Raw, Munich, 1947

1526
ZUM SCHLINGERN VON EISENBAHNFAHRZEUGEN (COMMENTS ON THE IRREGULAR OSCILLATION OF RAILROAD CARS)
Heumann, H., Organ, Aug. 1943, pp 221-235

1527
ZUM VERHULTEN VON EISENBAHNFAHRZEUGEN GLEISBOGEN (COMMENTS ON THE BEHAVIOR OF RAILROAD CARS ON CURVES)
Heumann, H., Organ f. d. Fortschritte d. Eisenbahnvesens, 1913, pp 104, 118, 136, and 158

1528
ZUR FRAGE DES RADEIFEN-UMBRISSES (COMMENTS ON THE QUESTION RELATIVE TO THE WHEELTREAD CONTOUR)
Heumann, H., Organ, Sept. 15, 1934

1529
FORMULAS FOR STRESS AND STRAIN
Roark, R. J., McGraw-Hill Book Company, 4th Edition, 1965, 417 p

1530
RAILWAY TRACK AND STRUCTURES CYCLOPEDIA
8th Edition, 1955, 325 p

1531
STRENGTH OF MATERIALS
Timoshenko, S., D. Van Nostrand Company, Inc., New York, Part II, Third Edition, 1956, 12 p

1532
THE THEORY OF ELASTICITY AND STRENGTH
Winkler, E., Prague, 1867, pp 182-184

1533
SURFACE CORRUGATIONS SPONTANEOUSLY GENERATED IN A ROLLING CONTACT DISC MACHINE
Carson, R. M., and Johnson, K. L., University of Cambridge, Cambridge, England, Wear, Vol. 17, 1971, pp 59-72

A flexibly mounted disc machine is described which permits the vibrations excited by rolling contact to be studied in isolation from their surroundings. The principal mode of vibration is a contact resonance in which the discs oscillate on the spring provided by their elasticity in the vicinity of their point of contact. Vibration in this mode has been observed to lead to the spontaneous generation of corrugations on the surface of the softer disc. Brass discs, dry or lubricated, progressively developed corrugations by plastic deformation. Duralumin discs, carefully degreased, developed corrugations by stick-slip wear when sliding accompanied rolling.

1534
HEUMANN TYPE PROFILE TESTS ON BRITISH RAILWAYS
Koffman, J. L., British Railways Board, Railway Gazette, Vol. 121, Apr. 2, 1965, pp 279-283

Tests conducted with an experimental coach to consider vehicle riding and economics in terms of wheel profiles are described. Heumann stressed the desirability of starting off with a profile similar to the worn one so that the shape will be maintained with as little alteration as possible throughout the life of the wheel. Wheel to rail contact conditions for a British Railway's standard wheel profile is compared to the Heumann profile as used on British Railways, Ride index values and wheel wear are shown for a British Railways coach with Heumann profile wheels.

1535
RAIL CURVE LUBRICANTS - A PARTIAL CORRELATION BETWEEN APPARENT VISCOSITY AND DELIVERY
Smith, F. W., and Dufault, R.J.A., National Research Council, Ottawa, Canada, Rpt. MP-37, Aug. 1965, 40p

This report gives measurements of the apparent viscosity and cone penetration of eight rail curve greases, and a correlation between these measurements described in a preceding report of the delivery of the same greases from a lubricator installed in a cold chamber. The results are expressed in the form of an equation between apparent viscosity and rate of delivery, valid when the temperature of the reservoir box is 20°F. This report serves as a final report on this part of the project, and recommendations are made for further laboratory studies on the adhesion to wheels and on the anti-wear properties of rail lubricants.

1536
READING ADDS YEARS TO CURVE RAIL LIFE WITH NEW LUBRICANT
Railway Age, Vol. 145, Nov. 10, 1958, pp 20-21

The service life of curve rail was increased 35 percent by use of flange lubricators equipped with molybdenum disulfide sticks in tests by the Reading producing a 65 percent return on investment. The railroad's rail adhesion study was centered on a grade 35 miles long with 150 major curves and 19 rail lubricators strategically located. Curve rail wear continued to be excessive. It was concluded that rail lubricators were not as effective as they should be. Development and use of a rail conditioning compound did not improve the situation. The compound helped rail adhesion, but accelerated curve wear on the rail. It is concluded that a lubricating method is desirable, but not at the expense of wheel-to-rail adhesion.

1537
MATCHING THE TRACK TO THE LOAD
Paterson, A., British Railways, Railway Gazette International, Feb. 1972, pp 53-56

The standard medium-manganese rail on BR weighs 113-1/4 lb/yd, and with 0.6 percent carbon and 1-1/4 percent manganese is a good general-purpose rail. For very heavy wear, particularly side cutting, a rolled 13 percent manganese rail is used. The magnesium rail cannot be welded to a normal rail and notch ductility is such that the rails cannot be turned. Trials in producing fracture-tough rails have shown encouraging results. It looks as if the new rails will show considerable improvement in toughness without reducing the head-wear properties. Although more expensive, there is every reason to believe that this steel will be particularly suitable for switches and crossings and at insulated joints where rail life is shortest.

1538
THE WEAR OF RAILS OF DIFFERENT GRADES OF STEEL
Engineering News, Vol. 66, No. 18, 1911, p 538

The relation of phosphorus to carbon is a very important feature in regard to the quality of steel for rails. Comparison between different weights and sections of rails of Bessemer and open-hearth steel indicate the superiority of the latter kind of steel.

Trials of experimental lots of both special Bessemer and open-hearth steel, and with different alloy are described. The average number of failures per 10,000 tons of rail laid for the different kinds tested are as follows: Open-hearth steel with ferro-titanium, 12; Bessemer steel with ferro-titanium, 13.5; Bessemer steel with nickel, 96; open-hearth steel with chromium nickel, 640.

1539
DYNAMICS OF BASES AND FOUNDATIONS
Barkan, D. D., McGraw-Hill, 1962

1540
THEORY OF ELASTICITY AND PLASTICITY
Westergaard, H. M., Harvard University Press and John Wiley & Sons, New York, 1952

1541
THE FORMATION AND STABILITY OF MARTENSITE LAYERS ON RAIL STEEL
Stolte, E., Stahl und Eisen, Vol. 22, Oct. 1963, pp 1363-1368

1542
THE VALIDITY OF LAYERED SOLID THEORIES FOR FLEXIBLE PAVEMENTS
Vesic, Proceedings of the International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, pp 283-290

1543
COMPARISON BETWEEN PREDICTED AND MEASURED PRESSURE DISTRIBUTIONS FOR CYLINDERS
Kannel, J., Battelle Columbus Laboratories, Columbus, Ohio, ASME Paper No. D3-71, 1973, To be published in the Journal of Lubrication Technology

1544
ON ROLLING FRICTION
Reynolds, O., Philosophical Transactions of the Royal Society, London, Vol. 116, 1876, p 1

1545
DESIGN PROCEDURES FOR DYNAMICALLY LOADED FOUNDATIONS
Whitman, R. V., and Richart, F. E., Journal of Soil Mechanics and Foundations Division, Proceedings of the ASCE, Vol. 94, No. SM-6, Nov. 1968, pp 169-193

1546
PUBLIC ROADS
Teller, L. W. and Sutherland, E. C., Apr., May, and June 1943

1547
DESIGN OF STRUCTURES UPON ELASTIC FOUNDATIONS
Gorbunov-Passadov, M. I. and Serebrajanyi, R. V., Proceedings of the 5th ICSMFE, Vol. 1, No. 11, pp 643-648

1548
WEAR
Archard, J. F., NASA Symposium on Interdisciplinary Approach to Friction and Wear, San Antonio, Texas, Nov. 28-30, 1967, pp 5.1-5.60

The development of fundamental knowledge of wear is reviewed with special emphasis upon the unlubricated wear of metals. One aspect which has received some attention is the classification of wear and some classifications are critically reviewed in the light of the experimental evidence of wear studies. Analytical theories of wear have a value in providing a more exact statement of assumed mechanisms of wear and also provide a basis for comparison between theory and experiment; from such comparisons are deduced values of the K factors of the theories. There is a need for physical explanations of these K factors which can be confirmed by subsidiary experiments.

1549
AREA ANNUAL CONVENTION
Cramer, R. E., Proceedings of the 45th Annual Convention AREA, Vol. 47, 1946

1550
RAIL STEELS, STRONGER, HARDER, OR TOUGHER?
Railway Gazette International, Vol. 128, Dec. 1972, pp 471-472

1551
ELASTIC DEFORMATION AND THE LOSS OF FRICTION
Archand, J. F., Proceedings of the Royal Society, London, England, A-243, 1957, p 190

This paper examines whether the hypothesis of elastic deformation of surface protuberances is consistent with Amontons's law, that the friction is proportional to the applied load. For a single elastic contact, the area of contact A is known to be proportional to the 2/3 power of load W. Since the frictional force is generally assumed to be proportional to A, it has been thought that in elastic deformation Amontons's law would not be obeyed. However, conforming surfaces usually touch at many points; in these circumstances A and W become nearly proportional. Experiments are described which show that the general law is that the friction is proportional to the true area of contact; whether or not Amontons's law is obeyed depends upon the surface topography. For highly elastic materials Amontons's law is obeyed when contact is made at many points, and other relations between A and W are observed when the contacts are few. Experiments with lubricated brass specimens show that the same conclusions apply to carefully prepared or well run-in metal surfaces running in conditions where the damage is small.

1552
STRESS CONCENTRATIONS AROUND HOLES
Savin, G. N., Pergamon Press, Oxford, England, 1961, 430 p

The book is subdivided into eight chapters, which, with the exception of the first one, can be read independently. The book therefore contains repetitions. The theory is useful to fastener holes in track design; however, experimental data are not available in the book on railroads. Particular attention is drawn to page 90 where formulas are given for determining stress concentration around circular and square holes.

1553
RESULTS OF A SURVEY OF RAIL JOINTS IRREGULARITIES USING MATISA RECORDS
Gilchrist, A. O., British Railways Research Department, Interim Rpt., DYN/15, Dec. 1965

1554
RUNNING OF BOGIES THROUGH CURVES, THE HEUMANN METHOD
Bontegoy, M. G., French Railway Techniques, No. 4, 1964, pp 225-232

1555
TRACTIVE RESISTANCE AND RIDING OF RAILCARS
Koffman, J. L., Diesel Railway Traction, Nov. 1963

1556
BASIC FEATURES OF THE GUIDING OF CARS ON RAILS
Heumann, H., Oldenburg, R., Munich, Germany, 1954

1557
INSTITUTE OF LOCOMOTIVE ENGINEERS
Heumann, H., Journal of the Institute of Locomotive Engineers, No. 295, 1963-1964, pp 517-529

1558
THE RAILROAD WHEEL SET
Muller, C. T., Glassers Annalen, Sept. 1953, pp 264-281

1559
RUNNING SAFETY AND PROTECTION AGAINST DERAILING OF CARS ON RAILS
Pflanz, K., Oesterreichische Bundesbahn, Lehrbehelf, No. 22

1560
DESTRUCTION FORMS IN RAILS IN RAILROAD OPERATION
Diehl, A., Stahl und Eisen, Vol. 38, Sept. 18, 1924, pp 1148-1149

1561
BALL AND ROLLER BEARING ENGINEERING
Palmgren, A., SKF Industries, Philadelphia, Pa., 1945

1562
INTRODUCTION TO THE TRACK GUIDING MECHANICS OF CARS ON RAILS
Danner, W., et. al., Archiv fur Eusenbahntechnik, No. 2, Jan. 1953, pp 1-28

1563
WHEELTREAD WEAR AND RUNNING OF THE CAR
Muller, C. T., Osterreichische Ingenieur-Zeitschrift, Vol. 7, No. 7, July 1964, pp 215-224

The experimental program lead to the following results: after a short running time, wheel profiles hollow out where they contact the rail heads. Once the wear shape has developed, it remains unchanged until turning of the wheel. The wear shape is largely independent of the new profile and strength of the wheel material. The wear to the rail is layed and is independent of initial shape. The experiment was designed to test the theory of Klingel, published in 1884. The mathematical model of the theory is given.

1564
BIBLIOGRAPHY ON CORRUGATION OF RAILS
British Railways, Research Department, Derby, England, 1954

1565
DESIGN ANALYSIS OF ROLLER TRACK SYSTEM FOR LARGE STEERABLE ANTENNA
Johns, T. G., Griffith, W. I., Eck, D. L., and Sorenson, J. E., Battelle Columbus Laboratories, Columbus Ohio, Final Rpt. to the U. S. Naval Research Laboratory, May 11, 1973, 41 p

This report covers the work performed on the design analysis of the roller-track system for the 300-foot-diameter ALT-AZ antenna at Sugar Grove, West Virginia. The broad objective of the program was to assess the important factors involved in the design of the roller-track system and to determine the adequacy of the present design in supporting the anticipated high loads. Newly developed computer programs were used that permitted the analysis of the stresses developed due to contact of the rollers and track. This report explains the basic concepts of these computer programs and describes their application and the computed results. The presently designed roller-track system, with both the rollers and the track fabricated from heat-treated SAE 4340 steel, should be capable of withstanding the anticipated maximum and normal operating loads over the anticipated life of the system without failure, provided the misalignment due to structural deflections does not exceed 0.07 degree. A less expensive steel, heat-treated SAE 1070, could probably be used for the rollers and track, if the misalignment due to structural deflections were below 0.05 degree. If the misalignments due to structural deflections were considerably lower than the values quoted above, the manufacturing tolerances could be correspondingly relaxed without danger of failure of the roller-track system due to yielding or fatigue.

1566
THE DYNAMIC RESPONSE OF ELASTIC BODIES IN ROLLING CONTACT TO RANDOM ROUGHNESS OF THEIR SURFACES
Gray, G. G., and Johnson, K. L., Journal of Sound and Vibration, Vol. 22, No. 3, 1972, pp 323-342

1567
PLASTIC INSULATION FOR RAIL JOINTS
Railway Track and Structures, Chicago, Illinois, Sept. 1973, p 37

1568
COMPARATIVE ANALYSIS OF DYNAMICS OF FREIGHT AND PASSENGER RAIL VEHICLES
Albeck, D. R., Prause, R. H., Day, J. B., and Meacham, H. C., Battelle Columbus Laboratories, Columbus, Ohio, Mar. 1974, Final Rpt, DOT-FR-20077, 207 p

This comparative analysis was an examination of the vehicle-track interactive dynamics where several types of trains are required to operate over the same route at different speeds. Two areas of concern were examined: the effects of track

geometry on vehicle response and track loads, and the effects of lateral force components acting on curves. A linear, 14-degree-of-freedom computer model was used to simulate a number of rail vehicles on a conventional track structure of rails, ties and ballast, including the Metroliner, passenger and freight cars, TurboTrain, and several locomotives. One of the uses of results from this study has been to assess the effects of track class speed limits on the different rail vehicles. Output data were generated in the form of track vertical and lateral forces, vehicle vertical and lateral accelerations (peak values in response to staggered-joint track, and both PSD and rms values in response to random track geometry), and a derailment index based on the lateral-to-vertical track force quotient. Ride quality indices based on the British Railways' weighting functions were also calculated, along with ISO-weighted car-body accelerations, for evaluation of subjective ride comfort.

1569
ASSESSMENT OF DESIGN TOOLS AND CRITERIA FOR URBAN RAIL TRACK STRUCTURES. VOL. I AT-GRADE TIE-BALLAST TRACK. VOL. II AT-GRADE SLAB TRACK
Prause, R. H., Meacham, H. C., et. al., Battelle Columbus Laboratories, Columbus, Ohio, Final Rpt. No. G-2283-1, Mar. 1974, DOT-TSC-563, 224 pp and 90 pp

These volumes assess current design practice based on a review of the literature and discussions with experienced track design personnel. The evaluation, in Vol. I, includes design loads and the criteria for selecting rail size, tie size and spacing, ballast depth, and subgrade parameters. The major track problems identified were rail joints, rail wear and noise on curves, rail fasteners, and rail corrugation. The evaluation, in Vol. II, includes descriptions of slab structures now in use in four countries, followed by reviews of design and analysis procedures used to characterize the subgrade and its support system. With a few exceptions, most of the work reported in the literature is based on highway or runway applicatons, where the mechanism of load transfer into the slab is completely different than in a rail support slab. Further research on the mechanisms of load transfer from rail fasteners into a reinforced concrete slab is needed, and the newly developed finite element approach appears well-suited. Continued study of settlement and failure criteria is needed for soil and base materials subjected to cyclic loading. The relative merits of various types of reinforced concrete slabs--for example, pre-stress or post-stress considerations, joints--should be studied before finalizing the UMTA track.

1570
THE CAUSE OF ROAD CORRUGATIONS AND THE INSTABILITY OF SURFACES UNDER WHEEL ACTION
Mather, K. B., Civil Engineering Public Works Review, Vol. 617, 1962, p 781

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PLASTIC FLOW AND RESIDUAL STRESS IN ROLLING AND SLIDING CONTACT
Johnson, K. L. and Jefferis, J. A., Proceedings of the Institute of Mechanical Engineers, Symposium on Fatigue, 1963

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*Entries relate to crosslevel, distortion, lateral profile, and superelevation.

**Entries relate to track gauge, and vertical profile.

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FOREIGN SOURCES INDEX