DOT-TSC-OST-78-14

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16. Abstract

This bibliography lists unlimited distribution reports released by the Transportation Systems Center from January through December 1977. It supplements Transportation Systems Center Bibliography of Technical Reports July 1970-December 1976 (DOT-TSC-OST-77-17). Reports are listed by sponsoring agency, and are indexed by subject, personal author, title, contract number, and report number.

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PREFACE

This bibliography lists unlimited distribution reports released by the Transportation Systems Center from January through December 1977. It updates Transportation Systems Center Bibliography of Technical Reports July 1970 - December 1976 (DOT-TSC-OST-77-17).

The following indexes are included: subject, personal author, corporate author, title, contract number, and report number. The indexes were compiled by Edith Allen of the Technical Information Center of the Transportation Systems Center.

INTRODUCTION

This bibliography lists unlimited distribution reports released by the Transportation Systems Center (TSC) from January through December 1977. Working papers, preliminary memoranda, and other limited distribution reports are excluded.

ARRANGEMENT OF THE BIBLIOGRAPHY

Reports are listed by sponsoring agency and arranged by DOT-TSC report number within each agency. A Department of Transportation Report Number/Transportation Systems Center Report Number Index is provided for cross reference.

For each entry, the following information is given:

DOT-TSC report number.

Title.

Performing organization.

Personal author(s).

NTIS accession number (if known).

Sponsoring agency report number (if different from DOT-TSC report number)

Type of report (interim or final).

Date. This indicates the date the report was approved by the sponsoring agency, and may not be the same as the publication date.

Number of pages.

Subject terms: based on Library of Congress subject headings.

Abstract: written by the author.

SAMPLE ENTRY

DOT/TSC Report Number	**DOT-TSC-FAA-74-16**
Title	**SYSTEM ACCESS CONTROL STUDY.**
Performing Organization	Bell Aerospace Company.
Author(s)	L. Shub, D. Allen, E. Clune, T. Lerner.
NTIS Accession No.	AD-782 045
Sponsoring Agency Report No.	FAA-RD-74-107
Contract No.	DOT-TSC-539
Type of Report	Final Report.
Date	June 1974.
Number of Pages	317p.
Subject Terms	Satellites-Aeronautical; Air Traffic Control-Satellite.
Abstract	This report presents a summary of a study conducted for the Transportation Systems Center of promising access control techniques which are applicable to an aeronautical satellite system. Several frequency division multiple access (FDMA) and time division multiple access (TDMA) configurations are analyzed and compared which are capable of providing voice, data and independent surveillance services. One of the FDMA concepts and a burst TDMA system are rated highest and are presented in greatest detail. Procedures are outlined for different types of interconnections. Included are preliminary designs of the avionics instrumentation.

The following indexes are included: subject, personal author, corporate author, title, contract number, and report number.

AVAILABILITY OF TSC REPORTS

All reports for which an NTIS accession number is included are available from the National Technical Information Service, Springfield, VA 22161. Current prices are listed in NTIS Government Reports Announcements.

A limited number of reports are available free of charge from the Technical Information Center/Code DTS-8311, U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142. Persons wishing to receive monthly announcements of new reports released by the Transportation Systems Center should also contact the Technical Information Center.

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PB 251 765
RA 74-38
Final Report November 1975 30p.

Automobile exhaust gas
Automobiles – Fuel consumption
Automobiles – Motors (Lean-burn)

This report is aimed at defining analytically and demonstrating experimentally the potential of the "lean-burn concept". Fuel consumption and emissions data are obtained on the engine dynamometer for the baseline engine, and two lean-burn configurations of the same engine and data comparisons are made. Individual cylinder equivalence ratios are measured to evaluate the cylinder-to-cylinder distribution. Pressure-time traces from individual cylinders are used to get information about ignition delay, combustion duration and cycle-to-cycle pressure variations. Fuel consumption and emissions data for one lean-burn configuration are obtained over the Federal Driving Cycle using a chassis dynamometer and the results are compared with the stock baseline results. Using experimental results and information from the existing literature, the potential of the "lean-burn concept" is assessed using the Blumberg-Kummer cycle analysis program.

DOT-TSC-OST-75-26.II
LEAN MIXTURE ENGINES
TESTING AND EVALUATION PROGRAM.
Volume II: Comprehensive Discussion
Jet Propulsion Laboratory
Mack W. Dowdy, Frank W. Hoehn and Tom G. Vanderbrug
PB 251 766
RA 74-38
Final Report November 1975 120p.

Automobile exhaust gas
Automobiles – Fuel consumption
Automobiles – Motors (Lean-burn)

This report is aimed at defining analytically and demonstrating experimentally the potential of the "lean-burn concept." Fuel consumption and emissions data are obtained on the engine dynamometer for the baseline engine, and two lean-burn configurations of the same engine and data comparisons are made. Individual cylinder equivalence ratios are measured to evaluate the cyclinder-to-cylinder distribution. Pressure-time traces from individual cylinders are used to get information about ignition delay, combustion duration and cycle-to-cycle pressure variations. Fuel consumption and emissions data for one lean-burn configuration are obtained over the Federal Driving Cycle using a chassis dynamometer and the results are compared with the stock baseline results. Using experimental results and information from the existing literature, the potential of the "lean-burn concept" is assessed using the Blumberg-Kummer cycle analysis program.

DOT-TSC-OST-75-26.III
LEAN MIXTURE ENGINES
TESTING AND EVALUATION PROGRAM.
Volume III: Appendices
Jet Propulsion Laboratory
Mack W. Dowdy, Frank W. Hoehn and Tom G. Vanderbrug
PB 251 767
RA 74-38
Final Report November 1975 84p.

Automobile exhaust gas
Automobiles – Fuel consumption
Automobiles – Motors (Lean-burn)

This report is aimed at defining analytically and demonstrating experimentally the potential of the "lean-burn concept." Fuel consumption and emissions data are obtained on the engine dynamometer for the baseline engine, and two lean-burn configurations of the same engine and data comparisons are made. Individual cylinder equivalence ratios are measured to evaluate the cylinder-to-cylinder distribution. Pressure-time traces from individual cylinders are used to get information about ignition delay, combustion duration and cycle-to-cycle pressure variations. Fuel consumption and emissions data for one lean-burn configuration are obtained over the Federal Driving Cycle using a chassis dynamometer and the results are compared with the stock baseline results. Using experimental results and information from the existing literature, the potential of the "lean-burn concept" is assessed using the Blumberg-Kummer cycle analysis program.

DOT-TSC-OST-75-55
VEHICLE TEST PROCEDURE DRIVING SCHEDULES
Transportation Systems Center
Joseph C. Sturm
PB-266 988
Final Report March 1977 214p.

Automobiles — Testing

The results of a study conducted to analyze the status of vehicle test procedure driving schedules are presented. Twenty-two driving schedules were identified and analyzed. Four categories of driving schedules were used: urban, suburban, highway/interstate, and other. Two types of driving schedules were included: "nonstylized," typified by the Environmental Protection Agency's Federal Test Procedure driving schedule, and "stylized," typified by the Society of Automotive Engineers' driving schedules. Parametric evaluators are presented for each driving schedule analyzed and discussed.

DOT-TSC-OST-76-3, I
TRUCK NOISE IX — NOISE REDUCTION STUDY OF AN IN-SERVICE DIESEL-POWERED TRUCK.
Volume I: Text
McDonnell Douglas Astronautics Company
Guy Leneman
PB-264 783
DOT-TSC-764
Final Report February 1977 70p.

Trucks — Noise
Trucks — Motors (Diesel) — Noise
Noise control

A series of tests to measure the noise contributions of subsystems was performed on a truck with a conventional short cab, equipped with a Cummins V-903 engine. The data acquired in these tests were used to select retrofittable components which would effectively reduce the total vehicle noise.

The original truck's A-weighted sound level during controlled acceleration tests (SAE J-366) was 90 dBA. The comparable contributions of the systems were 87 dBA for the engine, 84 dBA for the exhaust system, 76 dBA for the cooling system and 72 dBA for the induction system. The interior cab noise was 94 dBA.

A quiet truck test configuration had a sound level of 82 dBA on the left and 81 dBA on the right, with the fan disengaged. This configuration was not commercially feasible or usable on the road.

The final operational retrofitted configuration had a J-366 sound level of 87 dBA. The interior cab noise was 92 dBA.

The final truck had the original induction system, a new single vertical late model muffler, a clutched fan drive and engine covers. All of the retrofitted components are commercially available and in stock.

The total cost of all three changes is between $1000 and $1445 for a 3 dBA noise reduction. A 2 dBA noise reduction could be attained with engine covers only at a cost of from $470 to $770.

DOT-TSC-OST-76-3, II
TRUCK NOISE IX — NOISE REDUCTION STUDY OF AN IN-SERVICE DIESEL-POWERED TRUCK
Volume II: Appendix
McDonnell Douglas Astronautics Company
Guy Leneman
PB 264 784
DOT-TSC-764
Final Report February 1977 394p.

Trucks — Noise
Trucks — Motors (Diesel) — Noise
Noise control

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DOT-TSC-OST-76-6
AN INVESTIGATION OF SITE EFFECTS ON ROADSIDE MEASUREMENT OF TRUCK NOISE
Transportation Systems Center
Edward J. Rickley and Robert W. Quinn
PB-264 303
Final Report January 1977 182p.

Trucks — Noise — Measurement

Multi-microphone measurements of the passby noise emissions from three dedicated multi-axle trucks and from transient trucking were made at nine highway sites and one standard (SAE-J366b) measuring site. Measurements were made in and around Fort Wayne, Indiana, at sites of varied unobstructed configurations. Included in this report are tabulated peak RMS noise levels measured, curves of A-weighted noise levels versus offset distance, graphic noise level time history recordings, and 1/3-octave frequency spectra versus offset distance for selected events.

DOT-TSC-OST-76-14, I
TRUCK NOISE X
NOISE REDUCTION OPTIONS FOR DIESEL POWERED INTERNATIONAL HARVESTER TRUCKS.
Volume I - Development Work
International Harvester Company
Truck Engineering Center
S. T. Razzacki
PB-271 091/set
DOT-TSC-721
Final Report April 1977 156p.

Trucks — Noise
Trucks — Motors (Diesel) — Noise
Noise control

Noise reduction option development work was carried out on two in-service diesel powered IH trucks, consisting of a cab-over model and a conventional model with a baseline exterior noise level of 87 dB(A) each. Since no specific noise goals were set, International Harvester established an exterior noise reduction goal of 83 dB(A). Then, for each vehicle, proper noise source identification techniques were applied and major contributors were established. The commercially available source noise reducing components were tested singly, and were selected based upon an optimum evaluation. The selected components were collectively installed on the trucks and cumulative performance in the total truck environment was found to be adequate to meet the established noise level goals.

DOT-TSC-OST-76-14. II
TRUCK NOISE X
NOISE REDUCTION OPTIONS FOR DIESEL POWERED INTERNATIONAL HARVESTER TRUCKS.
Volume II - Cost-Noise Analysis and Field Installation
International Harvester Company.
Truck Engineering Center
S. T. Razzacki
PB 271 091/set
DOT-TSC-721
Final Report April 1977 122p.

Trucks — Noise
Trucks — Motors (Diesel) — Noise
Noise control

Noise reduction option development work was carried out on two in-service diesel powered IH trucks, consisting of a cab-over model and a conventional model with a baseline exterior noise level of 87 dB(A) each. Since no specific noise goals were set, International Harvester established an exterior noise reduction goal of 83 dB(A). Then, for each vehicle, proper noise source identification techniques were applied and major contributors were established. The commercially available source noise reducing components were tested singly, and were selected based upon an optimum evaluation. The selected components were collectively installed on the trucks and cumulative performance in the total truck environment was found to be adequate to meet the established noise level goals.

OFFICE OF THE SECRETARY OF TRANSPORTATION

DOT-TSC-OST-76-24
TRANSPORTATION SAFETY ANALYSIS
The Center for the Environment and Man, Inc.
Hans C. Joksch
PB-263 639
DOT-TSC-1089
Final Report November 1976 150p.

Transportation – Accidents – Mathematical models

A conceptual structure was developed for a model expressing transportation accident deaths as a function of transportation activity levels. The literature and data bases were reviewed. A first-level model was developed for the following modes: highway transport; air transport – scheduled and general aviation; and rail transport. The first-level model was used to project the number of transportation accident deaths, by mode, up to 1990, on the basis of transportation projections provided by TSC. An outline for a second-level model was developed.

DOT-TSC-OST-76-32
RAIL TRANSPORTATION REQUIREMENTS FOR COAL MOVEMENT IN 1980
Input Output Computer Services, Inc.
Samir A. Desai, James Anderson
PB-265 466
DOT-TSC-1000
Final Report December 1976 256p.

Coal – Transportation

This rail-oriented coal transportation study is one of a series conducted by the Department of Transportation to identify and quantify transportation requirements for energy materials. Information provided by these studies will be used by government and industry to examine and shape present and future transportation policies and related resource allocation decisions.

The primary objectives of this study are to develop and present rail industry estimates of the amount of coal that will move by rail in 1980, the additional equipment and facilities required to handle the increased traffic, and the associated lead times involved. Other key report objectives are to describe present coal flows, associated operational policies and practices, and the interfaces with connecting or continuing modes of transportation. When possible 1974-1980 comparisons for these factors are made to illustrate the magnitude and direction of expected changes in levels of operations, distribution patterns, etc.

DOT-TSC-OST-76-33
WATER TRANSPORTATION REQUIREMENTS FOR COAL MOVEMENT IN THE 1980's
Input Output Computer Services, Inc.
Samir A. Desai
PB-263 368
DOT-TSC-1000
Final Report December 1976 76p.

Coal – Transportation

This water-oriented coal transportation study is one of a series conducted by the Department of Transportation to identify and quantify transportation requirements for energy materials. Information provided by these studies will be used by government and industry to examine and shape present and future transportation policies and related resources allocation decisions.

The primary objectives of this study are to develop and present barge industry estimates of the additional equipment and facilities required to handle a projected doubling of coal traffic. Other key report objectives are to describe present coal flows, associated operational policies and practices, and the interfaces with connecting or continuing modes of transportation.

DOT-TSC-OST-76-35
AIR QUALITY ANALYSIS OF A MULTILEVEL COMPLEX INTERCHANGE: CASE STUDY USING THE IMPROVED TSC/EPA MODEL
Transportation Systems Center
Eugene M. Darling, Jr., David S. Prerau, Paul J. Downey and Jeffrey D. Garlitz
PB-262 882
Final Report December 1976 134p.

Air pollution – Mathematical models

As requested by the Region 3 Federal Highway Administrator, the Transportation Systems Center prepared a detailed computer analysis of air quality for a complex multilevel interchange in Baltimore consisting of elevated road, at-grade roads, and ascending and descending ramps.

An in-house version of the Environmental Protection Agency Gaussian Highway Line Source model, as modified by the Transportation Systems Center, was used. These analyses showed that the levels of air pollution near this interchange would not exceed national standards in either year in question, 1980 or 1995.

This analysis is treated as a case study, illustrative of a method that is useful for computing air-pollution levels associated with many highway configurations. The individual ingredients of the analysis are described in detail, including the handling of road geometry, the calculation of emissions, the estimation of meteorological parameters and the selection of receptor locations. A complete listing of the computer program used in these studies is included.

It is concluded that the method of air-quality analysis developed for this case is an easy-to-use, straightforward procedure of general applicability. Within the limitations of the model and subject to the accuracy of the input data, the approach can produce reasonable estimates of worst-case pollutant concentrations for comparison with national ambient-air-quality standards.

DOT-TSC-OST-76-39
COMPUTER-BASED RESOURCE ACCOUNTING MODEL FOR AUTOMOBILE TECHNOLOGY IMPACT ASSESSMENT
Charles Stark Draper Laboratory, Inc.
J. Barton DeWolf, Christian Davis, Peter C. Heinemann
PB-268 627
DOT-TSC-1021
Final Report October 1976 74p.

Automobile industry and trade — Mathematical models

A computer-implemented resource accounting model has been developed for assessing resource impacts of future automobile technology options. The resources tracked are materials, energy, capital, and labor. The model has been used in support of the Interagency Task Force on Motor Vehicle Goals Beyond 1980. The report describes the methodology.

Annual production requirements for up to thirty materials are accumulated. Projected demand is disaggregated among primary and secondary materials, imports and domestic sources. Capital and labor impacts of auto design changes, disaggregated by two-hundred industries are determined using a modified input/output model.

DOT-TSC-OST-76-44
A SIMULATOR TO PRODUCE NARROWBAND MULTIPATH EFFECTS ON L-BAND AIRCRAFT-TO-SATELLITE SIGNALS
Signatron, Inc.
Edward H. Getchell and Paul F. Mahoney
PB-263 624
DOT-TSC-372
Final Report December 1976 36p.

Satellites in navigation
Radio — Interference

The purpose of this program was to study the aircraft-to-satellite communications channel and to develop instrumentation to accurately simulate the effects of the multipath, Doppler and additive noise effects of such channels. Such a device which simulates aircraft-to-satellite communication channels has been designed and fabricated. The simulator provides capability for test and evaluation of communications and navigation equipment under controlled and repeatable conditions without the need for extensive, costly, time-consuming and nonrepeatable field experiments.

The basic approach to channel simulation is to split up the signal into several parts, delay each path differently then multiply the delayed signals by a set of complex noise waveforms and sum the results.

Both additive and multiplicative noise signals are exactly reproducible; thus the channel conditions may be reset and repeated.

The channel bandwidth is 10 MHz; the relative delay between direct path and multipath signals may be selected to be 5, 30 or 55 usec. The multipath delay spread is 8 usec with a 2 usec resolution.

DOT-TSC-OST-76-45
SURVEY OF DRIVER AID DEVICES FOR IMPROVED FUEL ECONOMY
Aerospace Corporation
M. G. Hinton, L. Forrest, D. P. Duclos, T. H. Davey, R. R. Sheahan, K. B. Swan
PB-264 162
F04701-75-C-0076
Interim Report November 1976 164p.

Automobile driving
Automobiles — Fuel consumption

This report presents a brief summarization of available information pertaining to devices offered to aid the driver in improving his driving habits in order to reduce fuel consumption.

Principal emphasis is placed on characterizing the available devices in terms of their features and operating principles. When appropriate, possible side effects (e.g., safety considerations) occasioned by the use of such devices are examined. The available fuel economy test data for drivers who had received training only (no auxiliary or aid devices) are reviewed for comparison purposes.

DOT-TSC-OST-76-47
ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE TRUCKS
Maine Department of Transportation
Kenneth M. Jacobs
PB-266 656
DOT-TSC-1042
Final Report February 1977 140p.

Trucks — Fuel consumption
Trucks — Motors (Diesel) — Fuel consumption

This report presents fuel consumption and other data on comparable diesel and gasoline trucks. The data was compiled from actual, operational records of the Maine Department of Transportation for trucks of about 24,000 pounds gross vehicle weight and 150 to 180 horsepower. Information on the use of other petroleum based products such as engine oil and lubes is also given, together with initial maintenance costs.

The information is broken down in various ways as the original data source allowed. In particular, information is given on winter and summer operations so that it is possible to consider the effects of different seasonal effects, such as usage, in the comparisons. The period covered is from 1972 through 1976.

In general, the diesel trucks used approximately one-third less fuel than comparable gasoline trucks.

DOT-TSC-OST-76-48
HIGHWAY TRAFFIC KINEMATICS AND THE CHARACTERISTIC RELATION
Transportation Systems Center
Diarmuid O'Mathuna
PB-266 673
Final Report March 1977 26p.

Traffic flow — Mathematical models

A new relation describing the fundamental formula of road traffic is presented, where the approach is guided by an emphasis on the parameter determination aspects of the problem. The proposed relation includes the degrees of freedom sufficient to allow independent satisfaction of the inherent highway constraints. It is shown how the relation can be fited to an empirically determined curve through appropriate choice of the parameters.

DOT-TSC-OST-76-49
MAXIMUM LIKELIHOOD AS AN OPERATIONAL TOOL IN SOCIO-ECONOMIC MODELING: AS OUTLINED IN A RECENT THESIS OF D.W. PETERSON
Transportation Systems Center
Diarmuid O'Mathuna
PB-265 356
Final Report February 1977 24p.

Social science — Mathematical models

The limitations of currently used estimation procedures in socio-economic modeling have been highlighted in the ongoing work of Senge, in which it is shown where more sophisticated estimation procedures may become necessary. One such advanced method (FIMLOF) based on the maximum likelihood procedure has been developed by Peterson and incorporated in a computer program, GPSIE. The present report gives a review of this development and includes a discussion of the relevant conclusions from the work of Senge.

DOT-TSC-OST-76-51
AGGREGATE AUTO TRAVEL FORECASTING: STATE OF THE ART AND SUGGESTIONS FOR FUTURE RESEARCH
Transportation Systems Center
Robert E. Mellman
PB-263 351
Final Report December 1976 46 p.

Traffic estimation

This report reviews existing forecasting models of auto vehicle miles of travel (VMT), and presents evidence that such models incorrectly omit time cost and spatial form variables. The omission of these variables biases parameter estimates in existing VMT models. More accurate parameter estimates are made, and suggestions are made for improving VMT models.

Accurate VMT models are important because VMT is a primary determinant of auto fuel use, pollution, and traffic fatalities; because the federal government is considering regulations to lower the levels of these externalities; and because future levels of the externalities must be measured in order to calculate the benefits to be derived from such federal regulation.

DOT-TSC-OST-76-54
EXPERIMENTAL DESIGNS AND PSYCHOMETRIC TECHNIQUES FOR THE STUDY OF RIDE QUALITY
ENSCO, Inc.
M. Dean Havron, Robert A. Westin
PB-268 584
DOT-TSC-864
Final Report May 1977 308p.

Vibration (Transportation engineering)

A major variable in both the cost of any new transportation system and rider acceptance of the system is the ride quality of its vehicles. At this time, there exists no set of objective criteria which would allow the transportation system designer to determine what level of ride quality would be considered acceptable by a wide variety of potential passengers. The purpose of this study was to establish statistically acceptable techniques for the development of methods for relating physical measures of vehicle vibration to passenger estimates of ride quality.

The major end products of this study are:
1. A general experimental strategy which will allow for the correlation of data from experiments performed in different settings and on different transportation modes.
2. A set of experimental designs for the statistically valid measurement of ride quality.
3. A set of psychometric scales for the determination of perceived ride quality.
4. The results of a validation test of the psychometric scales. This test was performed on a ride simulator which was programmed to duplicate the ride experienced on an interurban train.

DOT-TSC-OST-76-57
REVIEW OF DIESEL COMBUSTION MODELS FOR NOx AND SMOKE EMISSIONS
University of Southampton.
Institute of Sound and Vibration Research.
David Anderton
PB-276 350
DOT-TSC-1101
Final Report October 1977 166p.

Diesel motor exhaust gas -- Mathematical models

A comprehensive reveiw of diesel emissions models is presented together with assessments of the pertinent fundamental NOx and soot kinetics. The results of diesel emissions experiments carried out at Southampton are also presented and correlations are suggested.

The review suggests that available emissions models do not incorporate a sufficiently detailed description of the fundamental mixing and chemical kinetic processes occuring in the diesel. They cannot therefore be used predictively. Suggestions are made for model development, fundamental data acquisition and the use of incylinder experimental techniques. The latter are required to obtain data on the flowfield and mixing processes occurring in the diesel combustion chamber.

DOT-TSC-OST-76-58
A COMPARISON OF SIX HIGHWAY AIR POLLUTION DISPERSION MODELS USING SYNTHETIC DATA
Transportation Systems Center
Paul J. Downey, Jeffrey D. Garlitz, Kevin H. Murphy
PB-274 273
Final Report September 1977 194p.

Air pollution -- Mathematical models

This is the second of two studies conducted by the Transportation Systems Center (TSC) to test the performance of highway air pollution dispersion models, using synthetic data (i.e., either measured or artificially constructed input data for models, consisting of traffic and meteorological parameters). In the first study

(DOT-TSC-OST-77-33, dated June 1977), thirteen models were tested with a portion of the Airedale air quality data base. In the present study, six models (including five of the original thirteen) were tested with a new synthetic data base. The air pollution predictions of the six models were compared in pairs, and various measures of the difference between the predictions of each pair were calculated. A group of three models generating very similar predictions was discovered; these are called Consensus Models. In the first study, using the same analytical approach, these three models were also found to be Consensus Models, along with others which could not be tested in the present study. Synthetic data testing can only reveal the degree of agreement among model predictions. The capability of these models to predict real-world air pollution cannot be determined until an air-quality data base suitable for model validation become available.

DOT-TSC-OST-76-60
TRANSPORTATION STATISTICAL DATA AND INFORMATION
Transportation Systems Center
Robert Tap and Alan Kaprelian
PB-265 457
Final Report December 1976 226p.

Transportation — Statistics

The document contains an extensive review of internal and external sources of transportation data and statistics especially created for data administrators. Organized around the transportation industry and around the elements of the U.S. Department of Transportation, it is the most comprehensive single document that reviews transportation data and its history.

DOT-TSC-OST-76-61
ENERGY AND ECONOMIC IMPACTS OF PROJECTED FREIGHT TRANSPORTATION IMPROVEMENTS
Peat, Marwick, Mitchell & Co.
R.H. Leilich, R.D. Cohen, A. Green, M.J. Kendrick
PB-260 000
DOT-TSC-1001
Final Report May 1977 448p.

Freight and freightage — Fuel consumption
Transportation — Fuel consumption
Railroads — Fuel consumption
Trucks — Fuel consumption

This study examines current and future energy impacts for each major freight mode, by commodity, and, in many cases, by vehicle type. It also discusses potential economic impacts of these anticipated changes. The study is limited to intercity freight movements of both private and for-hire carriers. The study includes a determination of base case energy scenarios for 1972, 1980, and 1985 to serve as a basis for evaluating operational and technological impacts by 1980 and 1985 for an industry change scenario (in which industry is likely to implement changes on its own), and the government influence scenario (where changes could be accelerated by changes in economic and regulatory policies). Much of the data and findings contained in this study represent original research, but based on a relatively incomplete national data base. The report discusses in detail operational and technological changes which will have energy and economic impacts on each of the freight modes included in the report. Greater emphasis was given to intercity freight transportation by truck and railroad, with less emphasis on inland, coastal, and Great Lakes movements, pipelines and air freight.

DOT-TSC-OST-76-63
TRANSPORTATION NOISE BIBLIOGRAPHY
Transportation Systems Center
PB-264 521
July 1975 94p.

Transportation noise — Bibliography

A basic bibliography on transportation noise that introduces the non-professional to the variety of information available in the field. The selections are intended to give the reader only an indication of the wide range of coverage of such topics as noise control and abatement; effects of noise on man; noise sources including aircraft, surface transportation and marine transportation; economic aspects of noise control; methods of implementing noise control; and noise control and land use.

DOT-TSC-OST-76-64
SELECTED TRANSPORTATION TOPICS: ENERGY PRIMER
Transportation Systems Center
PB-263 077
July 1975 77p.

Transportation — Fuel consumption
Energy conservation

This is a general-interest publication, introductory in nature, designed to aid the user in gaining basic familiarity with, and understanding of, transportation energy. An immense amount of information has been generated in recent years regarding current and forecast energy transportation situations in the U.S. Energy statistics, supply and utilization forecasts, and evaluations of conservation alternatives are the topics emphasized. Ten abstracts were selected from recent literature. Each includes as much as possible of the author's data to save time by allowing the user to consult this Primer rather than scattered original reports. Numerous authors' tables have been retained with the abstracts.

DOT-TSC-OST-76-65
PRIORITY TECHNIQUES FOR HIGH OCCUPANCY VEHICLES: STATE-OF-THE-ART OVERVIEW
Transportation Systems Center
PB-263 117
November 1975 108p.

Bus priority techniques
Carpools and carpooling
Vanpools and vanpooling

This report, part of a series of publications based on research and development efforts sponsored by the Department of Transportation, is a concise state-of-the-art overview of priority techniques for high occupancy vehicles (buses, carpools, and vanpools). The report identifies and summarizes selected characteristics of 17 freeway-related and 37 arterial-city street priority techniques. The document also provides a perspective on planning and implementation guidelines, and legal, financial, and institutional considerations associated with priority techniques. Supplementary material includes a listing of current sources of information, a directory of referenced transit authorities, operating agencies, and governmental units, and a glossary of terms used in the report.

DOT-TSC-OST-77-1.I
STUDY OF AUTOMOBILE MARKET DYNAMICS.
Volume I: Description
Arthur D. Little, Inc.
Morton, A.S.; Strong, S.; Metcalf, E.; Marple, G.; Freedman, A.
PB-272 924
DOT-TSC-1060
Final Report August 1977 124p.

Automobile purchasing
Automobile industry and trade
Automobiles – Fuel consumption

To determine the effects of alternative energy conservation policies on total sales of new cars and upon the distribution by size-class and origin (foreign vs. domestic), in-depth interviews were administered to seven hundred recent new-car buyers. Extensive income and demographic data were collected from the respondents along with information on the characteristics and patterns of use of currently owned vehicles. Four policy options (no change, gasoline taxes, excise taxes proportional to fuel consumption, and regulation of fuel economy) were explained to the respondents. For each policy option, respondents indicated how they thought their automobile purchases for the 1976-1980 time period would be affected in terms of vehicle size, origin, timing of purchase, etc.

Volume I of this report describes the scenarios for each of the policy options, presents the survey findings, and estimates their applications on government policies.

DOT-TSC-OST-77-1.II
STUDY OF AUTOMOBILE MARKET DYNAMICS.
Volume II: Analysis
Arthur D. Little, Inc.
Morton, A.S.; Strong, S.; Metcalf, E.; Marple, G.; Freedman, A.
PB-272 925
DOT-TSC-1060
Final Report August 1977 74p.

Automobile purchasing
Automobile industry and trade
Automobiles – Fuel consumption

To determine the effects of alternative energy conservation policies on total sales of new cars and upon the distribution by size-class and origin (foreign vs. domestic), in-depth interviews were administered to seven hundred recent new-car buyers. Extensive income and demographic data were collected from the respondents along with information on the characteristics and patterns of use of currently owned vehicles. Four policy options (no change, gasoline taxes, excise taxes proportional to fuel consumption, and regulation of fuel economy) were explained to the respondents. For each policy option, respondents indicated how they thought their automobile purchases for the 1976-1980 time period would be affected in terms of vehicle size, origin, timing of purchase, etc.

Volume II describes the work in providing statistical inputs to a computer model by examining the effects of various options on the number of automobiles sold; the distribution of sales among small, medium and large cars; the distribution between automobiles of foreign and domestic manufacturers; and the gross revenue resulting from the automobile sales.

DOT-TSC-OST-77-4
FREIGHT TRANSPORTATION
A DIGEST OF TECHNICAL PAPERS
Volume I
Transportation Systems Center
PB-262 944
October 1976 212p.

Freight and freightage — Addresses, essays, lectures

This volume contains a number of technical papers dealing with intercity freight transportation. Collectively these systems oriented papers consider a wide range of subject matter including transportation facilitation, commodity flow, regulation, automatic control, demand modeling, transportation energy, evaluation of innovation, tariff computerization, network analysis and new concepts for freight transportation.

In addition to those subjects that deal with the transportation system or process, there are papers that treat specific modal considerations. These include discussion of aerodynamic drag effects on rail piggyback operations, rail freight yard technology review, summary of motor carrier return on investment considerations in a regulated industry, results of pipeline studies and use of simulation for waterway navigation and control.

DOT-TSC-OST-77-5
AMERICA'S FREIGHT SYSTEM IN THE 80's AND 90's . . . . BUT HOW TO GET THERE?: CONFERENCE PAPERS
Harbridge House, Inc.
PB-262 943
December 1976 244p.

Freight and freightage — Addresses, essays, lectures

DOT-TSC-OST-77-7
SYSTEMS STUDY OF PRECAST CONCRETE TUNNEL LINERS
Bechtel Corporation
Birkmyer, J.
PB-264 761
DOT-TSC-772
Final Report March 1977 147p.

Tunnel lining — Design and construction

The study addresses precast concrete lining systems. Existing precast concrete systems designed or constructed in Europe, Japan, and the United States are evaluated. With these as a point of departure, designs for lining systems applicable to the specific conditions encountered in the United States are developed. A comparative cost analysis is made between the linings described in the study, one existing precast concrete design and two in fabricated steel. Appreciably lower costs are found for all of the concrete liner designs when compared to those in fabricated steel. Water sealing systems are discussed and recommendations for the development and testing of sealing details are made. Guidelines for dissemination of information about, and for the implementation of the systems, are presented.

DOT-TSC-OST-77-8
TERRESTRIAL RADIODETERMINATION PERFORMANCE AND COST
Transportation Systems Center
Edwin H. Farr and Ralph D. Kodis
PB-273 401
Interim Report September 1977 50p.

Automatic vehicle monitoring

This second interim report summarizes information gathered during a study of the application of electronic techniques to geographical position determination on land and on inland waterways. Systems incorporating such techniques have been called terrestrial radiodetermination (TRD) systems. Their most common application to date has been to locate and track a large number of vehicles in real time. Other uses are envisioned for the future.

This report describes the performance of several leading systems that employ TRD. These systems are or have been operational to some degree. Cost data are also given. The report complements and extends the information given in the previous interim report. (See Cantor, Farr, and Kodis, Report No. DOT-TSC-OST-76-7, July 1976).

DOT-TSC-OST-77-9
A COMPARATIVE STUDY OF VARIOUS TYPES OF VEHICLE DETECTORS
Massachusetts Institute of Technology.
Electronic Systems Laboratory.
Marcel Singleton & John E. Ward
PB-275 585
DOT-TSC-849
Final Report September 1977 62p.

Traffic engineering — Electronic equipment

This report is a comparison between the different types of vehicle detectors and associated equipment. It covers practically all of the presence and motion detectors either being sold commercially or actively researched at this time, and includes radar detectors, ultrasonic detectors, induction-loop detectors, magnetic-gradient detectors, pressure-sensitive detectors, and magnetometers. The theoretical and practical aspects of the different classes of detectors are presented, including principles of operation, detection parameters, installation requirements, and relative costs. The survey is based on information obtained from manufacturers and the technical literature. Typical detector specifications and the characteristics of traffic-analyzer equipment are contained in the appendixes.

DOT-TSC-OST-77-10
DYNAMIC CENTRALIZED AND DECENTRALIZED CONTROL SYSTEMS
Massachusetts Institute of Technology.
Electronic Systems Laboratory.
D.P. Looze, P.K. Houpt, M. Athans
PB-275 470
DOT-TSC-849
Final Report September 1977 114p.

Traffic engineering

This report develops a systematic method for designing suboptimal decentralized control systems. The method is then applied to the design of a decentralized controller for a freeway-corridor system.

A freeway corridor is considered to be a system of parallel freeways and arterials connecting two locations. A centralized control system is designed for a freeway corridor using the Linear Quadratic Gaussian (LQG) regulator-design technique. It is found that the centralized design works well, subject to the validity of the model that is used.

An approach similar to the LQG method is used to develop the decentralized design method. A linearized model is used, and the subsystem filters and control laws are assumed to be linear. Communication between subsystems is specified before the filter and control gains are designed. The problem is formed as a static minimization constrained by a Lyapunov matrix equation. The variables over which the cost is minimized are the elements of the filter and control gains. A computer solution to the constrained static minimization is developed.

The design method is applied to a freeway-corridor system, and resulting design is compared to the centralized solution. It is found that the decentralized control system works almost as well as the centralized control system.

DOT-TSC-OST-77-11
AUTOMOBILE SCRAPPAGE AND RECYCLING INDUSTRY STUDY — OVERVIEW REPORT
H.H. Aerospace Design Company, Inc.
Kaiser, R., Wasson, R.P. and Daniels, A.C.W.
PB-273 286
DOT-TSC-1028
Final Report September 1977 418p.

Automobile wrecking and used parts industry
Scrap metal industry

After an automobile has lost its utility as a mode of transportation, it is usually deregistered and disposed of as scrap. The principal factors which influence the recovery of materials from junked automobiles are reviewed and evaluated. These include the number and materials composition of the automobiles that are retired annually in the U.S.; the flow of junk automobiles into the commercial recovery cycle and problems associated with abandoned automobiles; operations of the auto wrecking industry where serviceable parts are salvaged; and the structure, operations and technology of the

scrap industry which transforms automobile hulks into commercial grades of metal scrap. Since Federal laws and policies impact on the reclamation of materials from junked automobiles, a legal review of key legislation and policies is also included.

Because of a strong demand for auto hulks by scrap processors, created by an increased market for ferrous scrap, the problem of an ever increasing accumulation of unprocessed deregistered automobiles has been stabilized. In 1974, the fractional recovery of metallic materials from the approximately ten million automobiles deregistered that year was higher than from other forms of obsolete scrap. The estimated value of the recovered materials was in excess of one billion dollars.

DOT-TSC-OST-77-12
AUTOMOBILE CHARACTERISTICS HISTORICAL DATA BASE
Chilton Company
J.A. Milne, C. Cantwell, H. Eissler
PB-272 746
DOT-TSC-1174
Final Report August 1977 76p.

Automobiles – Specifications
Automobiles – Statistics
Automobiles – Fuel consumption

A collection of data concerning the physical, operating, and performance characteristics of automobiles for the model years 1955, 1960, 1965, 1968, and 1970 to 1974. Data is to be added to the data base already established by DOT/TSC, for the 1975 model year automobiles.

Information was primarily collected from published sources with extrapolation and correlations being made when raw data was not available.

Vehicles are reported by model year and are grouped by manufacturer using production volume and fuel economy-dependent attributes – i.e.: engine displacement, weight, and transmission type as criteria to select representative vehicles. Models which are essentially duplicated by more than one division of a manufacturer – i.e.: Ford Maverick and Mercury Comet, are represented by a model in only one of the divisions. Characteristics are documented for more than 1000 automobiles representative of total United States sales of all domestic and imported automobiles for the model years indicated.

DOT-TSC-OST-77-17
TRANSPORTATION SYSTEMS CENTER BIBLIOGRAPHY OF TECHNICAL REPORTS; JULY 1970 – DECEMBER 1976.
Transportation Systems Center
Edith W. Allen, editor
PB-271 327
Bibliography April 1977 234p.

Transportation – Bibliography

This bibliography lists unlimited distribution reports released by the Transportation Systems Center from July 1970 through December 1976. Reports are listed by sponsoring agency, and are indexed by subject, personal author, corporate author, title, contract number, and report number.

DOT-TSC-OST-77-25
STUDY DESIGN FOR A METHOD OF PROJECTING VEHICLE MILES OF TRAVEL
Environmental Impact Center, Inc.
F.T. Rabe
PB-273 288
TS-10596
Final Report August 1977 56p.

Traffic estimation

Vehicle miles of travel (VMT) by passenger automobiles is an important determinant of gasoline consumption, ambient air quality, highway safety, and personal and corporate financial conditions in the United States. Changing patterns and trends in VMT, therefore, have profound implications for energy conservation, environmental quality, and economic stability. Forecasts of likely future levels of VMT have become a central input to transportation policy analysis.

This report is an effort to assess the state of the art of VMT forecasting and map out strategies for extending it. The work included an inventory of data sources and a review of existing VMT models. Recommendations for long-, intermediate-, and short-range future research are included, along with estimates of effort and costs required for carrying out each possible research strategy.

DOT-TSC-OST-77-26
DYNAMIC MODELS OF THE U.S. AUTOMOBILE FLEET
Environmental Impact Center, Inc.
F. T. Rabe
PB-273 278
TS 9961
Final Report August 1977 46p.

Automobiles – Mathematical models

This report examines some of the dynamic properties of the automobile fleet. The focus is not on new-car demand, but rather on the overall behavior of the system. Relationships derived from previous studies have been incorporated and integrated in a single model. This lends empirical credence to the model as well as allowing a test of internal consistency for a group of parametric relationships estimated independently. An additional objective of the work is to test the utility of the Systems Dynamics modeling approach and the DYNAMO software package for a dynamic automotive fleet model.

DOT-TSC-OST-77-31
METHANOL AS AN AUTOMOTIVE FUEL
With Special Emphasis on Methanol-Gasoline Blends
Transportation Systems Center
A. Landman
PB-270 401
Final Report April 1977 94p.

Alcohol as fuel

This report reviews the available information on methanol as related to its potential use as an automotive fuel. Information gaps critical to assessment and future decisions are delineated and suggestions made for necessary R&D efforts. In this context, methanol is characterized and the results of various studies on methanol and methanol-gasoline blends, throughout the United States and elsewhere, are presented and compared. These studies encompass fuels and their use and effects in engines and vehicles. Cost information, although limited, is given as available. The report also describes and summarizes methanol production processes; their promise and expansion possibilities in relation to potential requirements. Various raw material sources are considered in the light of future production potential needs.

DOT-TSC-OST-77-32
UNCERTAINTIES IN ESTIMATES OF FLEET AVERAGE FUEL ECONOMY: A STATISTICAL EVALUATION
Environmental Impact Center
F. T. Rabe
PB-270 025
DOT-TSC-1311
Final Report June 1977 66p.

Automobiles – Fuel consumption

Research was performed to assess the current Federal procedure for estimating the average fuel economy of each automobile manufacturer's new car fleet. Test vehicle selection and fuel economy estimation methods were characterized statistically and sources of uncertainty identified. An empirical evaluation of these methods, based on limited available data, indicated that current estimates cannot determine average fuel economy to within 0.1 mile per gallon, the increment to be used in specifying financial penalties and credits to manufacturers under the Energy Policy and Conservation Act (PL 94-163). Alternative procedures for reducing uncertainties in the estimates were identified, and their potential impact on accuracy was quantified. Results confirm that the accuracy of the estimates could be significantly improved with no increase in sample size.

DOT-TSC-OST-77-33
HIGHWAY AIR POLLUTION DISPERSION MODELING: PRELIMINARY EVALUATION OF THIRTEEN MODELS
Transportation Systems Center
Eugene M. Darling, Jr., David S. Prerau, Paul J. Downey, Peter H. Mengert
PB-271 049
Final Report June 1977 260p.

Air pollution – Mathematical models

Thirteen highway air pollution dispersion models have been tested, using a portion the Airedale air quality data base. The Transportation Air Pollution Studies (TAPS) System, a data base management system specifically designed for evaluating dispersion models, has been used in the testing process.

Because of inadequacies in the Airedale data, it proved necessary to abandon the original plan to test the accuracy of model predictions, and instead to adopt the approach of treating the data as a synthetic data sample for use in determining how closely the model predictions agree with one another. Five models (three Gaussian and two Conservation of Mass) emerged as Consensus Models. However, the limited range of the data elements in this sample causes this finding to be preliminary. Further experiments with synthetic data are planned to extend the range of applicability of these initial results, pending the availability of highway air quality data suitable for model validation.

DOT-TSC-OST-77-34
AUTOMOBILE DRIVELINES
Transportation Systems Center
R. G. Colello
PB-269 591
Final Report May 1977 56p.

Automobiles – Fuel consumption
Automobiles – Motors
Automobiles – Transmission devices

This study assesses automobile driveline components and configurations, quantifying their performance as possible in the context of such current issues as fuel economy, exhaust emission reduction, safety, driveability, production costs and lead times, and engine life. The current and projected driveline technology is described. The results of simulation studies using the DOT/TSC Vehicle Simulation Program to analyze vehicles incorporating various driveline components and configurations in relation to fuel economy, acceleration, emissions and other factors of interest are also reported.

DOT-TSC-OST-77-36. I
MODAL TRAFFIC IMPACTS OF WATERWAY USER CHARGES.
Volume 1: Recovery Options and Impacts Summary
Transportation Systems Center
David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio
SET: PB-273 882 PB-273 883
Final Report August 1977 156p.

Inland water transportation – Transit charges

This report has considered waterway user charges, which have been proposed as a method of cost recovery of Federal expenditures. The report has examined possible modal carrier and traffic impacts due to user charges on the inland river system, and potential differential effects of various cost recovery options. It has found that waterway tonmiles may be reduced by as much as ten percent by the recovery of 100 percent of annual Federal operating, maintenance, and rehabilitation expenditures on rivers through a segment-specific toll. Adjustments to the changes in transportation prices by economic agents such as shippers, carriers, and producers should act to lower these traffic impacts over the long term. The report is divided into three volumes.

This volume serves as an introduction to and summary of the Department of Transportation inland waterway user charge analysis. Alternative recovery options are discussed, sample tolls are calculated, and potential impacts of cost recovery on waterway traffic and carrier finances are summarized.

DOT-TSC-OST-77-36. II
MODAL TRAFFIC IMPACTS OF WATERWAY USER CHARGES.
Volume II: Distribution Systems Analysis
Transportation Systems Center
David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio
PB-273 884
Final Report August 1977 366p.

Inland water transportation – Transit charges

This report has considered waterway user charges, which have been proposed as a method of cost recovery of Federal expenditures. The report has examined possible modal carrier and traffic impacts due to user charges on the inland river system, and potential differential effects of various cost recovery options. It has found that inland waterway ton-miles may be reduced by as much as ten percent by the recovery of 100 percent of annual Federal operating, maintenance, and rehabilitation expenditures on rivers through a segment-specific toll. Adjustments to the change in transportation prices by economic agents such as shippers, carriers, and producers should act to lower these traffic impacts over the long term. The report is divided into three volumes.

This volume describes the detailed analyses performed to determine the potential impacts of inland waterway cost recovery on waterway traffic and markets. Each chapter describes the distribution system for a particular commodity/industry group and estimates the impact of cost recovery tolls on barge traffic by evaluating potential changes in transportation mode, routing, materials' source, and production technologies.

DOT-TSC-OST-77-36. III
MODAL TRAFFIC IMPACTS OF WATERWAY USER CHARGES.
Volume III: Data Appendix.
Transportation Systems Center
David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio
PB-273 885; PB-273 882/Set
Final Report August 1977 208p.

Inland water transportation – Transit charges

This report has considered waterway user charges, which have been proposed as a method of cost recovery of Federal expenditures. The report has examined possible modal carrier and traffic impacts due to user charges on the inland river system, and potential differential effects of various cost recovery options. It has found that inland waterway ton-miles may be reduced by as much as ten percent by the recovery of 100 percent of annual Federal operating, maintenance, and rehabilitation expenditures on rivers through a segment-specific toll. Adjustments to the change in transportation prices by economic agents such as shippers, carriers, and producers should act to lower these traffic impacts over the long term. The report is divided into three volumes.

This volume is a data appendix for the Department of Transportation's analyses of Federal cost recovery on the inland waterways. Tables include toll calculations by river and commodity, and ton-mile loadings for each river segment by commodity and river of origination. This allows determination of the interactions of river segments in each commodity class.

DOT-TSC-OST-77-37. I
PHYSICAL FOUNDATIONS FOR SOCIO-ECONOMIC MODELING FOR TRANSPORTATION PLANNING
Part I: Interaction Between Urban Centers as a Potential Process
General Technical Services, Inc.
A. S. Iberall and S. Z. Cardon
PB-272 795
DOT-TSC-1157
Final Report September 1977 50p.

Transportation – Social aspects
Social science – Mathematical models

The objective of this research is to make use of a physically based social system model to study the determinants of city sizes and their interactions in a nation. In particular, it was required that attention be paid to how new transportation systems affect city sizes.

In this first part of a final report, the character of the distribution function for settlements of man is investigated. The distribution for weakly interacting settlements (early man as hunter-gatherer) is developed and experimentally tested against historical data. The distribution function for interacting settlements (since agricultural settlements) - Zipf's law - is then treated, first as a pure information theoretic, namely as a communicational "living" language, and then as a communicational language for communities of man loosely bound to the earth. To keep the ensemble alive, the need for good cheap transportation among a significant mobile fraction of the population is discussed.

DOT-TSC-OST-77-37. II
SYSTEMS MODELS FOR TRANSPORTATION PROBLEMS.
Part II: The Social Physics for Modern Societies - The Role of the Cities
General Technical Services, Inc.
A. S. Iberall, S. Z. Cardon
PB-273 184
DOT-TSC-1157
Final Report September 1977 170p.

Transportation – Social aspects
Social science – Mathematical models

The objective of this research was to make use of a physically based social systems model, developed earlier, to study the determinants of city sizes and their national interactions. In particular, information on the role of a transportation systems in affecting city sizes was required.

In this second part, the relation between the urban settlements and a potential mapping that is related to the land (its population density, material and energy resources, activities, products, and consumption) is outlined. The dependence of the urban settlement distribution on long-distance international trade is discussed. The emergence of a new major social institution, the large corporation which is competitive with the urban settlement, is discussed. The socio-economic effects of transportation systems, and their modernization is described.

DOT-TSC-OST-77-38
EFFECTIVENESS OF AUDIBLE WARNING DEVICES ON EMERGENCY VEHICLES
Bolt, Beranek and Newman Inc.
R. C. Potter, S. A. Fidell, M. M. Myles, D. N. Keast
PB-274 567
DOT-TSC-868
Final Report August 1977 152p.

Sirens (Vehicle)

The primary purpose of this study was to examine the effectiveness of audible warning devices (AWD's) on emergency vehicles in terms of aural detectability. Community noise intrusion and opportunities for AWD optimization were also investigated. The study concentrated upon the three parts of the detection process: (1) Source (siren); (2) Path (distance and structures); and (3) Receiver (the human detection process in the presence of noise). Measurements were made of sirens, automobile insertion loss, and human detection performance in real-life and simulated situations. Warning effectiveness distances were calculated for three representative situations: (1) Rural environment with vehicle windows closed and radio on; (2) Urban environment with vehicle windows open and radio off; and (3) Suburban environment with vehicle windows open and radio off. It was concluded that reliance on present audible warning devices to warn drivers in traffic is not justified. To be loud enough to warn in all orginary circumstances, the sound level of audible warning devices would have to be increased greatly – producing intolerable community noise. During emergency-vehicle driver training, drivers should be taught about the short detection distances commonly encountered. Present audible warning devices can be improved; more uniform horizontal forward radiation and higher frequency sounds would increase detectability. This analysis procedure can provide the basis for an objective measure of audible warning device performance. Such a performance measure could be incorporated into a recommended practice.

DOT-TSC-OST-77-41
REGIONAL MARKET, INDUSTRY, AND TRANSPORTATION IMPACTS OF WATERWAY USER CHARGES
Transportation Systems Center
David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio
PB-273 041
Final Report August 1977 116p.

Inland water transportation – Transit charges

The objective of the report is to analyze the impacts on water-served economic markets and water transportation of the imposition of user charges designed to recover Federal outlays for the operation, maintenance, and repair of the U.S. waterways and ports (OM&R). The report describes the development of a preliminary impact model based on an analysis of waterway network operations and a stage-of-processing analysis of markets dependent on water carriage. Initial results from the models are based on the assumption that 100 percent of the operations and maintenance costs of waterways and ports will be recovered. The models calculate the differential impacts between segment-specific and uniform-fuel tax-collection options for a variety of commodity groups and markets, using 1972 waterway traffic data.

In general, user charge impacts on regional market prices for commodities shipped by water were found to be not substantial. Delivered commodity price impacts rarely exceeded one or two percent for 100 percent recovery of OM&R on the Mississippi River System. The major impacts, if any, due to cost recovery are expected to occur in the transportation sector. Existing water right-of-way subsidies and substantial fixed investment in water-oriented shipping facilities insulate much barge traffic from other-mode competition. It is likely that, for present, waterways can retain existing traffic under user charges, but over ten to twenty years may stand to lose new traffic to other modes as plant location decisions reflect cost recovery considerations.

OFFICE OF THE SECRETARY OF TRANSPORTATION

DOT-TSC-OST-77-42
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. Report No. 7 – Mercedes Benz Model OM617 Diesel Engine
Bartlesville Energy Research Center
W. F. Marshall and K. R. Stamper
PB-271 884
RA-75-10
Interim Report July 1977 36p.

Automobile exhaust gas
Automobiles – Fuel consumption
Automobiles – Motors (Diesel)

Experimental data were obtained in dynamometer tests of the Mercedes Benz Model OM617 diesel engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen, and smoke) at steady-state engine-operating modes. The objective of the program is to obtain engine-performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

DOT-TSC-OST-77-43
TRANSPORTATION SAFETY INFORMATION REPORTS, JANUARY, FEBRUARY, AND MARCH 1977
Transportation Systems Center
William F. Gay
NTISUB/C/244-001
Final Report June 1977 76p.

Transportation – Accidents – Statistics
Transportation – Safety measures

The Transportation Safety Information Report, published quarterly, is a compendium of selected national-level transportation safety statistics for all modes of transportation. Each quarterly report presents and compares transportation fatalities, accidents, and injuries on a monthly and quarterly basis for the current and preceding year. In addition, it provides an overview of modal safety hazards, safety programs, and related accident prevention information.

Featured in this quarterly report is a discussion on Pedestrian Safety and an Intermodal Safety Affairs article on the Department's multi-modal research, analysis, and development facility - the Transportation Systems Center.

DOT-TSC-OST-77-44
SUMMARY REPORT: WORKSHOP ON VEHICLE RIDE QUALITY WILLIAMSBURG, VIRGINIA, AUGUST 13-15, 1975
Transportation Systems Center and National Aeronautics and Space Administration
A. R. Kuhlthau and Anna M. Wichansky (Editors)
PB-272 471
NASA CP-2103
N.G.R. 47-005-81
Final Report July 1977 168p.

Vibration (Transportation engineering) – Congresses

This report summarizes the proceedings of the 1975 Ride Quality Workshops, which were jointly sponsored by the U.S. Department of Transportation and the National Aeronautics and Space Administration and held in Williamsburg, Virginia during August 13-15, 1975. The workshops were conducted to review the information presented at the 1975 Ride Quality Symposium held during August 11-12, and to assess the state of the art in ride quality as surmised by various workshop participants. The proceedings are organized according to the main topics discussed by the four workshop groups: Accomplishments in Ride Quality Research, Needs of the Transportation Community, Ride Quality Research Techniques, and Ride and Environment Control Techniques. In addition, an appendix on scaling techniques and a list of workshop participants are included in the report.

DOT-TSC-OST-77-45
DEEP-DRAFT NAVIGATION USER CHARGES: RECOVERY OPTIONS AND IMPACTS
Transportation Systems Center
David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio
PB-272 951
Final Report August 1977 250p.

Harbors – Port charges

Alternative cost recovery options for Federal deep-draft navigation expenditures are investigated and the impacts of user charges on waterborne trades and commodity traffic, both foreign and domestic (Great Lakes and coastwise), are assessed. In addition, the foreign experience in port governance, pricing, and investment policies is examined, including representative levels of port-use fees. A detailed commodity traffic analysis for petroleum, grain, coal, iron ore, and general cargo has revealed that 100-percent recovery of total Federal deep-draft costs by uniform (on vessel or cargo tonnage for example) user charges will not substantially disrupt domestic or foreign waterborne traffic levels or patterns. However, port-specific user charges can significantly affect future port development and traffic levels in certain smaller and more costly ports, and encourage port consolidation. Action by domestic overland carriers, waterborne carriers, and shippers may act to minimize any adverse impacts. For traffic which navigates both inland river and coastal ports, effects of potential double (shallow- and deep-draft) user charges are examined. In general, a vessel-based system use-recovery approach will tend to minimize impacts across waterborne trades and commodity flows as well as traffic using both shallow- and deep-draft systems.

DOT-TSC-OST-77-47
FEASIBILITY ANALYSIS OF URBAN TRANSPORTATION SYSTEMS WITH SPECIAL REFERENCE TO TUNNELS
Systan, Inc. and Ecosometrics, Inc.
M. G. Myers, R. K. Wood, A. M. Lago, and L. B. Blattenberger
PB-274 372
DOT-TSC-1075
Final Report October 1977 458p.

Tunneling — Estimates and costs
Urban transportation — Cost of operation
Local transit — Cost of operation
Subways — Cost of operation

Performance-equivalent bus and rail systems were considered under various guideway choices such as dedicated lanes, medians, aerial structures, new rights-of-way, and tunnels. Average per passenger costs were determined for each alternative mode and guideway option. Peak-hour demand was projected for each of the 35 largest metropolitan areas based on analysis of 1970 journey-to-work tables and assumptions on future growth and distribution of population and employment. The decision to prefer tunnels over other choices is highly sensitive to right-of-way costs (property values) and the relative cost of tunnel excavation. If existing property values and construction costs prevail to 1990, 139 miles of tunnels nationwide are projected, while under more favorable conditions, nearly 400 miles of tunnels were found to be justified. The likelihood of fulfilling the optimistic condition is discussed in the report.

DOT-TSC-OST-77-48
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES.
Report No. 8 — Mitsubishi Model 6DS7 Diesel Engine
Bartlesville Energy Research Center
W. F. Marshall and K. R. Stamper
PB-274 374
RA-75-10
Interim Report August 1977 34p.

Automobiles — Motors (Diesel)
Automobile exhaust gas
Automobiles — Fuel consumption

Experimental data were obtained in dynamometer tests of the Mitsubishi Model 6DS7 diesel engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen, and smoke) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

DOT-TSC-OST-77-49
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES.
Report No. 9 — Chrysler (1975) 225-CID 1-bbl Engine
Bartlesville Energy Research Center
W. F. Marshall and K. R. Stamper
PB-274 375
RA-75-10
Interim Report August 1977 38p.

Automobiles — Motors
Automobile exhaust gas
Automobiles — Fuel consumption

Experimental data were obtained in dynamometer tests of a 1975 Chrysler 225-CID, 1-bbl engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

DOT-TSC-OST-77-50
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES.
Report No. 10 – Chevrolet (1975) 250-CID 1-bbl Engine
Bartlesville Energy Research Center
W. F. Marshall and K. R. Stamper
PB-274 376
RA-75-10
Interim Report August 1977 42p.

Automobiles – Motors
Automobile exhaust gas
Automobiles – Fuel consumption

Experimental data were obtained in dynamometer tests of a 1975 Chevrolet 250-CID, 1-bbl engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristics data required as input for engineering calculations involving ground transportation.

DOT-TSC-OST-77-51
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES.
Report No. 11 – Chrysler (1975) 318-CID 2-bbl Engine
Bartlesville Energy Research Center
W. F. Marshall and K. R. Stamper
PB-274 377
RA-75-10
Interim Report August 1977 42p.

Automobiles – Motors
Automobile exhaust gas
Automobiles – Fuel consumption

Experimental data were obtained in dynamometer tests of a 1975 Chrysler 318-CID, 2-bbl engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

DOT-TSC-OST-77-54
ELEVATED GUIDEWAY COST-RIDE QUALITY STUDIES FOR GROUP RAPID TRANSIT SYSTEMS
Massachusetts Institute of Technology.
Department of Mechanical Engineering
D. N. Wormley, J. K. Hedrick, L. Eglitis, D. Costanza
DOT-TSC-1206
Final Report October 1977 202p.

Automated guideway transit

A methodology is developed for relating cost to ride quality in elevated guideway system design, based upon directly relating guideway structural properties and construction tolerances to both cost and ride quality. It is illustrated in detail for group-rapid-transit precast concrete elevated guideway systems. These detailed cost-ride quality studies include an assessment of span properties, construction-related tolerances such as joint discontinuities, pier height variations, camber, and local surface roughness, and the effect of vehicle properties on cost and vehicle ride quality.

DOT-TSC-OST-77-56
RATE OF HEAT RELEASE IN DIESEL ENGINES
University of Southampton.
Institute of Sound and Vibration Research.
David Anderton
PB-275 421
DOT-TSC-1101
Final Report October 1977 146p.

Diesel motor

In this report, the concept of heat release in diesel engines is compared with reaction rates in petrol engines as a means of describing combustion. The intimate relationships between heat release, cylinder pressure development and cylinder pressure spectra are illustrated. A

combustion model for the prediction of heat release and combustion noise, based primarily on physical aspects of diesel combustion system design, is put forward. This model indicates that fuel droplet size and the temperature of the cylinder contents are of prime importance in determining cylinder pressure noise excitation. The relationship between cylinder pressure spectra and combustion induced engine noise is described and used to show how the combustion model can predict combustion induced noise at the design stage. A simplified procedure based on the results of this modelling is put forward to predict combustion induced noise as a function of rate of pressure rise, speed and bore and applied to a Standard Engine Structure. As an approximation the prediction formulae are also given in terms of initial peak rate of heat release, engine speed and bore. Mechanical noise aspects of diesel engines, although important, are excluded from the work.

DOT-TSC-OST-77-60
AMERICA'S FREIGHT SYSTEM IN THE 80's AND 90's . . . . . BUT HOW TO GET THERE?
Harbridge House, Inc.
PB-271 044
Conference Proceedings December 1976

Freight and freightage – Congresses

DOT-TSC-OST-77-62
PROPAGATION OF DISTURBANCES IN TRAFFIC FLOW
Massachusetts Institute of Technology.
Electronic Systems Laboratory
Pierre Dersin, S. B. Gershwin, and Michael Athans
PB-274 274
DOT-TSC-849
Final Report September 1977 294p.

Traffic assignment – Mathematical models
Traffic flow – Mathematical models

The system-optimized static traffic-assignment problem in a freeway corridor network is the problem of choosing a distribution of vehicles in the network to minimize average travel time.

It is of interest to know how sensitive the optimal steady-state traffic distribution is to external changes including accidents and variations in incoming traffic. Such a sensitivity analysis is performed via dynamic programming. The propagation of external perturbations is studied by numerical implementation of the dynamic programming equations.

When the network displays a certain regularity and satisfies certain conditions, we prove, using modern control theory and graph theory, that the effects of imposed perturbations which contribute no change in total flow decrease exponentially as distance from the incident site increases. We also characterize the impact of perturbations with nonzero total flow. The results confirm numerical experience and provide bounds for the effects as functions of distance.

DOT-TSC-OST-77-64
FIELD EVALUATION OF MILES-PER-GALLON METERS
Automobile Club of Southern California
Roger A. Banowetz and Louis J. Bintz
DOT-TSC-1160
Final Report November 1977 40p.

Automobiles – Fuel consumption

One hundred forty fleet automobiles based in Los Angeles were used to determine the influence of miles-per-gallon meters on fuel economy. Seventy cars were instrumented with the meters, and 70 were used without meters for control purposes. Fuel use and mileage records were collected over a 12-week period. The cars were used primarily for commuting in a mixture of highway, urban, and suburban driving. Drivers in both groups were paid every three weeks for the amount of fuel they saved as compared with pre-test fuel-use records. Analysis of variance of the resulting miles-per-gallon averages revealed no significant difference in fuel economy between the two groups.

UNITED STATES COAST GUARD

DOT-TSC-USCG-77-1
FIELD TESTS OF IN-SERVICE MODIFICATIONS TO IMPROVE PERFORMANCE OF AN ICEBREAKER MAIN DIESEL ENGINE
Colt Industries.
Fairbanks Morse Engine Division and Transportation Systems Center.
E. A. Kasel, C. L. Newton, R. A. Walter
AD-A046 241
CG-D-8-77
DOT-TSC-905
Final Report August 1977 100p.

Ice-breaking vessels
Diesel motors – Fuel consumption
Diesel motor exhaust gas

Field tests of in-service modifications to improve engine efficiency and lower the emissions were performed on the # 3 main diesel engine of the USCGS Mackinaw (WAGB-83). This engine is a model 38D8-1/8 manufactured by Colt Industries, Fairbanks Morse Engine Division, and is rated for 2000 hp at 810 rpm. Baseline and modified engine tests were performed while the ship engaged in routine maneuvers of engine start, warm-up, docking, undocking and steady-steaming. The measurements performed included fuel consumption, smoke carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x), total hydrocarbons (THC), oxygen (0_2), engine speed and load, as well as important engine temperatures and pressures.

The engine modifications were newer style pintle type fuel injector nozzles, shimmed injection pumps and advanced injection timing. These modifications decreased fuel consumption 1% to 3% depending on speed and load, reduced CO and THC up to 43% and 88% respectively and increased NO_x up to 38%. Smoke emissions decreased 50% at low-load engine conditions and 5% at high-loads.

DOT-TSC-FAA-74-19, I
PULSED ACOUSTIC VORTEX SENSING SYSTEM.
Volume I – Hardware Design.
Avco Corporation
Royal N. Schweiger
AD-A046 253
FAA-RD-75-161, I
DOT-TSC-620
Final Report June 1977 116p.

Wakes (Aerodynamics)

Avco Corporation's Systems Division designed and developed an engineered Pulsed Acoustic Vortex Sensing System (PAVSS). This system is capable of real-time detection, tracking, recording, and graphic display of aircraft trailing vortices.

This volume of the report presents hardware design aspects of the system. The design of the acoustic antenna and transducer is described. System control, computer hardware, and system/subsystem hardware interfaces are discussed.

DOT-TSC-FAA-74-19, II
PULSED ACOUSTIC VORTEX SENSING SYSTEM.
Volume II – Studies of Improved PAVSS Processing Techniques
Avco Corporation
Royal N. Schweiger
AD-A046 271
FAA-RD-75-161, II
DOT-TSC-620
Final Report June 1977 154p.

Wakes (Aerodynamics)

Avco Corporation's Systems Division designed and developed an engineered Pulsed Acoustic Vortex Sensing System (PAVSS). This system is capable of real-time detection, tracking, recording, and graphic display of aircraft trailing vortices.

This volume of the report presents the results of two subcontractor studies directed toward development of improved vortex tracking software techniques for the PAVSS. The volume recommends the incorporation of several improvements in the software. The subcontractor final reports (Scope Electronics, Inc. and Arcon Corporation) are furnished as appendixes to this volume.

DOT-TSC-FAA-74-19, III
PULSED ACOUSTIC VORTEX SENSING SYSTEM.
Volume III – PAVSS Operation and Software Documentation
Avco Corporation
Royal N. Schweiger
AD-A046 272
FAA-RD-75-161, III
DOT-TSC-620
Final Report June 1977 66p.

Wakes (Aerodynamics)

Avco Corporation's Systems Division designed and developed an engineered Pulsed Acoustic Vortex Sensing System (PAVSS). This system is capable of real-time detection, tracking, recording, and graphic display of aircraft trailing vortices.

This volume of the report presents the operation of the pulsed acoustic vortex sensing system and the computer software documentation.

DOT-TSC-FAA-74-19, IV
PULSED ACOUSTIC VORTEX SENSING SYSTEM.
Volume IV – PAVSS Program Summary and Recommendations
Avco Corporation
Royal N. Schweiger
AD-A046 254
FAA-RD-75-161, IV
DOT-TSC-620
Final Report June 1977 50p.

Wakes (Aerodynamics)

Avco Corporation's Systems Division designed and developed an engineered Pulsed Acoustic Vortex Sensing System (PAVSS). This system is capable of real-time detection, tracking, recording, and graphic display of aircraft trailing vortices.

This volume of the report summarizes the background and accomplishments of the PAVSS program carried out by Avco, and presents Avco's recommendation that further work on the PAVSS would not be economically sound.

DOT-TSC-FAA-75-9
AIRBORNE PROXIMITY WARNING INSTRUMENT LABORATORY TESTS
Transportation Systems Center
Ernst Meyer
AD-A036-727
FAA-RD-77-5
Final Report January 1977 15p.

Aeronautics – Safety measures

An Airborne Proximity Warning Instrument (APWI) designed and manufactured by Rock Avionics, New York, was subjected to a short laboratory test at the Transportation Systems Center to determine the suitability of this product for further evaluation as an aid to visual detection of other aircraft. The test results were affirmative with regard to the parameters tested: namely, sensor pattern and freedom from false alarm. Sensitivity was tested only to ascertain the feasibility of field and/or flight tests.

DOT-TSC-FAA-76-7
USERS' MANUAL FOR ILSS (REVISED ILSLOC): SIMULATION FOR DEROGATION EFFECTS ON THE INSTRUMENT LANDING SYSTEM
Transportation Systems Center
G. Chin, L. Jordan, D. Kahn, S. Morin, D. Newsom, M. Scotto
AD-A035 690
FAA-RD-76-217
Final Report December 1976 122p.

Instrument landing systems

This manual presents the complete ILSS (revised ILSLOC) computer program package. In addition to including a thorough description of the program itself and a listing with comments, the manual contains a brief description of the ILS system and antenna patterns. To illustrate the program, a test case has been created and the figures of the case are incorporated in the report. Program DYNM and program ILSPLT are included as appendixes. The ILSPLT, complete with sample graphs, is a plotting routine for ILSLOC.

For a technical mathematical analysis of the system, see report FAA-RD-72-137 (AD754517), "Instrument Landing System Scattering."

This report revises in part an earlier report FAA-RD-73-76, "Users' Manual for ILSLOC: Simulation for Derogation Effects on the Localizer Portion of the Instrument Landing System." The revisions include the treatment of triangular scatterers and glide slope antenna systems.

DOT-TSC-FAA-76-11. I
JOINT US/UK VORTEX TRACKING PROGRAM AT HEATHROW INTERNATIONAL AIRPORT
Volume I: Executive Summary
Transportation Systems Center
J. N. Hallock and W. D. Wood
AD-A024 842
FAA-RD-76-58. I
Final Report March 1976 34p.

Wakes (Aerodynamics)

From May 1974 through June 1975 the approach region to Runway 28R at Heathrow International Airport was equipped with aircraft wake vortex tracking equipment. The vortices from approximately 13,000 aircraft were monitored along with the attendant meteorological conditions. The joint US/UK project represents a major step in learning how vortices move and die in the terminal environment. An overview of the Heathrow project is given and it is shown how the project has significantly contributed to the capability to develop a vortex advisory system promising increased capacity through decreased aircraft separations.

DOT-TSC-FAA-76-11. II
JOINT US/UK VORTEX TRACKING PROGRAM AT HEATHROW INTERNATIONAL AIRPORT
Volume II: Data Analysis
Transportation Systems Center
J. N. Hallock, B. P. Winston, D. C. Burnham, T. E. Sullivan, I. G. McWilliams, and W. D. Wood
FAA-RD-76-58. II
Final Report November 1977 196p.

Wakes (Aerodynamics)

From May 1974 through June 1975, the approach region to runway 28R at Heathrow International Airport was equipped with aircraft wake vortex tracking equipment. The vortices from approximately 13,000 aircraft were monitored along with the attendant meteorological

conditions. The joint US/UK project represents a major step in learning how vortices move and die in the terminal environment. Volume I (published March 1976) is an overview of the project and summarizes the key points. Volume II describes the entire project from the workings and locations of the equipment to the analysis of the data.

DOT-TSC-FAA-76-22. I
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE.
Volume I: Executive Summary
Transportation Systems Center
Sejfi Protopapa
AD-A046 509
FAA-RD-75-173. I
DOT-TSC-707
Final Report August 1977 42p.

Satellites in navigation
Modems
Air traffic control
Phased array antennas
Doppler effect

The U.S. Department of Transportation (DOT), Federal Aviation Administration (FAA) program for air traffic control (ATC) experimentation and evaluation with the ATS-6 satellite was part of the Integrated ATS-6 L-Band Experiment. All tests were performed between September 1974 and April 1975. The U.S. DOT aeronautical program consisted of both ATC communications demonstration and technology tests. In support of the aeronautical satellite (AEROSAT) program, tests were designed to collect satellite-aircraft signal propagation data, evaluate L-band avionics hardware designs and perform preliminary satellite voice and data communications demonstration tests.

The technology tests were composed of multipath channel characterization tests; modem tests of voice, data and ranging; and aircraft antenna tests. Multipath results include overland data. Comparisons of multipath sample results with model prediction are given. Voice modem intelligibility scores, digital data bit-error rates and ranging modem performance are presented parametrically as functions of C/N_0 and S/I. Experimentally derived gain and multipath rejection performance data are given for the slot-dipole, phased-array and patch antennas for various aircraft/satellite geometries.

The demonstration tests of satellite supported communications for application to Oceanic ATC comprised two phases: demonstrations relating to U.S. concepts and practices, and demonstrations conducted as a joint effort between the U.S., the European Space Agency (ESA) and Canada.

The report consists of seven volumes: I-Executive Summary; II-Demonstration of Satellite-Supported Communications and Surveillance for Oceanic Air Traffic Control; III-Summary of U.S. Aeronautical Technology Test Program; IV-Data Reduction and Analysis Software; V-Multipath Channel Characterization Test; VI-Modem Evaluation Test; VII-Aircraft Antenna Evaluation Test.

DOT-TSC-FAA-76-22, III
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE
Volume III: Summary of U.S. Aeronautical Technology Test Program
Boeing Commercial Airplane Company
E. H. Schroeder, R. W. Sutton, A. D. Thompson, S. G. Wilson, C. J. Kuo
FAA-RD-75-173, III
DOT-TSC-707
Final Report September 1976 206p.

Satellites in navigation
Modems
Phased array antennas
Air traffic control
Doppler effect

The U.S. Department of Transportation (DOT) program for air traffic control (ATC) experimentation and evaluation with the ATS-6 satellite was part of the Integrated ATS-6 L-Band Experiment. This overall experiment was coordinated by the NASA/Goddard Space Flight Center and was international in scope, involving several participants. All tests were performed between September 1974 and April 1975. The U.S. DOT aeronautical program consisted of both ATC communications demonstration and technology tests. Tests were in support of the aeronautical satellite (AEROSAT) program to collect satellite-aircraft signal propagation data, evaluate L-band avionics hardware designs, and perform preliminary satellite voice and data communications demonstration tests. All tests were conducted between the FAA KC-135 aircraft and the NASA-Rosman ground station via the geostationary ATS-6 satellite. This report presents data on the U.S. aeronautical technology tests.

The technology tests were composed of multipath channel characterization tests; modem tests of voice, data and ranging; and aircraft antenna tests. Multipath results include delay-Doppler scatter function characterisitcs and calculations of spectra, spreads, and autocorrelations for both over-ocean and CONUS multipath. Comparisons of sample results with model prediction are given. Voice modem intelligibility scores, digital data bit-error rates and ranging modem performance are presented parametrically as functions of C/N_0 and S/I. Experimentally derived gain and multipath rejection performance data are given for the slot-dipole, phased-array and patch antennas for various aircraft/satellite geometries.

DOT-TSC-FAA-76-22, IV
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE.
Volume IV: Data Reduction and Analysis Software
Boeing Commercial Airplane Company
A. D. Thompson, S. G. Wilson, P. F. Rieder, W. L. Chu, M. J. Mardesich, C. V. Paulson, P. Alexander
FAA RD-75-173, IV
DOT-TSC-707
Final Report September 1976 230p.

Satellites in navigation
Modems
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Doppler effect

Software used for the reduction and analysis of the multipath prober, modem evaluation (voice, digital data, and ranging), and antenna evaluation data acquired during the ATS-6 field test program is described.

Multipath algorithms include reformatting operations, delay-spectra time histories, delay-Doppler scatter function $S(\tau, \omega)$, noise determination and removal, spread calculations, airborne tape analysis, and other detailed processing including time-domain analysis and various integral and Fourier operations on $S(\tau, \omega)$. Modem and antenna evaluation data processing software includes algorithms for the determination of (1) C/N_0 and multipath interference ratio, S/I, (2) digital data bit-error rates, block error statistics, and inter-error spacing, and (3) ranging error statistics and distribution. Sample outputs are given. Program listings and other information are provided in an auxiliary software data package.

DOT-TSC-FAA-76-22, V
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE
Volume V: Multipath Channel Characterization Test
Boeing Commercial Airplane Company
A. D. Thompson, B. J. Burreson, P. F. Rieder, P. Alexander
AD-A042 325
FAA RD-75-173, V
DOT-TSC-707
Final Report September 1976 360p.

Satellites in navigation
Modems
Phased array antennas
Air traffic control
Doppler effect

Results of aeronautical L-band multipath channel characterization tests are given. All tests were conducted between September 1974 and April 1975 as part of the U.S. DOT aeronautical technology test program. These tests were part of the international Integrated ATS-6 L-Band Experiment coordinated by the NASA/Goddard Space Flight Center. Wideband PN-coded test signals transmitted from an FAA KC-135 jet aircraft were relayed by the ATS-6 satellite for reception by the satellite aeronautical channel prober (SACP) receiver located at the NASA/Rosman ground station.

Both oceanic and overland multipath data are analyzed to provide delay-Doppler characterizations of the channel. Specific analysis outputs presented include the delay-Doppler scatter function, delay spectra, Doppler spectra, frequency and time autocorrelation functions, spread parameter measures, total scattered intensity and time-domain statistics. Oceanic results are compared to expectation through the use of physical optics surface integration vector scatter model. Results are presented for a variety of aircraft/satellite geometries, signal polarizations, and terrain states.

DOT-TSC-FAA-76-23
AIRPORT SURFACE TRAFFIC CONTROL TAGS PLANNING ALTERNATIVES AND COST/BENEFIT ANALYSIS
Transportation Systems Center
Paul S. Rempfer
AD-A037-790
FAA-RD-77-9
Final Report January 1977 52p.

Airports – Traffic control

The findings of a cost/benefit analysis of the deployment of a new airport ground surveillance system TAGS (Tower Automated Ground Surveillance) are presented. TAGS will provide a plan view display of aircraft on the airport's taxiways and runways like ground surveillance radar (ASDE); but unlike ASDE, TAGS will perform in heavy precipitation and automatically acquire and display aircraft flight identity. The findings indicate that a TAGS deployment of between four and nine systems is cost/beneficial. The development plan, system costs, analysis approach and sensitivity analysis supporting the findings are provided.

DOT-TSC-FAA-76-26
AIRPORT SURFACE TRAFFIC CONTROL VISUAL GROUND AIDS ENGINEERING AND DEVELOPMENT PLAN
Transportation Systems Center
F. D. MacKenzie
AD-A038-153
FAA-RD-77-16
Interim Report January 1977 68p.

Airports – Traffic control
Airports – Lighting

The plan described in this document supports the overall program at the Transportation Systems Center to define, design, develop, and evaluate systems that meet the requirements of airport surface traffic control. This plan is part of documentation supporting one aspect of the program, visual ground aids development. There are twenty-four concerns with the present visual ground aids. The concerns deal with the ability of the present system and its components to support taxiing operations in the lower visibility environment found during Category III conditions. This report describes an engineering and development plan which will identify solutions for the concerns, create the specifications for improved visual ground aids and lay the ground work for application in future Category III operations. The management of the development process leading to major improvements in the present system is described. The plan includes a schedule, budget, milestones and evaluation criteria.

DOT-TSC-FAA-76-27
ADVANCED PRODUCTIVITY ANALYSIS METHODS FOR AIR TRAFFIC CONTROL OPERATIONS
Stanford Research Institute
P. L. Tuan, H. S. Procter, G. J. Couluris
AD-A035-095
FAA-RD-76-164
DOT-TSC-1128
Final Report December 1976 198p.

Air traffic control – Mathematical models

This report gives a description of the Air Traffic Control (ATC) productivity analysis methods developed, implemented, and refined by the Stanford Research Institute (SRI) under the sponsorship of FAA and TSC. Two models are included in the productivity analysis methodology. The first is the Relative Capacity Estimating Process (RECEP) that models the traffic handling capabilities of individual ATC sectors in terms of routine, surveillance, and conflict-processing workloads. The second model is the Air Traffic Flow (ATF) model that simulates a multisector ATC network by tracing aircraft flows from sector to sector and measuring traffic loadings, workload requirements, and delays under given sets of traffic input parameters and congestion-relief strategy. The report covers the background and application experiences of the two models as well as technical descriptions of their input/output specifications, model structures, field data collection and reduction techniques, and potential model applications. Finally, a hypothetical example illustrating a typical RECEP/ATF application, together with postsimulation output analyses, are given. A general survey of other similar models and techniques, and their comparisons with RECEP and ATF, are also included in the report.

DOT-TSC-FAA-77-2
AIRPORT FACILITY QUEUING MODEL VALIDATION
Transportation Systems Center
Li Shin Yuan and Lawrence J. McCabe
AD-A041-258
FAA-AEM-77-4
Interim Report May 1977 50p.

Queuing Theory

Criteria are presented for selection of analytic models to represent waiting times due to queuing processes. An existing computer model by M. F. Neuts which assumes general nonparametric distributions of arrivals per unit time and service times for a single service was envisioned as best fulfilling requirements.

Data obtained from Denver Stapleton Airport were applied to this model. Service times and arrival rates at an express baggage check facility, a security station, and a gate were used as inputs. Delay times corresponding to the observed arrival rates were recorded and compared to model outputs. Using the T-test, agreement was obtained at the 5 percent level of significance for the mean values of the first two facilities. Predictions of waiting time distribution, however, did not pass the Kolmogroff test at the same level of significance. Discrepancies are due to a lack of time resolution in arrival times and the application of this model to multiserver situations.

DOT-TSC-FAA-77-3
REQUIREMENTS FOR FLIGHT TESTING AUTOMATED TERMINAL SERVICE
Transportation Systems Center
Joseph S. Dumas
AD-A041 975
FAA-AEM-77-6
Interim Report May 1977 38p.

Air traffic control – Automation

This report describes requirements for the flight tests of the baseline Automated Terminals Service (ATS) system. The overall objective of the flight test program is to evaluate the feasibility of the ATS concept. Within this objective there are two categories of specific ATS flight test objectives: (1) the objectives concerned with verifying the basic advisory capabilities of ATS and (2) the objectives concerned with evaluating pilots' responses to ATS messages. The flight testing is broken down into three parts. Part I will consist of system checkout flights. Part II will consist of validation and some pilot evaluation tests and will be conducted at NAFEC. Part III will consist primarily of normal airport operations at a selected general aviation airport. The requirements for the Part II and III evaluations of each of the ATS services to pilots are presented. For each service, there is a listing of the major issues involved in the evaluation and a discussion of the methods to be used in the evaluation. The description of the test methods for each service presents the type of missions that will be required, along with a table showing the measures to be taken and the sources of data where these measures can be most easily obtained.

DOT-TSC-FAA-77-4
AIRCRAFT WAKE VORTICES: A STATE-OF-THE-ART REVIEW OF THE UNITED STATES R&D PROGRAM
Transportation Systems Center
J. N. Hallock and W. R. Eberle, Editors
AD-A042 442
FAA-RD-77-23
Final Report February 1977 346p.

Wakes (Aerodynamics)

The report summarizes the current state-of-the-art understanding of the aircraft wake vortex phenomenon and the results of the United States program to minimize the restrictions caused by aircraft wake vortices in the terminal environment. The vortex phenomenon, vortex avoidance systems, and vortex alleviation techniques are discussed.

DOT-TSC-FAA-77-6
AIRLINE DELAY TRENDS, 1974-1975 A STUDY OF BLOCK TIME DELAYS, GROUND AND AIRBORNE, FOR SCHEDULED AIR CARRIERS
Transportation Systems Center
Helen M. Condell, Seymour M. Horowitz, Alan S. Kaprelian
AD-A039-483
FAA-EM-77-2
Annual Report March 1977 218p.

Airlines – Delays

Estimates of block, airborne and ground delays for route segments flown by United States domestic scheduled airlines operating out of twenty large airports are presented in this document. The data were determined from the CAB ER-586 Service Segment data base, which provides monthly operational times, both ground and airborne, for all route segments receiving scheduled air carrier service. The data in this report are limited to the three-hundred and thirty route segments connecting the twenty airports included in the study.

Average monthly estimates of the ground and airborne components of block delays, defined as delays encountered from "ramp to ramp" on a route segment, are presented for the two-year period from 1974-1975. Average monthly estimates of delays for the airborne portion of the segment ("wheel off" to "wheels on") are categorized according to (1) route segment, (2) airline, (3) aircraft type and (4) local scheduled arrival or departure time. Average monthly estimates of delays for the ground portion of the route segments are categorized according to departure and arrival ground times at the twenty airport locations included in the study. These estimates of ground delays are further categorized into "busy" time intervals (07:00 - 22:59) and "dull" time intervals (23:00 - 06:59).

DOT-TSC-FAA-77-8
AIRCRAFT VORTEX WAKE DECAY NEAR THE GROUND
AeroVironment Inc. and Poseidon Research
I. Tombach, P. B. S. Lissaman, J. B. Mullen, and S. J. Baker
FAA-RD-77-46
DOT-TSC-1008
Final Report May 1977 162p.

Wakes (Aerodynamics)

A multi-faceted experimental and analytical research program was carried out to explore the details of aircraft wake vortex breakdown under conditions representative of those which would prevail at low altitudes in the vicinity of airports.

Three separate approaches were taken simultaneously. Flight tests with Lockheed L-18 Lodestar and Boeing 747 aircraft flying over ground-based instrumentation provided data on overall vortex behavior, on the vortex ages at the time of onset of instabilities, and on the changes in the vortex velocity fields which resulted from vortex breakdowns. Analytical work on stability theories identified conditions under which vortices could undergo unstable decay. Experimental tests in a water tank looked at the internal instability of vortices, and also shed light on vortex motion near the ground. Finally, a heuristic modeling approach resulted in a simple representation of the relationship between the times of vortex breakdowns and the ambient turbulence levels.

Although a detailed mechanism for vortex breakdowns was not found, a universal function, usable for all aircraft, was developed for predicting vortex breakdown times within a factor of two error. It was also shown that vortex breakdowns do not generally result in total dissipation of the vortex energy, but rather a residual organized motion of significant intensity often persists after bursting of a smokemarked vortex has been noted to occur.

DOT-TSC-FAA-77-9. I
MOBILE LASER DOPPLER SYSTEM CHECKOUT AND CALIBRATION.
Volume I: Text.
Lockheed Missiles & Space Company Inc.
Huntsville Research & Engineering Center.
M. R. Brashears, T. R. Lawrence, A. D. Zalay
AD-A045 799
FAA-RD-77-48. I
DOT-TSC-1098
Final Report June 1977 150p.

Wakes (Aerodynamics)
Vertical wind shear
Doppler laser

A program has been carried out to make modifications to the Lockheed-Huntsville Mobile Laser Doppler Velocimeter (LDV) system; to calibrate and operate the system at the John F. Kennedy (JFK) Airport; to obtain a data base of wind, wind shear, and wake vortex measurements; and to assess the basic operational capabilities of the system based on these measurements. The basic operational capabilities, resolution, and integrity of a scanning LDV for the remote sensing of winds, wind shear, and wake vortices at terminal areas have been established.

DOT-TSC-FAA-77-9. II
MOBILE LASER DOPPLER SYSTEM CHECKOUT AND CALIBRATION.
Volume II: Appendixes
Lockheed Missiles & Space Company Inc.
Huntsville Research & Engineering Center
M. R. Brashears, T. R. Lawrence, A. D. Zalay
AD-A044 318
FAA-RD-77-48. II
DOT-TSC-1098
Final Report June 1977 342p.

Wakes (Aerodynamics)
Vertical wind shear
Doppler laser

A program has been carried out to make modifications to the Lockheed-Huntsville Mobile Laser Doppler Velocimeter (LDV) system; to calibrate and operate the system at the John F. Kennedy (JFK) Airport; to obtain a data base of wind, wind shear, and wake vortex measurements; and to assess the basic operational capabilities of the system based on these measurements. The basic operational capabilities, resolution, and integrity of a scanning LDV for the remote sensing of winds, wind shear, and wake vortices at terminal areas have been established.

DOT-TSC-FAA-77-10
BENEFIT ANALYSIS OF THE AUTOMATED FLOW CONTROL FUNCTION OF THE AIR TRAFFIC CONTROL SYSTEMS COMMAND CENTER
Transportation Systems Center
J. Richards
FAA-RD-76-204
Final Report June 1977 134p.

Air traffic control – Automation

This report summarizes the findings of a benefit analysis study of the present and proposed Air Traffic Control Systems Command Center automation systems. The benefits analyzed were those associated with Fuel Advisory Departure and Quota Flow procedures. Actual data on reduced arrival capacity conditions were analyzed. Benefits were then derived based on the supposition that flow control procedures had been utilized. Using future demand predictions, benefits for both the present and proposed advanced systems were estimated through 1990.

The study indicated that the only benefit that could be appropriately quantified was fuel savings due to the implementation of Fuel Advisory Departure Procedures.

DOT-TSC-FAA-77-11
GENERAL AVIATION AVIONICS STATISTICS: 1974
Transportation Systems Center
Judith C. Schwenk (Editor)
AD-A045 209
FAA-MS-77-2
Annual Report August 1977 126p.

Private flying – Statistics

The primary objectives of this study were to (1) provide a framework for viewing the general aviation (GA) aircraft fleet, which would relate airborne avionics equipment to the capability for an aircraft to perform in the National Airspace System, and (2) within this framework, to portray the types of aircraft common to the GA fleet in terms of descriptive information on the aircraft.

To provide the framework, capability groups of avionics equipment were designed and translated into aircraft capability to perform certain functions in the airspace system. Two types of groups evolved: hierarchical groups consist of avionics equipment meeting FAA requirements for flying in different airspace segments, in different conditions and for landing at different classes of airports; non-hierarchical groups consist of avionics equipment which give an aircraft additional capability, but which are not required equipment according to FAA regulations.

Once the framework was developed, the GA fleet, as represented by the 1974 Aircraft Statistical Master File, was distributed among the capability groups, and its characteristics were studied. In addition, individual capability groups were analyzed to discover subgroups of aircraft with homogeneous characteristics. This report presents the methodologies used in the analyses, statistical tables and other results.

DOT-TSC-FAA-77-13
LASER DOPPLER VELOCIMETER MEASUREMENTS OF B-747 WAKE VORTEX CHARACTERISTICS
Lockheed Missiles & Space Company, Inc.
Huntsville Research & Engineering Center
M. R. Brashears and A. D. Zalay
FAA-RD-77-85
DOT-TSC-1145
Final Report September 1977 224p.

Wakes (Aerodynamics)
Doppler laser

To determine the behavior of the wake vortices of a B-747 at low altitudes and to measure the vortex-decay process behind the B-747 as a function of altitude above ground, flap and spoiler settings, and different flight configurations, a B-747 aircraft flew 54 passes at low level over a ground-based lasser Doppler velocimeter (LDV) system. From the LDV measurements, the location and flow field of the wake vortices and the general vortex roll-up, transport, and decay trends were obtained.

Results of the study indicated that the deployment of spoilers and flaps enhanced the decay of the vortex peak tangential velocity in the near wake while aircraft altitude, glide slope, and landing gear deployment had little effect. The report discusses the LDV wake vortex measurements including the instrumentation used, the experimental test sequence, the results of the wake measurements in terms of the vortex roll-up, transport, and decay trends, and a comparison of the wake vortex characteristics for different configurations.

DOT-TSC-FAA-77-14
VERIFICATION OF WIND MEASUREMENT WITH MOBILE LASER DOPPLER SYSTEM
Lockheed Missiles & Space Company, Inc.
Huntsville Research & Engineering Center
M. R. Brashears, W. R. Eberle
AD-A047 252
FAA-RD-77-117
DOT-TSC-1098
Final Report September 1977 170p.

Winds — Measurement
Remote sensing systems
Doppler laser

The Lockheed Mobile Atmospheric Unit is a laser Doppler velocimeter system designed for the remote measurement of the three components of atmospheric wind. The unit was tested at the National Oceanic and Atmospheric Administration Table Mountain Test Site to verify the capability of the system to measure wind remotely and to evaluate alternative data-processing algorithms. Remotely measured wind data are compared with concurrent data measured by anemometers on the NOAA 150-meter meteorological tower. The test program showed that the laser Doppler velocimeter system is an accurate instrument for the remote measurement of winds.

DOT-TSC-FAA-77-15
INVESTIGATION OF WIND CONDITIONS DURING EARLY MORNING HOURS AT LOS ANGELES INTERNATIONAL AIRPORT
Lockheed Missiles & Space Company, Inc.
Huntsville Research & Engineering Center
M. C. Krause, W. R. Eberle, G. M. Miller, and E. J. Gorzynski.
FAA-RD-77-116
DOT-TSC-1190
Final Report October 1977 84p.

Doppler laser
Airport noise control
Wakes (Aerodynamics)
Vertical windshear
Winds — Measurement

Los Angeles International Airport (LAX) uses a unique runway utilization pattern to minimize noise pollution between midnight and 0600. During these hours, all approaches are conducted to the east, and all takeoffs are conducted to the west. The low-altitude portions of all takeoff and landing operations are thereby conducted over the Pacific Ocean. During these operations, pilots have occasionally reported encountering unusual wind conditions. It is the objective of this study to use the Lockheed-Huntsville mobile laser Doppler unit velocimeter unit to monitor winds and wake vortices in the approach zone of runway 6R to identify the sources of the wind anomalies reported by the pilots. No incidents of pilot-reported wind anomalies occurred during the five-week data collection period.

DOT-TSC-FAA-77-16
PRELIMINARY LIMITED SURVEILLANCE RADAR (LSR) COST/BENEFIT ANALYSIS
Transportation Systems Center
Paul S. Rempfer
AD-A046 829
FAA-ASP-77-10
Final Report October 1977 54p.

Radar air traffic control systems

This report presents the findings of a cost/benefit analysis of the deployment of a new Limited Surveillance Radar (LSR). An LSR is an inexpensive, single channel, short-range (about 20 miles), primary radar for use at approach control facilities which cannot economically justify an Airport Surveillance Radar/Radar Beacon System (ASR/RBS). An LSR can also be used in tower cabs to aid in VFR operation where a BRITE display is not feasible due to coverage limitations dictated by obstructions or distance from the parent radar facility.

The study is preliminary in that it is brief and uses rough estimates and assumptions for both benefits and costs. Its purpose is to give a gross estimate of the current deployment potential of the LSR and to aid in decisions regarding further system analysis, development, and testing.

DOT-TSC-FAA-77-19
CHARACTERIZATION OF CURRENT TOWER CAR ENVIRONMENTS
Transportation Systems Center
V. J. Hobbs, D. F. Clapp; P. Rempfer, D. Devoe, J. Bellantoni, L. Maddock, J. Raudseps, L. Stevenson, J. R. Coonan, J. Kuhn, E. Hilborn
FAA-EM-77-10
Interim Report November 1977 210p.

Air traffic control
Human engineering

This report describes the general tower cab environment in terms of:

a) The evolution of the tower cab, current cab classification and staffing levels, and the basic flow of ATC data relevant to cab operations.
b) A breakdown of functions performed by tower cab personnel, the basic equipment used to perform those functions, and allocation of equipment and responsibilities to various controller positions.
c) Current tower-related systems and procedures, including airspace surveillance, surface surveillance, flight data handling and the role of the flight progress strip, air/ground communications, the data processing and display systems, weather related systems, and current landing systems. The equipments covered included the Airspace Surveillance Radar (ASR), Brite Radar Indicator Equipment (BRITE), Airport Surveillance Detection Equipment (ASDE-2), the NUBRITE display, Display Enhancement Unit (DEU), Flight Data Entry and Printout equipment (FDEP), basic radar PPI, TPX-42 automation and ARTS II and ARTS III displays, Runway Visual Range (RVR) and Runway Visual Value (RVV) equipment, various altimeters, etc.

DOT-TSC-FAA-77-25
INSTALLATION AND TEST OF DOPPLER ACOUSTIC SENSOR
Avco Corporation
R. P. McConville
FAA-RD-76-223
DOT-TSC-939
Final Report October 1977 106p.

Wakes (Aerodynamics)
Doppler radar

This report presents details of the installation of a Doppler acoustic vortex sensing system at JFK Runway 31R, the hardware and software improvements made since installation, vortex diagnostic and tracking data and analysis, and conclusions and recommendations.

DOT-TSC-FAA-77-27
VERIFICATION OF WIND MEASUREMENT TO 450 - METER ALTITUDE WITH MOBILE LASER DOPPLER SYSTEM
Lockheed Missiles & Space Company, Inc.
Huntsville Research & Engineering Center
M. R. Brashears, W. R. Eberle
FAA-RD-77-181
DOT-TSC-1190
Final Report December 1977 270p.

Winds – Measurement
Remote sensing systems
Doppler laser

The Lockheed mobile atmospheric unit is a laser Doppler velocimeter system designed for the remote sensing of winds. The capability of the laser Doppler velocimeter accurately to measure winds to 150-meter altitude has been previously demonstrated. To assess the capability of the laser Doppler velocimeter to measure winds at higher altitudes, the system was tested adjacent to the 481-meter instrumented WKY-TV television transmission tower at the National Severe Storms Laboratory test site near Norman, Oklahoma. Comparisons between the laser-measured winds and the anemometer-measured winds are presented. The sources of discrepancies between laser-measured wind and anemometer-measured wind are discussed.

FEDERAL HIGHWAY ADMINISTRATION

DOT-TSC-FHWA-75-2
SIMULATION STUDIES FOR AN URBAN TRAFFIC CORRIDOR
Transportation Systems Center
Lawrence McCabe, Robert Ricci, Patricia Concannon
PB 246 756
Final Report October 1975 48p.

City traffic — Mathematical models
Traffic assignment — Mathematical models

This report describes the salient features of the SCOT (Simulation of Corridor Traffic) model and a successful calibration and validation. SCOT is a computer model that may be applied to an urban traffic corridor and will simulate vehicular traffic on freeways, including on and off ramps, and urban streets. Vehicles are treated microscopically on the arterial street system and macroscopically as platoons on the freeway. Output statistics for each simulated link include numbers of vehicles discharged, total times of travel, average occupancy, and average speeds for specified time intervals.

Calibration and validation data collected via photographic techniques on a 1.2 mile test network of the Dallas North Central Expressway are described. Calibration details and statistical comparisons of the simulation results with the field data are presented. The Mann-Whitney U tests showed no significant differences between field and simulation results at the 1% level of significance for the basic parameters of traffic: mean speed, flow and saturation. This and other applied tests indicate that the SCOT Model adequately replicates freeway traffic performance.

A demonstration of the origin-destination (0-D) traffic assignment capability of the model is described. A review of the O-D simulation results indicates that the minimum time-path criteria used has not been conclusively shown to be the correct criteria for origin destination traffic assignments.

An analysis of freeway ramp control versus no ramp control for the Dallas test network shows a statistical reduction in speed with no ramp control for those freeway links in the vicinity of the on-ramp.

DOT-TSC-FHWA-76-1
RAILROAD GRADE CROSSING PASSIVE SIGNING STUDY
Transportation Systems Center
Joseph Koziol and Peter Mengert
PB-264-749
Interim Report January 1977 126p.

Railroads — Crossings

More than three-fourths of the 219,000 public railroad grade crossings nationwide are equipped with passive warning signs only. A two-phase study is now underway to develop improved passive signing for use at these grade crossings. This study is a pool-funded effort involving 25 states, the Federal Railroad Administration and the Federal Highway Administration. This report describes seven signing configurations (at-crossing sign and advance warning signs) tested in two states during Phase I of the study, the test sites, the types of data collected, the experimental variables, the analysis procedure, and the results of Phase I. Upon completion of Phase II, which involves nationwide testing, a final report will be written making recommendations on what signs should be adopted for driver warning at railroad grade crossings.

DOT-TSC-FHWA-76-2
MAINE FACILITY RESEARCH SUMMARY RESULTS 1973-1976
Transportation Systems Center
Joseph S. Koziol
PB 271 729
FHWA-RD-77-54
Final Report May 1977 28p.

Traffic safety
Railroads — Crossings
Traffic signs and signals
Speed limits

An overview of the Maine Facility - a two-lane rural highway test site - is presented, and past experimentation conducted at the facility is summarized. Experiments briefly described include Speed Control in Rural School Zones, Evaluation of Speed Control Signs for Small Rural Towns, Narrow Bridge Warning Devices, Flashing Traffic Control Devices at Intersections, and Passive Signing at Railroad Crossings.

FEDERAL HIGHWAY ADMINISTRATION

DOT-TSC-FHWA-76-3
EVALUATION OF SPEED CONTROL SIGNS FOR SMALL RURAL TOWNS
Transportation Systems Center
J. S. Koziol, Jr. and P. H. Mengert
PB-270 558
Final Report May 1977 120p.

Speed limits
Traffic signs and signals

This report describes the results of a comprehensive experiment dealing with speed control and driver behavior when approaching and driving through speed zones on a high speed, rural, two-lane highway. The basic objective of the experiment was to test the range of practical traffic control devices which alert drivers to the need for reducing speed when approaching concentrated areas of population and invoke voluntary compliance with the speed regulatory devices in a manner promoting increased safety in vehicle operation. Twelve different configurations of speed limit signs and warning devices were evaluated. All experiments were conducted at the Federal Highway Administration Maine Facility in the Town of Palmyra located along U.S. Route 2. The speed regulation in effect for all sign configurations was 35 mph (56 km/h). Results showed that:

- Active warning signs (i.e., signs with flashing beacons activated by vehicles violating the speed regulation) were the most effective (statistically significant) for both day and night
- During the day, flashing signs (i.e., signs with continuously flashing beacons) appeared to be second in effectiveness (after active signs).
- At night, pavement markings and rumble strips appeared to be next in effectiveness (after active signs).

DOT-TSC-FRA-76-7.I
TRAIN-TO-TRAIN REAR END IMPACT TESTS — Volume I — Pre-Impact Determination of Vehicle Properties
Ultrasystems, Inc.
Dynamic Science Division
R.L. Anderson, P.L. Cramer
PB-274 416
FRA/ORD-76/303,I
DOT-TSC-840
Final Report March 1977 100p.

Railroads — Accidents
Railroads — Cars — Testing
Locomotives — Testing

Nine train-to-train rear end impact tests were performed by the Dynamic Science Division of Ultrasystems, Inc., at DOT's Transportation Test Center.

This final report documents these nine tests.

Volume I, Pre-Impact Determination of Vehicle Properties, summarizes the vehicle properties obtained prior to the impact tests. These vehicle properties were used in computer simulation of the impact tests and included weights, pitch moments of inertia, spring rated, vertical center of gravity location, and linear dimensions.

DOT-TSC-FRA-76-7.II
TRAIN-TO-TRAIN REAR END IMPACT TESTS — Volume II — Impact Test Summaries
Ultrasystems, Inc.
Dynamic Science Division
R.L. Anderson, P.L. Cramer
PB-274 417
FRA/ORD-76/303,II
DOT-TSC-840
Final Report March 1977 124p.

Railroads — Accidents
Railroads — Cars — Testing
Locomotives — Testing

Nine train-to-train rear end impact tests were performed by the Dynamic Science Division of Ultrasystems, Inc., at DOT's Transportation Test Center.

This final report documents these nine tests.

Volume II, Impact Test Summaries, describes the impact tests. The impact tests were remotely controlled with impact speeds ranging from 3 to 30 mph. An array of approximately 20 high-speed cameras and 50 channels of data, including accelerations, strains, and displacement, documented the impacts.

DOT-TSC-FRA-76-7.III
TRAIN-TO-TRAIN REAR END IMPACT TESTS — Volume III — Appendix A: Impact Test Data Appendix B: Report of Inventions
Ultrasystems, Inc.
Dynamic Science Division
R.L. Anderson, P.L. Cramer
PB-274 418
FRA/ORD-76/303.III
DOT-TSC-840
Final Report March 1977 342p.

Railroads — Accidents
Railroads — Cars — Testing
Locomotives — Testing

Nine train-to-train rear end impact tests were performed by the Dynamic Science Division of Ultrasystems, Inc., at DOT's Transportation Test Center.

This final report documents these nine tests.

Volume III, Impact Test Summaries Appendix, is an appendix to Volume II. It contains the original data of the impact test.

DOT-TSC-FRA-76-14.I
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING AUTOMATIC GATE SYSTEMS. Volume I: Overview and Low Cost Railroad/Highway Grade Crossing Gate Systems
MB Associates
Andrew St. Amant
PB-265 724
FRA/ORD 77-06.I
DOT-TSC-859
Final Report February 1977 90p.

Railroads — Crossings

This report, Volume I of a two-volume study, examines the potential for reduction of the cost of installing and maintaining automatic gates at railroad-highway grade crossings. It comprises a general overview; a review of current practices, equipment, and standards; a consideration of modification of existing specifications to permit use of alternative technologies; the generation of design concepts for new gate systems or subsystems intended to offer significant economic benefits; an analysis and comparative evaluation of the more promising concepts; and conclusions concerning further design, development, and test activities. Concepts found to be particularly promising include a low-cost gate-drive mechanism utilizing high-reliability commercially available components; a swing-away, gravity resetting arm support intended to reduce the incidence of gate breakage; and a gate arm utilizing new materials to obtain resistance to breakage.

DOT-TSC-FRA-76-14.II
POTENTIAL MEANS OF COST REDUCTION IN GRADE CROSSING AUTOMATIC GATE SYSTEMS
Volume II: Improved Gate Arm Concepts for Railroad/ Highway Grade Crossings
Gulf and Western AD&E Center
James Duttera and Martin Friedland
PB-265 725
FRA/ORD 77-06.II
DOT-TSC-858
Final Report February 1977 66p.

Railroads – Crossings

This report, Volume II of a two-volume study, examines the potential for reduction of the cost of installing and maintaining automatic gates at railroad-highway grade crossings. It includes a review of current practices, equipment, and standards; consideration of modification of existing specifications to permit use of alternative technologies: generation of design concepts for new gate systems or subsystems intended to offer significant economic benefits; analysis and comparative evaluation of the more promising concepts; and conclusions concerning further design, development, and test activities. Concepts found to be particularly promising include a pneumatic gate-drive mechanism and a swing-away, gravity-resetting arm support intended to reduce the incidence of gate breakage; and a gate arm utilizing new materials to obtain resistance to breakage.

DOT-TSC-FRA-76-17
AN ANALYSIS OF THERMAL TRACK BUCKLING IN THE LATERAL PLANE
Princeton University.
Department of Civil Engineering.
Arnold D. Kerr
PB-267 938
FRA-OR&D-76-285
DOT-TSC-900
Interim Report September 1976 70p.

Railroads – Rails – Defects

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

DOT-TSC-FRA-76-19.I
INNOVATIVE CONCEPTS AND TECHNOLOGY FOR RAILROAD-HIGHWAY GRADE CROSSING MOTORIST WARNING SYSTEMS
Volume I: Overview and Concept Generation and Analysis
Cincinnati Electronics Corp.
F.H. Raab, M.C. Brooker, T.E. Ryan, and J.R. Waechter
PB-273 354
FRA/ORD-77/37.I
DOT-TSC-841
Final Report September 1977 210p.

Railroads – Crossings

This document includes a general review of innovative conceptual and technical approaches to train-activated motorist warning systems for use at railroad-highway grade crossings, and also contains a specific report describing a study directed toward the generation, analysis and evaluation of innovative concepts. The review includes a discussion of communication-link systems, radar train detection, locomotive-mounted transmitters and several other concepts. The basic application constraints of safety, reliability, resistance to serve environments and low cost are used as the basis for evaluating the merits of the alternative concepts.

The special study reported here explores the communication-link concept in detail, with particular emphasis on train-detection techniques. The use of microprocessor technology is advocated, along with substantial changes in motorist warnings.

DOT-TSC-FRA-76-19.II
INNOVATIVE CONCEPTS AND TECHNOLOGY FOR RAILROAD-HIGHWAY GRADE CROSSING MOTORIST WARNING SYSTEMS.
Volume II: The Generation and Analysis of Alternative Concepts
Tracor-Jitco, Inc.
D.D. Peterson and D.S. Boyer
PB-273 355
FRA/ORD-77/37.II
DOT-TSC-842
Final Report September 1977 96p.

Railroads — Crossings

This report describes the results of a study directed toward the generation, analysis and evaluation of innovative conceptual and technical approaches to train-activated motorist warning systems for use at railroad-highway grade crossings. Particular attention is given to the use of the track as a transmission line in a guided reflection (radar-like) technique operating at audio frequencies. Attention is also given to improve special road surfaces in advance of the crossing, and to optically programmed traffic lights.

DOT-TSC-FRA-76-23
A PRELIMINARY DESCRIPTION OF STRESSES IN RAILROAD RAIL
Battelle Columbus Laboratories
Thomas G. Johns and Kent B. Davies
PB-272 054
FRA-ORD-76-294
DOT-TSC-1038
Interim Report November 1976 136p.

Railroads — Rails — Defects

One portion of the Federal Railroad Administration's (FRA) Track Performance Improvement Program is the development of engineering and analytic techniques required for the design and maintenance of railroad track of increased integrity and safety. Under the program management of the Transportation Systems Center (TSC), one portion of this program predicts the reliability of rail in track. A necessary requirement for the development of these techniques is the ability of determining the stress and strain history of the rails in service. This is necessary to form a more comprehensive basis for a quantitative understanding of flaw initiation and growth. This report is one of a series of reports that provide a comprehensive description of stresses in rail required for predicting the reliability of rail in track structures. It provides a description of stresses encountered in railroad rails compiled from information available in the literature before 1976.

DOT-TSC-FRA-76-25
IMPROVEMENT OF THE EFFECTIVENESS OF MOTORIST WARNINGS AT RAILROAD-HIGHWAY GRADE CROSSINGS
Transportation Systems Center
J.B. Hopkins and E. White
PB-266 784
FRA/ORD-77/07
Final Report February 1977 96p.

Railroads — Crossings

Flashing red incandescent lamps have formed the primary motorist warning device at grade crossings for several decades, in spite of technical constraints that inherently limit the overall effectiveness possible. Tightly focused beams, necessary to obtain high intensity at low power consumption, make perceived brightness highly dependent on precise alinement, which is difficult to achieve and expensive to maintain. In this report an examination of appropriate literature and existing standards reveals preliminary requirements of function and desirable qualities for such motorist warnings. A consideration of relevant lighting technology shows that significant improvement is possible through the use of xenon flashlamps in standard crossing mountings. The quiet flash of the xenon unit appears to be more effective, with little deviation from the applicable standards, what motorists are used to, and conventional equipment. This study includes a discussion of optimal specifications, relevant technology, field tests, and related topics including system credibility and the use of highway traffic signals.

DOT-TSC-FRA-76-27
THE CAUSE OF THERMAL FATIGUE CRACKING IN METROLINER WHEELS
United States Steel Corporation.
Research Laboratory
G.F. Carpenter
PB-265 751
FRA/ORD-77/17
DOT-TSC-712
Final Report March 1977 92p.

Car-wheels — Defects

One new wheel and two used wheels (one with a thermal crack in the tread) were examined for mechanical properties, macrostructure, microstructure, and residual stresses. Similar examinations were conducted on three new wheels which were first subjected to various braking cycles designed to define the conditions that produce cracking. The braking tests were conducted on the laboratory dynamometer.

The results of this study indicated that the wheel that had developed a thermal crack in service had been intermittently and severely heated around the tread surface and that such heating had altered the microstructure, produced residual tensile stresses and permitted the crack to initiate.

The results further showed that neither altered microstructures nor cracking could be produced by many emergency brakings or speed-reduction brakings with normal brake shoes and forces.

DOT-TSC-FRA-76-28
A BIBLIOGRAPHY ON RAIL TECHNOLOGY
Battelle-Columbus Laboratories
Walter E. Chapin, Rolland D. King, Helen C. Pestel, and Ruth H. Breslin
PB-275 046
FRA/ORD-77/15
RA-75-19
Final Report May 1977 538p.

Railroads — Rails — Bibliography

This rail technology review provides assistance to a number of rail technology programs initiated by the Transportation Systems Center (TSC) for the Federal Railroad Administration (FRA). The results of a search and review in four specific areas in the field of rail technology are presented in the form of a bibliography with descriptive abstracts, source acknowledgments, and availabilities. The geographic scope of the review was worldwide with particular emphasis on the literature of the United States, Canada, the United Kingdom, Western Europe, the Soviet Union, and Japan.

The technical scope of investigations for which abstracts are presented include such important topics as the nondestructive examination of rails, the determination of rail stresses and strains and factors affecting them, rail failure behavior and the analysis of rails-in-service, and the metallurgical aspects of rail steel and its production.

The time period covered by the review is 1965 through 1975, with particular emphasis on the past five years. Types of literature covered include: journal articles, conference papers, reports, textbooks, handbooks, and unpublished papers. Indices for the identification of the abstracts are provided.

DOT-TSC-FRA-76-29
MAINTAINING ALERTNESS IN RAILROAD LOCOMOTIVE CREWS
Transportation Systems Center
D.B. Devoe and C.N. Abernethy
PB-266 273
FRA/ORD-77/22
Final Report March 1977 68p.

Railroads — Employees
Locomotive engineers

The problem of assuring alertness in railroad locomotive crews is defined. Principles for maintaining alertness are derived from the experimental literature on vigilance and several unresolved questions are explored through three experiments. The findings are summarized in a set of criteria for evaluating alerting devices and techniques, and devices currently in use on the railroads are evaluated against these criteria. Recommendations are offered for improving current devices and for exploring new techniques.

DOT-TSC-FRA-76-30.I
AERODYNAMIC FORCES ON FREIGHT TRAINS
Volume I — Wind Tunnel Tests of Containers and Trailers on Flatcars
Andrew G. Hammitt Associates
Andrew G. Hammitt
PB-264 304
FRA/ORD-76/295.I
DOT-TSC-1002
Final Report December 1976 150p.

Railroads — Trains — Dynamics

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

DOT-TSC-FRA-76-31
STUDIES OF FREIGHT TRAIN ENGINEER PERFORMANCE
Transportation Systems Center
E.D. Sussman and D. Ofsevit
PB-267 622
FRA-OR&D-76-306
Final Report December 1976 72p.

Locomotive engineers
Human engineering

As a part of the International Government-Industry Program on Track Train Dynamics, the performance of engineers in freight train handling was studied by recording and analyzing train operations and engineer responses under field conditions. Data collection took place during regular revenue freight operations over five representative railroads containing varied terrain and operating conditions. Data collection was accomplished by using a digital data acquisition system specifically designed for this study. Levels of engineer performance were evaluated through the use of an objective rating form specifically designed for this study. Scores on this form were correlated with digitally recorded data.

Engineers were found to consistently respond to changes in locomotive drawbar force as indicated on the cab loadmeter. Higher-rated engineers tended to make fewer and more accurate responses than lower-rated engineers. No systematic pattern of response to cab accelerations was found, nor was a systematic change in smoothness of performance revealed over the length of a trip. Frequency of the use of various controls was found to depend more on railroad terrain and procedures then on individual engineer skills.

DOT-TSC-FRA-76-32
STRESS MEASUREMENTS IN RAILROAD WHEELS VIA THE BARKHAUSEN EFFECT
Southwest Research Institute
R.R. King, J.R. Barton, and W.D. Perry
PB-271 216
FRA/ORD-77/11
DOT-TSC-713
Final Report February 1977 86p.

Car-wheels — Defects
Non-destructive testing

The feasibility of utilizing the Barkhausen Effect in ferromagnetic steels as a nondestructive means for ascertaining residual stresses in railroad wheels was investigated. Railroad wheels are generally manufactured with compressive stress distributions in the rim to impede the propagation of fissures or thermal cracks caused by brake applications. In service, these compressive stresses may gradually become tensile, thus increasing the potential for wheel failure. Specimens examined using the Barkhausen noise measurement technique included four new wheels and two used wheels. Stress measurements from this nondestructive technique were compared with stress values determined by a dissection method of strain

relaxation. Qualitative consistency in these data were observed, although testing of a larger data base will be required to determine the utility of the Barkhausen noise measurement technique for identifying those wheels which are potentially hazardous because of tensile stress buildup.

DOT-TSC-FRA-76-34
TRAIN GENERATED AIR CONTAMINANTS IN THE TRAIN CREW'S WORKING ENVIRONMENT
Transportation Systems Center
J.R. Hobbs, R.A. Walter, T. Hard, & D. Devoe
PB-265 355
FRA/ORD-77/08
Final Report February 1977 52p.

Railroads – Employees
Locomotive engineers
Railroads – Environmental aspects

This document contains data on the levels of air contaminants in the train crew's working environment. Measurements were made in locomotive cabs and cabooses of freight trains travelling through long tunnels and over mountainous terrain. In addition, measurements were performed in long-hood forward locomotives during through freight operations and in switchyard locomotives. The data from this study indicate that the breathing environment of railroad operating crews is acceptable within the guidelines of the published Occupational Safety and Health Administration (OSHA) standards. Appendix A covers the sources of air contaminants in the railroad environment and Appendix B gives a detailed description of the measurements in this study. A review of related studies is given in Appendix C.

DOT-TSC-FRA-76-35
RAILROAD CLASSIFICATION YARD TECHNOLOGY
A Survey and Assessment
Stanford Research Institute
S.J. Petracek, A.E. Moon, R.L. Kiang, M.W. Siddiqee
PB-264 051
FRA/ORD-76/304
DOT-TSC-968
Final Report January 1977 346p.

Railroads – Yards

This report documents a survey and assessment of the current state of the art in rail freight-car classification yard technology. The major objective was the identification of research and development necessary for technological improvements in railroad classification yards. This involved a projection of future classification yard needs and a comparison of these requirements with existing technology. Separate tasks included a description of the hardware, costs, performance characteristics, and operational practices of existing yards; formulation of general yard-network interaction concepts; collection of in-depth background information concerning the yard population in the United States (categorized by type, technology, and function); estimation of the demands likely to be placed on the nation's network of freight-car terminals during the foreseeable future; and an assessment and prioritization of those areas of terminal operations that warrant further research or development.

DOT-TSC-FRA-77-1
THE RAILROAD PERFORMANCE MODEL
Transportation Systems Center
James F. Oiesen
FRA-OPPD-77-11
Final Report October 1977 312p.

Railroads – Freight cars – Mathematical models

This report describes an operational, though preliminary, version of the Railroad Performance Model, which is a computer simulation model of the nation's railroad system. The ultimate purpose of this model is to predict the effect of changes in government or industry policies on the performance of the railroads

This model simulates the history of individual cars and individual loads of freight; and it explicitly incorporates a number of decisions made by government, railroads, and shippers.

This model includes phenomena such as freight car shortages and surpluses, interlining, per diem rates, car service rules, the demurrage system, routing of cars, and the allocation of home and foreign empty cars.

DOT-TSC-FRA-77-2
DEVELOPMENT OF A SYSTEM TO DISPLAY AND RECORD SLACK ACTION IN FREIGHT TRAINS
Transportation Systems Center
J. D. Vrabel, E. D. Sussman, D. Ofsevit
PB-272-944
FRA/ORD-77-53
Final Report August 1977 62p.

Railroads – Trains – Dynamics

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

DOT-TSC-FRA-77-3
FATIGUE CRACK PROPAGATION IN RAIL STEELS
Battelle Columbus Laboratories
G. E. Feddersen, R. D. Buchheit, D. Broek
PB-272-062
FRA/ORD-77/14
DOT-TSC-1076
Interim Report June 1977 108p.

Railroads – Rails – Defects

In order to establish safe inspection periods of railroad rails, information on fatigue crack growth rates is required. These data should come from a sufficiently large sample of rails presently in service. The reported research consisted of the generation and analysis of fatigue crack growth data of 66 rail samples taken from existing track all over the United States. Additional information concerns mechanical properties, chemical composition, microstructure, and fractographic features.

A statistical analysis was performed to evaluate possible correlations with fatigue crack growth properties and microstructural parameters. Weak correlations were found with carbon, manganese and oxygen content, and with the fraction of pearlite.

A subsequent phase of this research program is laid out.

DOT-TSC-FRA-77-4
OVERVIEW OF COMPUTER-BASED MODELS APPLICABLE TO FREIGHT CAR UTILIZATION
Transportation Systems Center
Laura Baker
FRA-OPPD-77-12
Final Report October 1977 96p.

Railroads – Management – Mathematical models
Railroads – Yards – Mathematical models

This report documents a study performed to identify and analyze twenty-two of the important computer-based models of railroad operations. The models are divided into three categories: network simulations, yard simulations, and network optimizations. The simulations are used to assess the impact of certain operating policies and planning procedures. The network simulations examine system-wide effects, while the yard simulations focus on the operations performed within a single yard. Network optimizations typically are used to calculate optimal distribution for a rail system's empty freight cars based on the railroad's car distribution rules and goals. The description of each model includes its history, design approach, fundamental logic, unusual features, hardware and software specifications, and its extent of application. In the case of a model's implementation on a rail system, attempts were made to obtain test results and evaluations. This served as a basis for reviewing each model.

DOT-TSC-FRA-77-5
WAYSIDE DERAILMENT INSPECTION REQUIREMENTS STUDY FOR RAILROAD VEHICLE EQUIPMENT
Shaker Research Corporation
John L. Frarey, Richard L. Smith, Allan I. Krauter
PB-271 244
FRA/ORD-77/18
DOT/TSC-1029
Final Report May 1977 150p.

Railroads – Accidents

An analysis of the causes of the railroad equipment caused derailments was made. Data reported to the FRA were the primary source of derailment information; however, data from other sources were also available. Individual cause codes were consolidated into groups that had a common characteristic that might be used to detect the presence of the defect. Seven consolidated cause code groupings were identified that accounted for over 80 percent of the cost of equipment caused derailments. Existing wayside inspection systems were evaluated. Developmental wayside inspection systems were identified. A method was developed that assigns a purchase cost number for possible wayside detection schemes that is based on the cost of derailment and effectiveness of the system.

A recommendation is made that FRA set up Wayside Inspection Station(s) as a means of evaluating improvement to present systems and new wayside inspection methods.

DOT-TSC-FRA 77-6
U.S.-U.S.S.R. RAIL INSPECTION INFORMATION EXCHANGE
Battelle Pacific Northwest Laboratories
F. L. Becker
PB-272 612
FRA/ORD-77/35
DOT-TSC-979
Final Report June 1977 86p.

Railroads – Rails – Defects
Railroads – Track – Inspection
Non-destructive testing

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

The objective of this information exchange was to achieve a technical description of Soviet rail inspection technology and practice and to learn of recent R&D efforts for nondestructive inspection (NDI) of rail. The pertinent areas included: contemporary rail NDI systems, planning and scheduling of rail inspection, inspection of track components other than rail, methods for measurement of rail stresses, and recent R&D efforts in rail NDI.

This report is divided into five sections: itinerary, description of devices and techniques, applicability of Soviet technology to U.S. rail NDI, effectiveness of the information exchange, and recommendations for future exchanges. The itinerary section of the report lists the facilities and personnel contacted, and relates the content of the technical discussions that took place. The equipment section of the report describes the devices and techniques that were discussed. A critical review of the applicability of Soviet technology to U.S. rail NDI and the effectiveness of the information exchange are contained in the following two sections of the report. The concluding section lists the recommendations for future exchanges based on the experiences of this delegation.

DOT-TSC-FRA-77-7
METHODS FOR JOINING OF RAILS: SURVEY REPORT
Battelle-Columbus Laboratories
Daniel Hauser
PB-272 066
FRA/ORD-77/16
Final Report July 1977 164p.

Railroads – Rails – Fastenings
Railroads – Rails – Defects

The performance of track structures depends greatly on the integrity of the connections between rail sections. Because the majority of service and detected rail failures occur at joints, particularly conventional bolted joints, this survey was conducted to review existing practices, examine potential joining methods, and identify promising new methods and modifications of joining methods that can provide improved rail performance and lower fabrication cost. Methods for joining rails in the field as well as in plants by both metallurgical methods (welding and brazing processes) and nonmetallurgical methods (mechanical fastening and adhesive bonding) are reviewed. Joining procedures, inspection methods, laboratory and in-track performance, failure modes, adaptability to shop and field fabrication, personnel skills required, and costs are discussed. Joining methods that warrant additional development are identified and developmental efforts are outlined.

DOT-TSC-FRA-77-9
MEASUREMENT PLAN FOR THE CHARACTERIZATION OF THE LOAD ENVIRONMENT FOR CROSS TIES AND FASTENERS
Battelle-Columbus Laboratories and Bechtel Incorporated
Robert H. Prause, Harold D. Harrison, and Robert C. Arnlund
PB-271 393
FRA/ORD-77/03
DOT-TSC-1044
Interim Report April 1977 88p.

Railroads – Track
Railroads – Ties
Railroads – Rails – Fastenings

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

DOT-TSC-FRA-77-10
SUMMARY STATISTICS OF THE NATIONAL RAILROAD-HIGHWAY CROSSING INVENTORY FOR PUBLIC AT-GRADE CROSSINGS
Transportation Systems Center
John S. Hitz, Editor
PB-271 334
FRA-OPPD-77-8
Final Report June 1977 160p.

Railroads – Crossings

In response to the Federal Railroad Safety Act of 1970, a joint government/industry effort to compile a national inventory of railroad-highway crossings was initiated in 1972 and completed in 1976. The inventory contains data on the physical and operational characteristics of all 402,000 railroad-highway crossings in the United States of which 219,000 are public at-grade, 142,000 are private, 37,500 are public grade separated and 3,500 are pedestrian. This report presents comprehensive statistical summaries of the characteristics for all public at-grade crossings reported in the inventory as of August 1976. This information will be useful at the Federal, state, and local levels for determining effective allocation of crossing improvement funds and developing R&D, legislative, information and education programs aimed at improving safety at crossings.

DOT-TSC-FRA-77-11
RAILROADS AND THE ENVIRONMENT: ESTIMATION OF FUEL CONSUMPTION IN RAIL TRANSPORTATION
Volume II-Freight Service Measurements
Transportation Systems Center
John B. Hopkins and A. T. Newfell
PB-273 277
FRA-OR&D-75-74.II
Final Report September 1977 46p.

Railroads – Fuel consumption

Fuel consumption measurements have been carried out in cooperation with several railroads for a variety of types of revenue freight service. Intermodal operations have been emphasized, but this report also includes studies relating to branchline and general freight movements. The wide range of operating parameters examined includes train speed, weight, length, type, power-to-weight ratio, and terrain. In particular, this report describes the test conditions, operating parameters and fuel usage indices for 80 separate line-haul movements on six different railroads, covering 53,000 train miles. Trailer-On-Flatcar (TOFC) service predominates, but several manifest freights, two unit coal trains, and two COFC trains are included. Branchline service is also reported and analysed for six 174-mile round trips. In spite of considerable variation in relevant parameters and inherent imprecision in the data, the results are found to exhibit a basic consistency both internally and with past estimates.

DOT-TSC-FRA-77-13
RAIL INSPECTION SYSTEMS ANALYSIS AND TECHNOLOGY SURVEY
Battelle Columbus Laboratories
W. D. Kaiser, R. H. Byers, D. Ensminger, H. C. Meacham, J. H. Flora, W. C. Bruce, L. Becker, G. Posakony
PB-272 931
FRA/ORD-77/39
DOT-TSC-979
Final Report September 1977 228p.

Railroads – Rails – Defects
Railroads – Track – Inspection
Non-destructive testing

This study was undertaken to identify existing rail inspection system capabilities and methods which might be used to improve these capabilities. Task I was a study to quantify existing inspection parameters and Task II was a cost effectiveness study to utilize the results of Task I in defining the total costs incurred in inspecting and replacing rail and in defining the most cost effective inspection system.

Some of the major findings from these studies were that the practices of stopping for hand check and to mark flaws and of manually processing all data were the major factors presently limiting inspection speeds. It was concluded that use of automatic data processing and elimination of the stops would allow speeds to be increased to about 25 mph (40 kmph) and inspection costs would be reduced by about a factor of 2. It was also concluded that with extensive transducer and carriage development, speeds up to 50 mph (80 kmph) were feasible and would further reduce inspection costs from 0 up to a maximum of about 30 percent depending upon usage. A recommendation was made to develop an inspection vehicle with an ultimate speed capability of 50 mph (80 kmph) or higher.

DOT-TSC-FRA-77-18
STRUCTURAL ADEQUACY OF FREIGHT CAR TRUCK CASTINGS AND WHEELS
IIT Research Institute
Milton R. Johnson
FRA/ORD-77/51
DOT-TSC-727
Final Report October 1977 82p.

Car-trucks (Railroads)
Car-wheels

The structural adequacy of freight car truck castings and wheels to resist fatigue damage is reviewed. The environmental load data described in an earlier report under this program and additional load data which have only recently become available are used to calculate the expected fatigue life under various assumptions of the stresses present in the components. It is found that under most conditions the components should not develop fatigue cracks. This confirms the observation that there are a relatively small number of fatigue failures of these components in service. Since failures of these components can lead to serious derailments, it is important that the circumstances leading to a higher risk of fatigue failure be identified so that under these circumstances truck components can be subjected to more frequent and stringent inspections under the railroad frieght car safety standards of the FRA. The results of tests to determine the fatigue strength of wheel plates are also described. The tests showed that there is a substantial safety margin with respect to fatigue when one considers the effects of lateral loads acting on the wheel.

DOT-TSC-FRA-77-22
COST EFFECTIVENESS OF RESEARCH AND DEVELOPMENT RELATED TO RAILROAD ELECTRIFICATION IN THE UNITED STATES
Transportation Systems Center
Frank L. Raposa and Curtis H. Spenny
FRA-ORD-77-62
Interim Report December 1977 166p.

Railroads – Electrification

The object of this report is to determine the impact of research and development on railroad electrification in the United States. It is presumed that electrification is economically viable and that a prior commitment has been made to electrifying the high density mainlines. Research and development topics are identified from a series of government/industry workshops. Those near-term and mid-term topics found to have major impact include substation and railroad/utility interface improvements to reduce energy costs, improvements in catenary design and construction techniques, improvement in locomotive power density and adhesion, and reduction in electromagnetic interference. Their impact on a postulated network is measured by the savings which could accrue if the research and development accomplishments were implemented when available. Additional non-hardware topics identified for the near term include system engineering, standards, and socio-economic and environmental impact. Far-term topics identified include linear motors and brakes, d-c electrification, and improvements for electrification of lighter density routes. The cost benefits of d-c electrification for the second increment of the postulated network are presented.

DOT-TSC-FRA-77-25
USE OF COMPUTER SIMULATION FOR THE ANALYSIS OF RAILROAD OPERATIONS IN THE ST. LOUIS TERMINAL AREA
Bolt, Beranek, and Newman, Inc.
E. William Merriam
TS-13305
Final Report November 1977 80p.

Railroad simulators

This report discusses the computer simulation methodology, its uses and limitations, and its applicability to the analysis of alternative railroad terminal restructuring plans. Included is a detailed discussion of the AAR Simulation System, an overview of twelve other railroad simulations, and an analysis of how they or other simulation systems might aid the restructuring project being conducted by the railroads in St. Louis. Included is critical analysis of what "validation" of simulation means and what it does and does not imply. Also discussed is the meaning of the terms "network" (as in network simulation) and "levels of detail." Simulation builders and railroaders view these terms differently, which often results in disappointment with the results of supposedly "successful" simulation ventures. The importance of user familiarity with both the simulation system and railroad problems is stressed. A major conclusion reached is that none of the existing network simulations is suitable for detailed analysis of railroad terminal areas. Development of a simulation system incorporating a new approach for performing such analysis is within the state-of-the-art and is recommended.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHTSA-76-3
A SEMI-AUTOMATED PULSE-ECHO ULTRASONIC SYSTEM FOR INSPECTING TIRES
Transportation Systems Center
Robert P. Ryan
PB-272 323
HS-802-104
Interim Report July 1977 58p.

Nondestructive testing
Ultrasonic testing
Automobiles — Tires — Testing

A nondestructive tire-testing system has been developed using the pulse-echo ultrasonic technique, which offers substantial advantages over all other physical nondestructive-testing methods and shows promise of reducing the cost of production-tire inspection.

Developed under the sponsorship of the National Highway Traffic Safety Administration (M. J. Lourenco, Program Director), the system was specifically designed to meet the requirements for detecting flaws in new tires. For this application, the reliable detection of possibly subtle flaws demands sophisticated techniques, but costs can be minimal because a high level of automation may be used.

Work is underway to relate tire failure to anomalies observable by reflection ultrasonics. If satisfactory correlation can be demonstrated the system may be used to screen larger samples of tires before testing for compliance with Motor Vehicle Standard 109.

This report describes the ultrasonic techniques, explains the operation of the system and presents examples of data displays produced by the system test results from a small sample of tires.

DOT-TSC-NHTSA-76-4
MANUAL FOR ANALYSIS OF ETHANOL IN BIOLOGICAL LIQUIDS
University of Oklahoma Health Sciences Center
Kurt M. Dubowski
PB-266 688
HS 802 208
DOT-TSC-472
Final Report January 1977 126p.

Blood alcohol
Gas chromatography

This manual covers selected aspects of the analysis of ethanol in biological liquids and the interpretation of the results of such analyses. Recommendations are made concerning the selection, collection, identification, and preservation of suitable biological liquid specimens from living and dead subjects for traffic law enforcement and related purposes. Procedural details are given for analysis of ethanol in such biological liquids by both automated and manual versions of gas chromatography of headspace vapors, with and without internal standards; and the analytical performance characteristics of the method are set forth. Brief consideration is also given to the interpretation of the results of alcohol analysis in blood and other biological liquids.

DOT-TSC-NHTSA-77-2
SPECTRAL ANALYSIS OF THE EFFECTS OF DAYLIGHT SAVING TIME ON MOTOR VEHICLE FATAL TRAFFIC ACCIDENTS
Transportation Systems Center
Norman J. Meyerhoff
PB-267 982
DOT HS-802 324
Final Report April 1977 140p.

Daylight saving
Traffic accidents — Research

This report shows that Daylight Saving Time (DST) reduces the number of persons killed in motor vehicle fatal traffic accidents by about one percent. This estimate is based on a spectral (Fourier) analysis of these fatalities which utilizes a filtering technique to identify the part of the fatality frequency spectrum which is sensitive to DST while suppressing all other frequencies. To establish a cause/effect relationship between DST and changes in the filtered fatality time series, the changes are measured in two ways: (1) Across DST transitions and (2) For corresponding dates in years with and without DST. Certain statistical criteria are then applied to these measurements in order to confirm the existence of a DST effect on accidents and fatalities.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHSTA-77-4
ULTRASONIC DETECTION OF OVERBUFFING IN RETREADED TIRES
Transportation Systems Center
S. N. Bobo, A. J. Scapicchio
PB-273 697
HS-802-539
Interim Report August 1977 40p.

Automobiles – Tires – Testing
Nondestructive testing
Ultrasonic testing

A study was performed to determine the feasibility of nondestructive inspection by the reflection ultrasound for damage from overbuffing of retreaded tires. Following the introduction, the report briefly describes the principles of the method. Then, the details of the study are discussed. In Part I, comparison of inspection for overbuffing of two tires by X-rays and reflection ultrasound conclusively showed that the latter technique was superior. In Part II, flaws of varying severity, deliberately introduced in six tires were identified by reflection ultrasound, positively in 24 instances and tentatively in the remainder. Subsequent X-ray inspection proved negative. The report ends with a brief section of conclusions and recommendations.

DOT-TSC-UMTA-76-2
A COMPUTER PROGRAM (POWREQ) FOR POWER REQUIREMENTS OF MASS TRANSIT VEHICLES
Transportation Systems Center
C. H. Spenny and J. M. Clarke
UMTA-MA-06-0044-77-2
Final Report August 1977 69p.

Subways — Fuel consumption — Simulation methods
Buses — Fuel consumption — Simulation methods

This project was performed by the Power and Propulsion Branch of the Transportation Systems Center. The objective was to develop a computer program suitable for use in analyses requiring estimates of the energy requirements of transit vehicles. The Power Requirements (POWREQ) simulation model was designed to execute on the DEC-10 Operating System either in batch mode or time-sharing mode via remote terminals. A CALCOMP plotting routine is provided so that the user can request graphs illustrating the time variation of the important parameters. The graphs are generated off-line.

The Computer Program (POWREQ) described herein has been developed as a tool to be used in systematic analyses requiring the estimation of energy requirements of mass transit vehicles as a function of driving schedules and vehicle size, shape, and gross weight. POWREQ can be employed for systematic analyses of road/rail vehicles.

DOT-TSC-UMTA-76-7
TRANSIT FARE PREPAYMENT
The Huron River Group, Inc.
W. R. Hershey, D. J. Forkenbrock, M. J. Berla, B. A. Miller, and M. E. Dewey
PB-265 227
UMTA-MA-06-0049-76-3
DOT-TSC-1056
Final Report August 1976 186p.

Local transit — Fares (Prepaid)

Fare prepayment encompasses all methods of paying for transit rides other than by cash. Types of prepayment include: (1) those which allow the purchaser a fixed number of rides, usually over an unlimited time period (tickets, tokens, punch cards); and (2) those which are valid for an unlimited number of rides over a fixed time period (passes, permits).

A brief mail survey was first conducted to determine prepayment practices in a large sample of transit operators. This was followed by a detailed telephone survey of 146 operators, in which characteristics of the systems and their prepayment plans were ascertained.

Four distinct user surveys were conducted to investigate the decisions made among available payment methods. Response to prepayment options seems to vary with trip purpose, frequency of transit use, and user characteristics. Employer-sponsored programs for distributing or subsidizing prepayment instruments are popular among users and seem to have significant potential.

The study concludes that fare prepayment can be an important element of a transit system's marketing program, both for attracting and holding riders and for building the system's image. More attention needs to be given to assuring that the transit operator's fare prepayment components fit together into a rational, comprehensive fare structure.

DOT-TSC-UMTA-76-16
SPECIAL TRANSPORTATION SERVICES FOR THE ELDERLY AND HANDICAPPED DEMONSTRATION PROJECT — BATON ROUGE, LOUISIANA
CACI, Inc. and Capital Transportation
Chester H. McCall, Jr., Mary I. Olson, and Harry I. Reed, III
PB-263 904
UMTA-LA-06-0001-76-1
DOT-TSC-1082
Final Report November 1976 98p.

Physically handicapped — Baton Rouge — Transportation
Aged — Transportation — Baton Rouge
Demand responsive transportation — Baton Rouge

In July 1972 the Urban Mass Transportation Administration, under its Service Development Program, awarded an 18-month grant to the City of Baton Rouge to demonstrate the feasibility of establishing a "modern, cost-effective method of transporting the aged and disabled by means of a specially designed system, separate from conventional public transit, but coordinated with the community's existing public transportation resources." After a delay of 21 months, the specialized transportation services grant was signed and planning and staffing were implemented. This final report details a chronology of

what happened leading up to and during the conduct of the specialized services. In addition, programs encountered and steps taken to resolve these problems are presented. Statistics on system clients, trips, and costs are presented for the 12 months of STS system operation. Where appropriate, implications that might bear on the initiation of a similar service elsewhere are set forth.

DOT-TSC-UMTA-76-17
IN-SERVICE PERFORMANCE AND COSTS OF METHODS TO CONTROL URBAN RAIL SYSTEM NOISE TEST AND EVALUATION PLAN
Wilson, Ihrig & Assoc., Inc. and DeLeuw, Cather & Co.
Hugh J. Saurenman and Michael C. Holowaty
PB 272-521
UMTA-MA-06-0025-77-10
DOT-TSC-1053
Interim Report April 1977 67p.

Car-wheels — Noise
Noise control

This interim report is the Test and Evaluation Plan, the second report of a study to investigate the effectiveness of four techniques for reducing wheel/rail noise in rail rapid-transit systems (resilient wheels, damped wheels, wheel truing, and rail grinding) by implementing a testing program on the Market-Frankford Line of the Southeastern Pennsylvania Transportation Authority (SEPTA). The previous report covered the experimental design portion of this study (UMTA-MA-06-0025-76-4, May 1976). The ultimate goal of this study is to provide sufficient information to allow a transit system with given track and car conditions and budgetary constraints to determine the mix of the available methods of control of wheel/rail noise which will result in the greatest overall benefit.

The purpose of this report is to present the test and evaluation plan of this study; that is, to detail the methods and equipment that will be used to collect, manage, and reduce the data on both acoustic performance and costs of the four noise control methods. Included are descriptions of the locations for the noise measurements, the schedule which has been set up for wheel and rail maintenance, and the survey of other transit systems which will be performed to collect information relevant to the application of the noise-control methods. This study is designed to provide information on both the long-term and short-term costs and effectiveness of various noise abatement procedures if implemented on typical urban rail systems in the United States.

DOT-TSC-UMTA-76-18
PROCEEDINGS: SEMINAR ON UNDERGROUND CONSTRUCTION PROBLEMS, TECHNIQUES AND SOLUTIONS, CHICAGO, ILLINOIS, 20-22 OCTOBER 1975
Chicago Urban Transportation District
William L. Barnes and Petros P. Xanthakos, Editors
PB 264-027
UMTA-MA-06-0025-76-8
TS-12548
Proceedings December 1976 439p.

Tunneling — Congresses

The seminar on "Construction Problems, Techniques and Solutions" held at the First Chicago Center in Chicago, Illinois, on October 20-22, 1975, was organized to focus on anticipated construction problems of the Chicago Central Area Transit Project to include underground construction techniques, new technology, ground engineering techniques (underpinning, dewatering, grouting), and involved an exchange of experiences among owners, design teams, contractors, and other pertinent agencies.

This report consists of seminar presentations by representatives of the U.S., France, England, and Japan to an audience of more than 250 engineers, contractors, and administrators from the U.S. and Canada. The papers (19) prepared for this seminar follow in their entirety, and the authors are identified by their titles and associations as of October 1975. Additionally, a complete summary of the panel discussion held during the last afternoon of the seminar and moderated by Harold E. Nelson, CUTD Executive Director, is furnished because of the pertinent views that were expressed therein. This set of proceedings was prepared because of the valuable summary of the state-of-the-art of urban underground construction technology that developed during the seminar, and because of the continuing requests for seminar presentation material. This three-day seminar was funded by UMTA through the Transportation Systems Center as part of its tunneling program. The proceedings were compiled by the Chicago Urban Transportation District with funding assistance from UMTA.

DOT-TSC-UMTA-77-1
CONSTRUCTION MONITORING OF SOFT GROUND TUNNELS: A RATIONAL HANDBOOK OF PRACTICES FOR RAPID TRANSIT SYSTEM PLANNERS AND MANAGERS
Parsons, Brinckerhoff, Quade & Douglas Inc.
Birger Schmidt
PB-264 361
UMTA-MA-06-0025-76-6
DOT-TSC-661
Handbook January 1977 70p.

Tunneling — Handbooks, manuals, etc.

The objectives of the Urban Mass Transportation Administration (UMTA) Tunneling Program are to lower subway construction costs and reduce construction hazards and damage to the environment. Advances in the practice of technology of construction monitoring of soft ground tunnels and deep excavations can lead to a better control, and in some cases reductions in, transit construction costs. This handbook documents the findings of a recent UMTA construction monitoring instrumentation research project. The handbook is directed to systems managers and planners to show how to incorporate successful monitoring programs in their systems to help control and reduce costs. Recommendations are made for planning and specifying the purchase and installation of instrumentation.

DOT-TSC-UMTA-77-2. I
GUIDELINES FOR IMPROVED RAPID TRANSIT TUNNELING SAFETY AND ENVIRONMENTAL IMPACT
Volume I: Safety
A. A. Mathews, Inc.
John D. Bledsoe and Arthur P. Chase
PB 271-047
UMTA-MA-06-0025-77-7
DOT-TSC-802
Final Report January 1977 117p.

Tunneling — Safety measures

Two of the major objectives of the Urban Mass Transportation Administration Tunneling Program are to lower subway construction costs and reduce construction hazards and damage to the environment. The study consists of a two-volume report and aims to develop guidelines for improved rapid transit tunneling safety and environmental impact; that is, this effort is directed toward underground construction applicable to modern transit subway systems in urban areas.

Volume 1: Safety. Examination of construction safety regulations, tunnel construction accident data, and features of underground construction leading to unsafe work show that a systems approach to safety is required. Ten guidelines were drafted to supplement current construction safety regulations (OSHA 29CFR1926). Recommendations for further study and evaluation were made to complete the systems safety approach.

DOT-TSC-UMTA-77-2. II
GUIDELINES FOR IMPROVED RAPID TRANSIT TUNNELING SAFETY AND ENVIRONMENTAL IMPACT
Volume II: Environmental Impact
A. A. Mathews, Inc. and Alan M. Voorhees and Associates, Inc.
Andrew C. Lemer and C. Y. Cheng.
PB 271-048
UMTA-MA-06-0025-77-8
DOT-TSC-802
Final Report January 1977 138p.

Tunneling — Environmental aspects

Two of the major objectives of the Urban Mass Transportation Administration Tunneling Program are to lower subway construction costs and reduce construction hazards and damage to the environment. This study consists of a two-volume report and aims to develop guidelines for improved rapid transit tunneling safety and environmental impact; that is, this effort is directed toward underground construction applicable to modern transit subway systems in urban areas.

Volume II. Environmental Impact. Investigation of subway construction jobs shows that at least two principles underlie treatment of environmental problems. First, planning and design should consider both short-term and permanent damage to environment, and second, a need for better communication of contractor's planned activities and public concerns so that disruptions can be minimized. Guidelines were developed along these principles and are grouped into the following categories: general, community relations, and specific environmental control techniques.

DOT-TSC-UMTA-77-3
ANALYSIS OF SHORT RAMPS FOR DUAL-MODE AND PRT STATIONS
Transportation Systems Center and Alden Self-Transit Systems Corporation
Richard D. Wright and Robert P. Whitten
PB 272-351
UMTA-MA-06-0048-77-2
Final Report July 1977 125p.

Dual mode transportation — Safety measures
Personal rapid transit — Safety measures
Automated guideway transit — Safety measures

This report is the result of continuing efforts to understand the safe-headway trade-offs for personal rapid transit (PRT) and dual-mode systems. It adds a new dimension to the traditional interactions among control complexity, safety, and acceleration. Analyses and computer programs are developed to determine how short it is possible to make the ramps leading into and out of off-line PRT stations. Simplified reference solutions are obtained and results are presented for state-of-the-art, improved, and advanced system parameters. Potential savings in the costs of stations are very large, due to the high construction cost of station ramps.

Both point-follower and vehicle-follower control systems are considered. For point-follower control systems, the acceleration ramp can usually be eliminated. The deceleration ramp can usually be greatly shortened, particularly if the main guideway headway is sufficient for successive cars to enter a station. The speed of through cars is not affected. For vehicle-follower control systems, small deviations in the speed of through cars allows both acceleration ramps and deceleration ramps to be appreciably shortened. The greater the velocity deviation, the shorter the ramps can be, limited only by the comfort, convenience and time-loss limits on the through cars.

DOT-TSC-UMTA-77-4. I
AN ANALYSIS OF TRANSPORTATION PLANNING EFFECTIVENESS
Transportation Systems Center
Mary D. Stearns, Edward Cooper, K. H. Schaeffer
PB 272-756
UMTA-MA-09-9003-77-1
Final Report July 1977 79p.

Urban transportation planning

This document analyzes the impact of the Urban Mass Transportation Administration (UMTA) Section 9 Technical Study Grants program on urban areas' transportation planning effectiveness. It documents a novel methodology and analysis procedure for measuring a program's effect, and it is based on data from case studies of a representative group of twenty urban areas, conducted during 1976, which are reported in a companion report titled: "Transportation Planning Effectiveness: Twenty Case Studies." The twenty urban areas represent all UMTA regions, a range of population sizes, residential densities, and demographic characteristics. The case studies are reported in a uniform format which focuses on transportation planning effectiveness but also includes the urban areas' socio-economic and travel characteristics, transit and transportation planning history. Appendix A of this report summarizes the twenty case studies.

Specifically, this study reports the influence of Technical Study Grants on transportation planning effectiveness which is measured by the development of professional planning capability, acquisition of new capital equipment, introduction of new or improved services with existing facilities, and alterations in the local institutional climate. The conclusions suggest that the Technical Study Grants have been directly responsible for upgrading the quality of local transportation planning as well as for facilitating capital acquisitions and service changes.

DOT-TSC-UMTA-77-4. II
TRANSPORATION PLANNING EFFECTIVENESS
Twenty Case Studies
Transportation Systems Center
John Barber, Mary D. Stearns, Edward Cooper, and Leslie Hollingsworth
UMTA-MA-09-9003-77-2
Final Report December 1977 324p.

Urban transportation planning — Case studies

This document consists of 20 site-specific case studies of urban area experience with the Technical Study Grant Program (Section 9 of the Urban Mass Transportation ACT) of the Urban Mass Transportation Administration (UMTA). The objective of the case studies is to determine how the Technical Study Grant Program has contributed to transportation planning effectiveness by impacting local transportation policy and decision-making or guiding capital investments. The case studies employ a stand-

ardized format which focuses on transportation planning effectiveness in terms of development of professional planning capability, acquisition of capital equipment, introduction of new or improved service, and altered institutional climate. In addition, this document contains matrices which summarize and compare urban area transportation planning effectiveness, an explanation of the urban area selection procedure, and an appendix describing the data collection procedure.

Although these transportation planning effectiveness case studies are site-specific, the experiences reported and the methodology employed reveal substantive and procedural topics of general interest in the evaluation of transportation planning and of programs at any level to facilitate such planning.

DOT-TSC-UMTA-77-5
A STUDY OF THE COSTS AND BENEFITS ASSOCIATED WITH AVM
Transportation Systems Center
H. D. Reed, M. Roos, M. Wolfe, R. DiGregorio
PB-266 293
UMTA-MA-06-0041-77-1
Final Report February 1977 256p.

Automatic vehicle monitoring

Automatic Vehicle Monitoring (AVM) technology has long been perceived as a means of increasing the efficiency and productivity of transit operations as well as that of other users such as police and taxi. This study seeks to examine the economic viability of AVM for a range of users and their unique applications. The report examines other installations throughout the North American continent and Europe to extract empirical evidence needed to substantiate cost saving possibilities both for single and multiple user applications.

DOT-TSC-UMTA-77-6, I
ENGINEERING TESTS FOR ENERGY STORAGE CARS AT THE TRANSPORTATION TEST CENTER
Volume I — Program Description and Test Summary
AiResearch Manufacturing Company
William T. Curran
PB 269-400/PB 269-399/set
UMTA-MA-06-0025-77-2
DOT-TSC-838
Final Report May 1977 138p.

Subways — Propulsion systems (Energy storage)

This document describes the Energy Storage Car (ESC) tests performed by AiResearch from May 1974 through January 1975 at the Transportation Test Center, Pueblo, Colorado.

The primary purpose of the tests documented herein was to demonstrate the principles and feasibility of an energy storage type propulsion system, and its adaptability to an existing car design. The test program comprised four phases of tests on two New York City Transit Authority R-32 cars where the conventional propulsion system was replaced by an energy storage system. The four test phases were: verification of safe arrival, debugging procedures, performance verification tests, and expanded test program. This report contains test data collected during the performance verification and expanded test program phases. Data recorded during these tests is stored on magnetic analog tape and adds to UMTA's growing data bank for urban rail vehicles.

DOT-TSC-UMTA-77-6, II
ENGINEERING TESTS FOR ENERGY STORAGE CARS AT THE TRANSPORTATION TEST CENTER
Volume II — Performance Power Consumption and Radio Frequency Interference Tests
AiResearch Manufacturing Company
William T. Curran
PB 269-401/PB 269-399/set
UMTA-MA-06-0025-77-3
DOT-TSC-838
Final Report May 1977 112p.

Subways — Propulsion systems (Energy storage)
Subways — Fuel consumption
Radio — Inteference

This document describes the Energy Storage Car (ESC) tests performed by AiResearch from May 1974 through January 1975 at the Transportation Test Center, Pueblo, Colorado.

The primary purpose of the tests documented herein was to demonstrate the principles and feasibility of an energy storage type propulsion system, and its adaptability to an existing car design. The test program comprised four phases of tests on two New York City Transit Authority R-32 cars where the conventional propulsion system was replaced by an energy storage system. The four test phases

were: verification of safe arrival, debugging procedures, performance verification tests, and expanded test program. This report contains test data collected during the performance verification and expanded test program phases. Data recorded during these tests is stored on magnetic analog tape and adds to UMTA's growing data bank for urban rail vehicles.

DOT-TSC-UMTA-77-6.III
ENGINEERING TESTS FOR ENERGY STORAGE CARS AT THE TRANSPORTATION TEST CENTER
Volume III — Noise Tests
AiResearch Manufacturing Company
William T. Curran
PB-269 402/PB-269-399/set
UMTA-MA-06-0025-77-4
DOT-TSC-838
Final Report May 1977 91p.

Subways — Propulsion systems (Energy storage)
Subways — Noise

This document describes the Energy Storage Car (ESC) tests performed by AiResearch from May 1974 through January 1975 at the Transportation Test Center, Pueblo, Colorado.

The primary purpose of the tests documented herein was to demonstrate the principles and feasibility of an energy storage type propulsion system, and its adaptability to an existing car design. The test program comprised four phases of tests on two New York City Transit Authority R-32 cars where the conventional propulsion system was replaced by an energy storage system. The four test phases were: verification of safe arrival, debugging procedures, performance verification tests, and expanded test program. This report contains test data collected during the performance verification and expanded test program phases. Data recorded during these tests is stored on magnetic analog tape and adds to UMTA's growing data bank for urban rail vehicles.

DOT-TSC-UMTA-77-6.IV
ENGINEERING TESTS FOR ENERGY STORAGE CARS AT THE TRANSPORTATION TEST CENTER
Volume IV — Ride Roughness Tests
AiResearch Manufacturing Company
William T. Curran
PB-269-403/PB-269 399/set
UMTA-MA-06-0025-77-5
DOT-TSC-838
Final Report May 1977 168p.

Subways — Propulsion systems (Energy storage)
Vibration (Transportation engineering)

This document describes the Energy Storage Car (ESC) tests performed by AiResearch from May 1974 through January 1975 at the Transportation Test Center, Pueblo, Colorado.

The primary purpose of the tests documented herein was to demonstrate the principles and feasibility of an energy storage type propulsion system, and its adaptability to an existing car design. The test program comprised four phases of tests on two New York City Transit Authority R-32 cars where the conventional propulsion system was replaced by an energy storage system. The four test phases were: verification of safe arrival, debugging procedures, performance verification tests, and expanded test program. This report contains test data collected during the performance verification and expanded test program phases. Data recorded during these tests is stored on magnetic analog tape and adds to UMTA's growing data bank for urban rail vehicles.

DOT-TSC-UMTA-77-7
INTEGRATED DIAL-A-RIDE AND FIXED ROUTE TRANSIT IN ANN ARBOR, MICHIGAN
Cambridge Systematics, Inc. and Multisystems, Inc.
L.A. Neumann, J.A. Wojno, R.D. Juster
PB-267 941
UMTA-MA-06-1083-77-1
DOT-TSC-1083
Final Report March 1977 210p.

Demand responsive transportation — Ann Arbor
Local transit — Michigan — Ann Arbor

Since the conclusion of a dial-a-ride pilot project in the fall of 1972, the Ann Arbor Transportation Authority (AATA) has developed and incrementally implemented an integrated dial-a-ride and conventional fixed-route bus transit system (Teltran) which utilizes a computer assisted reservation system and provides the city with 100 percent geographical coverage during all hours of operation. The final phase of the Teltran system was implemented in the summer of 1976. The AATA's experience with integrated demand responsive and fixed-route service provides some valuable insights for other communities considering major transportation improvements. This evaluation was conducted as part of UMTA's Service and Methods Demonstration project to help disseminate information on an innovative transit system. This evaluation focuses on the intergrated service provided within Ann Arbor.

This report describes the development, implementation, and current status of the Teltran system as it existed in the spring of 1976. In particular, this evaluation provides a detailed description of Teltran system configuration (and changes in that configuration by time of day and day of the week), system dispatching and operation, and the effectiveness of an incremental implementation process. In addition, the effect of Teltran on improving transit level of service and ridership is examined as well as the productivities achieved. This reports states that Teltran has achieved the city-wide coverage objective. The other local objective, reducing auto ownership to one car per family, lacks data to determine the success in achieving this objective.

DOT-TSC-UMTA-77-9
STUDY OF SUBWAY STATION DESIGN AND CONSTRUCTION
DeLeuw, Cather & Company and Skidmore, Ownings & Merrill
Robert S. O'Neil, John S. Worrell, Peter Hopkinson, Robert H. Henderson
PB-268 894
UMTA-MA-06-0025-77-6
DOT-TSC-1027
Final Report March 1977 214p.

Subways — Stations — Design and construction

Due to the high cost of urban underground transit construction in recent years, construction practices used in other countries were reviewed to determine if construction methods which are commonly accepted there might be adapted to U.S. practice. Design and administrative practices were also reviewed to determine which have the most significant effect on station costs to assure that future system developers are aware of the items that offer the greatest opportunities to control costs.

Using 13 on-site interviews in Europe and North America, unusual construction methods, design considerations, and general considerations which offer opportunities for cost savings were identified. Two basic points for reducing costs were emphasized repeatedly by those interviewed: the basic recommendation for obtaining economy in station design and construction is to take advantage of every opportunity which the locale and site offer; and while final design and construction practices are the most visible sources of expenditure, it is almost universally the early policy, planning, and design decisions which have the greatest effect on the final cost of a transit project.

With the experience and opinions of the many transit authorities and construction agencies and a review of current literature as a base, a set of seven recommended subway station designs were developed. To examine costs, three series of estimates were performed comparing the station types among themselves, comparing the costs of varying major station dimensions, and comparing costs of alternative construction methods, such as slurry walls and other excavation support systems which performed multiple functions.

DOT-TSC-UMTA-77-10
EVOLUTION OF THE KNOXVILLE TRANSPORTATION BROKERAGE SYSTEM
CACI, Inc.
A. Jeffrey Skorneck
PB-270 103
UMTA-TN-06-0006-77-1
DOT-TSC-1082
Interim Report October 1976 72p.

Vanpools and vanpooling — Knoxville
Urban transportation planning — Knoxville

A demonstration project designed to explore the feasibility and transportation service impacts of the transportation brokerage concept is currently underway in Knoxville, Tennessee. The transportation broker seeks to identify and match transportation supply and demand across a wide range of users, providers, and modes. The two-year (July 1975-July 1977) demonstration project is funded by the Urban Mass Transportation Administration as part of the Service and Methods Demonstration Program.

This interim report describes the brokerage system concept and documents the activities leading to the implementation of the brokerage system in Knoxville. Included is a discussion of the various institutional and regulatory barriers to participation by private providers (a key element of supply) and how some of these were overcome. The Knoxville pre-operational experience is potentially of interest and applicability to other locales. Information for this report was gathered through an in-depth review of existing documentation, and personal interviews with representatives of the University of Tennessee, City of Knoxville, and various legal agencies.

DOT-TSC-UMTA-77-11
INCIDENCE RATES AND TRAVEL CHARACTERISTICS OF THE TRANSPORTATION HANDICAPPED IN PORTLAND, OREGON
Crain Associates
John Crain and William Courington
PB-269 859
UMTA-OR-06-0004-77-1
DOT-TSC-1081
Final Report April 1977 94p.

Physically handicapped — Portland, Oregon — Transportation
Aged — Transportation — Portland, Oregon

This report presents incidence rates, characteristics, and travel patterns of transportation handicapped and able-bodied elderly (65 and over) persons. A functional definition of handicap is used based on a person's ability to perform eight activities often required in traveling. Those identified as transportation handicapped are further classified as moderately or severely handicapped.

Tables and discussion are presented on demographics, health problems, use of mobility aids, and trip rates, purposes and modes, and origin/destination patterns. A section is devoted to functional problems in using public transportation vs. handicap classification, health problem and use of mechanical aid. Respondents are evaluated in their ability to use six different transit modes ranging from a fixed-route regular bus to a door-to-door bus with a lift. Wheelchair/walker users are analyzed separately.

Data for this report was derived from a 6,000 household survey conducted in Portland. The survey design, questionnaires and field procedures are described.

DOT-TSC-UMTA-77-12
GENERAL VEHICLE TEST INSTRUMENTATION EVALUATION
Transportation Systems Center
Lowell V. Babb
PB 269-598
UMTA-MA-06-0025-77-9
Final Report March 1977 214p.

Subways — Rolling stock — Testing

A General Vehicle Test System (GVTS) has been developed by the Transportation Systems Center to facilitate rail transit vehicle testing at the Transportation Test Center (TTC), Pueblo, Colorado. This system was designed to be responsive to requirements specified in the publication GENERAL VEHICLE TEST PLAN (GVTP) for URBAN RAIL TRANSIT CARS, report number UMTA-MA-06-0025-75-14.

This report presents the results of evaluation tests carried out on the GVTS at the TTC, Pueblo, Colorado, in May 1975. The GVTS is an integrated instrumentation system consisting of transducers, signal conditioners, signal filters, interface and control electronics, a data acquisition system, signal monitoring and output devices, and all related hardware and software. The objective of this test series is to evaluate the performance of the instrumentation system under actual rail transit operating conditions. Parameters evaluated include vehicle current, voltage, acceleration/vibration pressure, pressure, temperature, displacement, and strain. The GVTS as tested provides 37 of the 48 required Standard Outputs described in the GVTP. Additional equipment and/or development is required to provide full coverage of the required 48 outputs. The instrumentation common to all of the tests in this series is described in Appendix A; subsequent appendices describe each individual test including data samples.

DOT-TSC-UMTA-77-13
COM-BUS: A SOUTHERN CALIFORNIA SUBSCRIPTION BUS SERVICE
CACI, Inc.
Chester H. McCall, Jr.
PB 272-470
UMTA-MA-06-0049-77-4
DOT-TSC-1082
Final Report May 1977 106p.

Bus lines — California — Express routes

COM-BUS is an example of private entrepreneurship entering the transit field and providing a service which continues to meet passenger demands at better than a 90 percent load factor and at a profit. This document analyzes current COM-BUS operations, service management, and evolution. Supply, demand, and attendant productivities are discussed, and COM-BUS service characteristics and their potential transferability to other locales are set forth.

COM-BUS is a privately owned organization operating at a profit without any form of subsidy. COM-BUS serves about 2,000 commuters per day on 47 routes which provide service in Ventura, Los Angeles, and Orange counties. A majority of the routes use chartered passenger buses with 38 to 47 seats. Eight 13- to 16-passenger minibuses are used on routes where demand is insufficent to warrant larger buses. Service provides a fairly personalized morning pickup, with major portions of the runs to work destinations being express and using freeways. In the evening, passengers are picked up at work locations, and runs to their initial origins are made. COM-BUS was organized and now operates with a minimum of capital outlay, and is managed by essentially volunteer support. Travel times using COM-BUS are slightly longer than for private automobiles making the same trips. COM-BUS fares are considerably less than corresponding costs to operate a private automobile for a similar trip. The success of COM-BUS is important in view of the current heavy subsidies required for most transportation systems.

DOT-TSC-UMTA-77-14
IMPACT EVALUATION OF MORGANTOWN PRT 1975-1976 RIDERSHIP: INTERIM ANALYSIS
Transportation Systems Center
Mary D. Stearns and K. H. Schaeffer
PB 270-916
UMTA-MA-06-0026-77-1
Final Report June 1977 79p.

Automated guideway transit — Morgantown
Personal rapid transit — Morgantown
College students — Transportation — Morgantown

The Morgantown Personal Rapid Transit System (PRT) is a new type of public transportation system which was built as a research development and demonstration project by the Urban Mass Transportation Administration. This system began passenger service in October 1975, and consists of three stations, 2.1 miles of two-lane guideway, and a 45-vehicle fleet. The Pre-PRT Phase recorded travel patterns and ridership by all modes prior to the initiation of PRT passenger service. The Post-PRT Phase evaluation has been postponed until January 1977.

This Interim Analysis report describes the Morgantown PRT system ridership levels and trends during its initial period of operation, the 1975-76 academic year. This analysis measures the impact on ridership of seven operating characteristics: fleet mileage, actual operating hours, system availability, trip reliability, vehicle availability, downtime frequency, and downtime duration. Data were obtained from West Virginia University management reports on daily ridership, and system operation and analysis included statistical tests of significance and multivariate statistical procedures. The findings show that ridership by day of the week was proportionately similar throughout the 1975-1976 academic year, that a substantial amount of the interweekly ridership variance is due to the university schedule, and that weekend ridership was similar throughout the time period. This report concludes that the PRT is a significant transportation mode for routine travel and that ridership is highly responsive to quantity of service offered.

DOT-TSC-UMTA-77-15
FLYWHEEL PROPULSION SIMULATION
Alexander Kusko, Inc.
Charles M. King, Alexander Kusko
PB-272 259
UMTA-MA-06-0044-77-1
DOT-TSC-1180
Final Report May 1977 204p.

Subways — Propulsion systems (Flywheel)

This report was prepared in support of the Urban Mass Transportation Administration's program in flywheel energy storage. This report develops and describes the analytical models and digital computer simulations that can be used for the evaluation of flywheel-electric propulsion systems employed with urban transit vehicles operating over specified routes and with predetermined velocity profiles. The computer simulation is divided into two sections. The first section simulates the dynamic behavior of the vehicle enroute, computes the energy and power requirements, and the power losses of each of the propulsion system components. The second section utilizes thermal models to compute the temperature rises of each of the propulsion system components. The simulations can be used to determine the suitability of a given flywheel-electric propulsion system for an intended mission.

DOT-TSC-UMTA-77-17
CLEVELAND NEIGHBORHOOD ELDERLY TRANSPORTATION DEMONSTRATION PROJECT
Crain & Associates
John Crain
PB-269 860
UMTA-OH-06-0018-77-1
DOT-TSC-1081
Final Report April 1977 168p.

Aged — Transportation — Cleveland
Demand responsive transportation — Cleveland

This documentation describes the Cleveland Neighborhood Elderly Transportation (NET) Demonstration Project in terms of descriptions of the transportation system and how it was operated, the operational agencies involved in the project, the test area, and the operational results. There is also an analysis of the operational problems encountered, the costs incurred, and suggested means for improving the service and reducing costs. Results of surveys of users and non-users of the service are also presented in an attempt to assess the social impacts and benefits relative to costs. Finally, observations are given on how the demonstration was ended, the type of post-demonstration system that has been implemented by the responsible local government agencies and the analysis/decision making process used by these agencies in formulating their plans. A specific section is included on transferability of results to other areas.

DOT-TSC-UMTA-77-20
SERVICE AND METHODS DEMONSTRATION PROGRAM ANNUAL REPORT
Transportation Systems Center
Donald Kendall, Robert Casey, Carla Heaton, Howard Simkowitz, Howard Slavin, Robert Waksman
PB-270 673
UMTA-MA-06-0049-77-2
Final Report April 1977 562p.

Urban transportation planning
Transportation planning
Demand responsive transportation
Bus priority techniques
Aged — Transportation
Physically handicapped — Transportation

This report contains a description of the Service and Methods Demonstration Program. Recently completed and current and future demonstration projects are described and project results from similar demonstrations are compared. The comparisons are made by grouping projects according to the program objectives addressed: (1) decrease transit travel time, (2) increase transit reliability, (3) increase transit coverage, (4) increase transit vehicle productivity, and (4) improve the mobility of transit dependents.

Independent activities carried out in support of the demonstrations are described, such as the development of evaluation guidelines and improved methodologies for demonstration evaluation, analytical studies in support of the development of experimental demonstrations, studies of independent local innovations, case studies of transit operations in small communities. Information dissemination mechanisms and activities intended to facilitate more widespread knowledge of effective approaches to improving transit are discussed.

DOT-TSC-UMTA-77-21
THE CALL-A-BUS DEMONSTRATION PROJECT - SPECIALIZED TRANSPORTATION FOR THE ELDERLY AND HANDICAPPED IN SYRACUSE, NEW YORK
SYSTAN, Inc. and Central New York Regional Transportation Authority
R. Lave, M. Holoszyc, J. Clare, J. Przepiora
UMTA-NY-06-0041-77-1
DOT-TSC-1084
Final Report June 1977 158p.

Aged — Transportation — Syracuse
Physically handicapped — Syracuse — Transportation
Demand responsive transportation — Syracuse

This report describes, analyzes and evaluates the conduct and results of the Syracuse Call-A-Bus demonstration, in which special transit services were provided for the elderly and handicapped populations of Onondaga County, New York. These services included an advance-reservation door-to-door service for individual users and a group trip service for organizations. Subscription services were also provided. The demonstration was operated by CNY Centro, Inc., a transit operating subsidiary of the Central New York Regional Transportation Authority, during the period from October 1, 1973 to October 31, 1975. CNY Centro has continued to operate Call-A-Bus services under its own budget following the demonstration's termination.

DOT-TSC-UMTA-77-23
INSURANCE FOR URBAN TRANSPORTATION CONSTRUCTION
Cresheim Company, Inc.
James E. Barrett
PB 272-108
UMTA-MA-06-0025-77-13
DOT-TSC-1159
Final Report June 1977 116p.

Insurance
Subways – Design and construction – Costs

This report investigates insurance programs for urban transportation construction, including subways, and establishes guidelines by which an authority owner can choose the insurance program which best serves the needs dictated by the conditions and factors of the specific job. An optimal insurance program combines lowest costs, highest standards, and most effective administration. There are many possible tradeoffs; thus, the decision is complex.

An analysis of insurance programs is presented; e.g., Coordinated and conventional, witholding policies, deductibles, liability, Completed Operations Coverage and other possible coverage combinations. Various forms of insurance are discussed, as are programs for general construction safety. Innovative variations of Coordinated Insurance Programs are explored. The results are decision-making guidelines for owners for managing risk in urban transportation construction.

DOT-TSC-UMTA-77-24
MARTA TUNNEL CONSTRUCTION IN DECATUR GEORGIA – A Case Study of Impacts
Abt Associates Inc.
Peter C. Wolff and Peter H. Schoinick
PB 271-366
UMTA-MA-06-0025-77-14
DOT-TSC-1018
Final Report July 1977 137p.

Tunneling – Environmental aspects – Decatur, Georgia

The focus of this report, Phase II, is on the assessment-forecasting relationship, namely, how to assess impacts and then to illustrate how those actual impacts could have been forecast. This report presents a case study conducted in Decatur, Georgia, in order to assess the disruptive effects associated with the construction of rapid transit tunnels for the Metropolitan Atlanta Rapid Transit Authority (MARTA) East Line. This case study has three objectives: 1) to pilot test the assessment methodology developed in Phase I (No. UMTA-MA-06-0025-76-5); 2) to refine the methodology as a forecasting tool; and 3) to develop mitigation procedures.

A socio-economic profile of Decatur is presented. Impacts of the construction are considered, both in general and specific terms. The major findings identified three causal agents as being more important than the others; the barrier effect, noise, and mud. Also identified are three groups of people that are more severely affected than the others: the retail merchants in downtown Decatur; middle class residents; and the "special population" (Poor, Black, and Elderly) in a public housing project.

This report addresses "Retrospective forecasting of impacts" in order to establish how the assessed impacts could have been predicted at the planning stage. The findings point out that many impacts could have been predicted through the use of a "predictive logic," and that, therefore, mitigation measures could have been taken.

DOT-TSC-UMTA-77-26
EVALUATION OF SERVICE AND METHODS DEMONSTRATION PROJECTS: PHILOSOPHY AND APPROACH Interim Report
Transportation Systems Center
Mark Abkowitz, Carla Heaton, and Howard Slavin
PB 271-005
UMTA-MA-06-0049-77-5
Interim Report May 1977 23p.

Urban transportation planning
Transportation planning

The Urban Mass Transportation Administration's Service and Methods Demonstration (SMD) Program has the objective of improving existing transit operations by sponsoring the development and implementation of new techniques and services on a nation-wide basis. The SMD Program pursues demonstration projects and studies in four major program areas: Traffic management, Paratransit, Service for Transit Dependents, and Price and Service Improvements.

This document contains a summary description of the philosophy and technical approach underlying the evaluation of SMD projects. It describes the supply-demand framework for performing urban transportation impact evaluation and the application of this framework to the following demonstration topics: background and setting; project implementation and operations; level of service (supply) changes; travel behavior (demand) changes; operator impacts and productivity; and non-travel impacts.

The SMD Program attempts to maximize the quality and utility of information gained from the demonstrations by developing and employing a consistent, carefully structured approach to demonstration evaluation. Each evaluation is built around the basic analytical framework described in this report, with emphasis placed on using state-of-the-art data collection and analysis techniques which are consistent from the standpoint of efficiency, accuracy, and output.

DOT-TSC-UMTA-77-27
PROCEEDINGS OF WORKSHOP ON METHODOLOGY FOR EVALUATING THE EFFECTIVENESS OF TRANSIT CRIME REDUCTION MEASURES IN AUTOMATED GUIDEWAY TRANSIT SYSTEMS
Transportation Systems Center
Walter Hawkins and E. Donald Sussman (Editors)
PB 273-695
UMTA-MA-06-0048-77-1
Final Report July 1977 120p.

Automated guideway transit — Security measures — Congresses

The Transportation Systems Center conducted a workshop, sponsored by the Urban Mass Transportation Administration, to discuss methodologies for evaluating the effectiveness of transit crime and vandalism reduction measures which can be used on Automated Guideway Transit systems. Senior transit security staff, transit security researchers, and transit planners contributed papers and participated in this workshop. This workshop focused on current methods of assessing the effectiveness of crime and vandalism reduction methods that are used in conventional urban mass transit systems, and on how they might be applied to new Automated Guideway Transit systems. Conventional as well as novel methods of assessment were presented and discussed. Among the major issues discussed were the use of the critical incident technique to assess the community's needs with regard to transit security: the establishment of a board similar to the National Transportation Safety Board, which will focus on security issues; and the role of security specialists and management in transit planning.

DOT-TSC-UMTA-77-28
EXPERIMENTS ON FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES A Summary of Results
Transportation Systems Center
Bernard E. Blood and Bernard W. A. Kliem
PB 270-951
UMTA-MA-06-0041-77-2
Final Report June 1977 51p.

Automatic vehicle monitoring
Loran

In 1975, to further the development and to refine and demonstrate multiuser Automatic Vehicle Monitoring (AVM) application, the Urban Mass Transportation Administration and the Transportation Systems Center (TSC) initiated a two-phase program. Phase I of this AVM program was completed in March 1977. The Phase I objective was to formally test four different vehicle-location concepts against a technical performance specification prepared by TSC. Phase II of the AVM program will involve the selection of one of the tested location methods, the detailed design of an overall AVM system, and its deployment in a major urban area for test and evaluation in bus-transit and police operations.

During the winter of 1976-1977, four different technical methods for automatically locating surface vehicles were tested in both high and low-rise regions in Philadelphia, Pennsylvania. The tests were designed to evaluate the methods for their applicability as location subsystems of AVM systems. Two "signpost" concepts, one utilizing semi-passive transponders and the other active transmitters as well as two "area-coverage" concepts, one employing Loran-C and the other a pulse trilateration method, were tested. This report (Phase I) outlines the experimental objectives, summarizes the test results and presents the major findings. The tables in this report chart out the Fairchild, the Hazeltine, the Hoffman, and the Teledyne test results.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-77-30. I
LORAN AUTOMATIC VEHICLE MONITORING SYSTEM, PHASE I
Volume I: Test Results
Teldyne Systems Company
R. Stapleton and F. Chambers
PB 274-955
UMTA-MA-06-0041-77-10
DOT-TSC-1238
Final Report August 1977 286p.

Automatic vehicle monitoring
Loran

In September 1976, the Transportation Systems Center entered into contracts with four companies for the design, development, and deployment of a multi-user Automatic Vehicle Monitoring (AVM) System which can be deployed in any city in the U.S. The system developed is based on operator need and thus will be available to all potential AVM users in the transit industry as well as law enforcement or any other candidate industry. This document contains the test results obtained by one of the contractors, Teledyne Systems Company, and covers the activities of Phase I which involved the installation and test of Teledyne's LORAN AVM system in Philadelphia, Pennsylvania, during the winter of 1976-1977. A summary report of all four systems tested is available and titled: EXPERIMENTS ON FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES (PB 270-951).

Phase I tests were divided into two primary categories (random-route and fixed-route tests) and are described herein. Performance characteristics measured include location accuracy, time of passage accuracy, and coverage. Currently the coverage area is more than 16 million square miles and additional coverage can be provided anytime through the addition of portable LORAN transmitter stations. The LORAN AVM system has demonstrated its ability to meet fixed-route accuracy requirements. A method for meeting the time of passage and random-route accuracy is presented herein. Phase I consists of two volumes: *Volume I: Test Results* and *Volume II: Appendices.* In Phase II the system will be put into operational status at the Southern California Rapid Transit District in Los Angleles.

DOT-TSC-UMTA-77-30. II
LORAN AUTOMATIC VEHICLE MONITORING SYSTEM, PHASE I
Volume II: Appendices
Teldyne Systems Company
R. Stapleton and F. Chambers
PB 274-956
UMTA-MA-06-0041-77-11
DOT-TSC-1238
Final Report August 1977 160p.

Automatic vehicle monitoring
Loran

In September 1976, the Transportation Systems Center entered into contracts with four companies for the design, development, and deployment of a multi-user Automatic Vehicle Monitoring (AVM) System which can be deployed in any city in the U.S. The system developed is based on operator need and thus will be available to all potential AVM users in the transit industry as well as law enforcement or any other candidate industry. This document contains the test results obtained by one of the contractors, Teledyne Systems Company, and covers the activities of Phase I which involved the installation and test of Teledyne's LORAN AVM system in Philadelphia, Pennsylvania, during the winter of 1976-1977. A summary report of all four systems tested is available and titled: EXPERIMENTS ON FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES (PB 270-951).

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URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-77-31. I
A COMPREHENSIVE FIELD TEST AND EVALUATION OF AN ELECTRONIC SIGNPOST AVM SYSTEM
Volume I: Test Results
Hoffman Information Idenfification, Inc.
George W. Gruver
PB 272-907
UMTA-MA-06-0041-77-8
DOT-TSC-1237
Final Report August 1977 331p.

Automatic vehicle monitoring

In September 1976, the Transportation Systems Center entered into contracts with four companies for the design, development, and deployment of a multi-user Automatic Vehicle Monitoring (AVM) System which can be deployed in any city in the U.S. This report contains the interim results obtained by one of the contractors, Hoffman Identification, Inc. (HI3), and covers the activities of Phase I which involved the installation and test of a HI3 AVM System in Philadelphia, Pennsylvania, during the winter of 1976-1977. A summary report on all systems tested is EXPERIMENTS ON FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES (PB 270-951).

Phase I tests were divided into two primary categories: 1) random-route tests (police, paratransit, taxi, etc.), and 2) fixed-route (transit). In the random-route tests, the system showed the capability of locating the vehicle to within 282 feet, at 95 percent of the sample points under a wide range of urban and environmental conditions. In the fixed-route tests, an odometer and 15 signposts provided the vehicle's location to within 105 feet at 95 percent of the sample points along a 13-mile route. The time of passage of designated bus schedule "timepoint" was automatically determined to within 11 seconds 95 percent of the time. Phase I consists of two volumes: *Volume I: Test Results* contains a description of all test configurations, test procedures, location algorithms, data processing, and test results; *Volume II: Appendix* contains the test log sheets, test data, and data processing results corresponding to all Phase I tests.

DOT-TSC-UMTA-77-31. II
A COMPREHENSIVE FIELD TEST AND EVALUATION OF AN ELECTRONIC SIGNPOST AVM SYSTEM
Volume II: Appendix
Hoffman Information Identification Inc.
George W. Gruver
PB 273-436
UMTA-MA-06-0041-77-9
DOT-TSC-1237
Final Report August 1977 336p.

Automatic vehicle monitoring

In September 1976, the Transportation Systems Center entered into contracts with four companies for the design, development, and deployment of a multi-user Automatic Vehicle Monitoring (AVM) System which can be deployed in any city in the U.S. This report contains the interim results obtained by one of the contractors, Hoffman Identification, Inc. (HI3), and covers the activities of Phase I which involved the installation and test of HI3 AVM System in Philadelphia, Pennsylvania, during the winter of 1976-1977. A summary report on all systems tested is EXPERIMENTS ON FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES (PB 270-951).

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DOT-TSC-UMTA-77-33
PRE-DEMONSTRATION ACTIVITIES OF THE WESTPORT INTEGRATED TRANSIT SYSTEM
CACI, Inc.
Robert E. Furniss
PB 271-998
UMTA-MA-06-0049-77-7
DOT-TSC-1082
Interim Report July 1977 81p.

Demand responsive transportation — Westport
Taxicabs — Westport

In August 1976 the Urban Mass Transportation Administration awarded a demonstration grant to the Westport Transit District (WTD) to examine the feasibility of combining shared-ride taxi service and other paratransit services with conventional bus services in Westport, Connecticut. This report describes the Westport Service and Methods Demonstration Project involving integrated transit operations and paratransit services, and documents and assesses the implementation process associated with this demonstration.

This report focuses on documenting and assessing the brokerage role performed by the WTD in implementing shared-ride services. The contents include a discussion of the institutional and operational elements involved in contracting with local taxi operators to provide shared-ride service. In addition, arrangements for system maintenance, marketing, and public information dissemination are described. Implications from the Westport pre-demonstration experience are potentially of interest and applicability to other locales.

DOT-TSC-UMTA-77-35
REPORT ON PHASE I TESTS OF FAIRCHILD AUTOMATIC VEHICLE MONITORING (AVM) SYSTEM
Fairchild Space & Electronics Company
A. J. Pokorny, H. Briefel
PB 273-816
UMTA-MA-06-0041-77-3
DOT-TSC-1235
Final Report August 1977 192p.

Automatic vehicle monitoring

The general objective of the program is to design, implement, and operate an area-wide multi-user Automatic Vehicle Monitoring System (AVM) in Los Angeles for the purpose of making a quantitative evaluation of AVM effectiveness, first, for transit and paratransit and, second, for other AVM users.

Phase I of the Program, covered by this report, was to ascertain that Fairchild's chosen technique for vehicle location satisfied the requirements as delineated in the System Performance Specifications.

A demonstration consisting of a series of operational tests was conducted in Philadelphia, Pa. A second series of engineering tests was conducted at Fairchild's facility in Germantown, Md.

The tests show the Fairchild AVM system can be operated with a high degree of accuracy and confidence.

DOT-TSC-UMTA-77-38
THE NORFOLK VANPOOL AND CONTRACT HAULER DEMONSTRATION PROJECT
Transportation Systems Center
James L. Poage
UMTA-MA-06-0049-77-6
Final Report August 1977 68p.

Vanpools and vanpooling — Norfolk, Virginia

This report presents an evaluation plan to measure the impacts of a vanpool demonstration project in Norfolk, Virginia. Under the project, the Tidewater Transportation District Commission will purchase vans with a project grant and lease them to individual drivers for use in vanpools for commuting to work at the Navy bases in the Tidewater area. The demonstration project is funded by the Urban Mass Transportation Administration as part of the Service and Methods Demonstration Program.

This evaluation plan describes the demonstration setting, the project operation, project issues, measures for evaluation and sources of data for assessing the measures.

DOT-TSC-UMTA-77-39
SHARED-RIDE TAXI COMPUTER CONTROL SYSTEM REQUIREMENTS STUDY
DAVE Systems.
TRANSMAX Division.
G. J. Fielding, et al.
PB 275-335
UMTA-MA-06-0054-77-1
DOT-TSC-1272
Interim Report August 1977 53p.

Taxicabs
Demand responsive transportation

The technical problem of scheduling and routing shared-ride taxi service is so great that only computers can handle it efficiently. This study is concerned with defining the requirements of such a computer system. The major objective of this study is to develop the system requirements and perform a functional design of the computer control system (CCS) for an automated shared-ride taxi (SRT) system. A SRT operation using a CCS offers a potential for increased taxi dispatching efficiency, improved driver productivity and profitability, improved quality of service, integration of taxis into areawide transit, and improved mobility for the transportation disadvantaged.

This interim report describes progress on the study and indicates major findings to date. It is an executive-level summary, and it does not attempt to include all information or justify all statements. Rather, it is an overview of accomplishments leading to a concluding section which outlines preliminary system design requirements. These requirements are subject to change since the work in many areas is not yet complete.

The Appendices consist of a Bibliography and a Report of Inventions.

DOT-TSC-UMTA-77-41
SAN DIEGO WHEELCHAIR ACCESSIBLE BUS STUDY
Transportation Systems Center
Robert F. Casey
UMTA-MA-06-0049-77-8
Interim Report September 1977 53p.

Physically handicapped — San Diego — Transportation
Buses — Design and construction

This study describes the implementation and early operation of a pilot project of fixed route, wheelchair accessible bus service on two routes of the San Diego Transit system. Five buses of the Transit Authority fleet were retrofitted with wheelchair lifts by the lift manufacturer. Four lift equipped buses are used in the service with one bus held as a spare.

Relatively few lift problems have been encountered. Nevertheless, lift design improvements have been and are continually being made to improve its performance and usability. Ridership by wheelchair confined persons has been low and a number of possible reasons for this are enumerated.

Wheelchair accessible bus service will incur added operational costs but insufficient experience has been generated to permit estimation of the annual amount.

DOT-TSC-UMTA-77-42
SUBSIDIZED TAXI PROGRAMS FOR ELDERLY AND HANDICAPPED PERSONS IN THE SAN FRANCISCO BAY AREA
Crain & Associates
Pamela Bloomfield & Sydwell Flynn
UMTA-MA-06-0049-77-9
DOT-TSC-1081
Final Report September 1977 84p.

Aged — Transportation — San Francisco
Physically handicapped — San Francisco — Transportation
Taxicabs — San Francisco — Fares (Reduced)

This report examines six examples of subsidized taxi systems serving elderly and handicapped persons in the San Francisco Bay Area; the program locations are San Leandro, Santa Clara County, Sunnyvale, Palo Alto, Lafayette and Fremont. All programs studied are designed to deliver subsidized taxi service at a reasonable cost to target groups residing within the program areas; in most cases, clients purchase coupons or scrip at discounted prices to pay for taxi service. The taxi companies then bill the programs on a bi-weekly or monthly basis. All six programs are experiencing rising client enrollments and ridership volumes. Details are provided regarding program costs, service levels, administrative procedures and perceptions of all parties involved.

DOT-TSC-UMTA-77-44
EFFECTS OF DECELERATION AND RATE OF DECELERATION ON LIVE SEATED HUMAN SUBJECTS
Transportation Systems Center
C. N. Abernethy, G. R. Plank, and E. D. Sussman
UMTA-MA-06-0048-77-3
Final Report October 1977 26p.

Automated guideway transit

This report describes the testing of live, seated human subjects to determine the maximum deceleration and associated rate of change of deceleration (jerk) at which the majority of potential users of automated guideway transportation (AGT) systems can remain securely in their seats. In this study, subjects underwent various levels of deceleration and associated jerk in an instrumented vehicle. Subjects were decelerated while seated normally (forward-facing), sideward (turned 90 degrees counterclockwise from the direction of travel), and normally, but tilted backward (facing forward but with the entire seat tilted 5 degrees backward). Subjects also underwent various levels of jerk while seated normally only. Two groups of subjects were chosen to represent anthropometric extremes of potential passengers: males larger than 90 percent of the male population, and females smaller than all but 10 percent of the female population. Based on these tests, an estimate of the maximum permissible emergency deceleration for forward-facing, seated AGT passengers is 0.47 g, and for side-facing passengers, 0.41 g. The tests also indicated that tilting the entire seat assembly backward 5 degrees increased the estimated maximum permissible deceleration to 0.52 g.

DOT-TSC-UMTA-77-48
THE SANTA MONICA FREEWAY DIAMOND LANES: A Summary Report
SYSTAN, Inc.
J. W. Billheimer; R. J. Bullemer; C. Fratessa
UMTA-MA-06-0049-77-12
DOT-TSC-1084
Final Report September 1977 111p.

Bus priority techniques — Santa Monica
Carpools and carpooling — Santa Monica
Bus lines — Santa Monica — Express routes

The Santa Monica Freeway Diamond Lanes, a pair of concurrent-flow preferential lanes for buses and carpools linking the City of Santa Monica, California, with the Los Angeles CBD, opened on March 16, 1976 and operated amid much controversy for 21 weeks until the U.S. District Court halted the project. The Diamond Lane project marked the first time preferential lanes had been created by taking busy freeway lanes out of existing service and dedicating them to the exclusive use of high-occupancy vehicles.

This report summarizes the findings of the official, objective independent evaluation of the project sponsored by the U.S. Department of Transportation as part of the UMTA Service & Methods Demonstration Program. The report addresses a broad range of project impacts in the following major areas: Traffic speeds and travel times; traffic volumes and carpool information; bus operations and ridership; safety and enforcement; energy and air quality; and public attitudes and response. Analysis shows that the project succeeded in increasing carpool ridership by 65% and the increased bus service accompanying the Diamond Lanes caused bus ridership to more than triple. Nonetheless, energy savings and air quality improvements were insignificant, freeway accidents increased significantly, non-carpools lost far more time than carpoolers gained, and a heated public outcry developed which has delayed the implementation of other preferential treatment projects in S. California.

DOT-TSC-UMTA-77-55
ASSESSMENT OF OPERATIONAL AUTOMATED GUIDEWAY SYSTEMS — JETRAIL
Transportation Systems Center
G. Anagnostopoulos, R. Wlodyka, I. Mitropoulis
J. Putukian, R. Kangas
UMTA-MA-06-0067-77-1
Final Report December 1977 280p.

Automated guideway transit

This is an assessment and evaluation of Jetrail, the first operational completely automated, demand-responsive, group rapid, intra-airport transportation system. It was installed by Braniff International Airlines at Love Field in Dallas, Texas, for their passengers and guests.

It connects a parking lot at the entrance to Love Field and the Braniff terminal with three-quarters of a mile of double-lane monorail and has ten suspended vehicles, a maintenance facility, and three stations.

The system was intended to retain passengers in the face of increased congestion at Love Field. It operated successfully from April 1970 to January 1974, at which time Braniff moved to the new Dallas-Ft. Worth Regional Airport.

Over six million passengers were carried 1.3 million miles over a four-year period without a fatality or major mishap. The system did this in spite of the engineering novelty and early, low reliability of the propulsion and control systems.

The Jetrail system continues to be used as an engineering test-bed for a prototype linear induction motor propulsion system. This latter system, called Astroglide, is being developed by PRT Systems Inc. Since the motor has no moving parts, it is markedly simpler than the rotary motor and drive train of the Jetrail system.

This report provides information on the Jetrail operational experience and the Astroglide prototype for transportation planners, designers, developers, and operators of automated transit systems for intra-airport, urban, recreational, and freight applications.

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