DOT-TSC-OST-82-2

U.S. Department
of Transportation

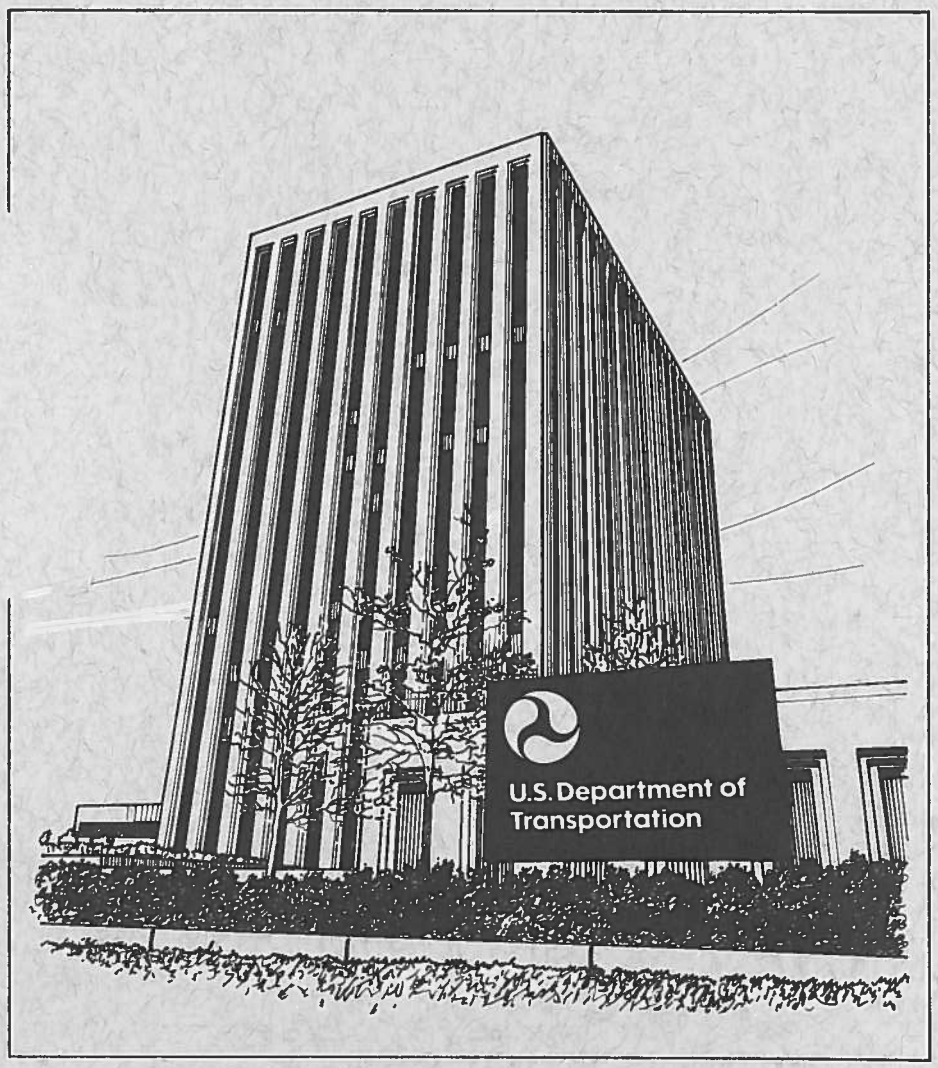
**Research and
Special Programs
Administration**

Transportation Systems Center Bibliography of Technical Reports

January '79-December '80

Transportation Systems Center
Kendall Square
Cambridge, Massachussetts 02142

January 1982



Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-82-2		

4. Title and Subtitle	5. Report Date
TRANSPORTATION SYSTEMS CENTER BIBLIOGRAPHY OF TECHNICAL REPORTS January '79 - December '80	January 1982
	6. Performing Organization Code: 831
7. Author(s): Elizabeth Gans*	8. Performing Organization Report No.: DOT-TSC-OST-82-2
9. Performing Organization Name and Address: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142	10. Work Unit No. (TRAIS): G8312/Y83-10
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Office of the Secretary, Washington DC 20590	13. Type of Report and Period Covered: Bibliography, December 1977 - December 1981
	14. Sponsoring Agency Code

15. Supplementary Notes

*Raytheon Service Company

16. Abstract

This bibliography lists unlimited distribution reports released by the Transportation Systems Center from January 1979 through December 1980. It supplements previous bibliographies covering the period from July 1970 through December 1978. Reports are listed by sponsoring agency, and are indexed by subject, personal author, title, contract number, and report number.

17. Key Words	18. Distribution Statement
Transportation Bibliography	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	94	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

PREFACE

This bibliography lists unlimited distribution reports released by the Transportation Systems Center from January 1979 through December 1980. It updates Transportation Systems Center Bibliography of Technical Reports, July 1970—December 1976 (DOT-TSC-OST-77-17), January—December 1977 (DOT-TSC-OST-78-14) and January—December 1978 (DOT-TSC-RSPA-79-5).

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

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 number).

Type of report.

Date of report.

Number of pages.

Subject terms (based on Library of Congress subject headings).

Abstract (written by author of report).

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-930 , 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.

CONTENTS

UNITED STATES COAST GUARD

DOT-TSC-USCG-79-4
SAN FRANCISCO VESSEL TRAFFIC SERVICE WATCHSTANDER ANALYSIS
Transportation Systems Center
J. W. Royal, D. B. Devoe, C. N. Abernethy, K. S. Kearns, and R. A. Rudich
CG-D-60-79
Interim Report November 1979 82p.

Human Engineering

A team of human factors specialists analyzed the performance of watchstanders in the U.S. Coast Guard's San Francisco Vessel Traffic Center at Yerba Buena Island, San Francisco, California. Data collected included copies of the center's forms and logs, records and tapes of watchstander activities for a total of 10 hours of observation, records of 9 in-depth interviews with operations personnel, stress questionnaires and critical incident interviews from 12 watchstanders, and photographs of equipment and workspace layout. Analysis of the data yielded a breakdown of watchstander time utilization, a summary communications loading, and data for a tentative model of watchstander activity as a function of traffic and communications loads. Seven suggestions for improving operations were offered.

DOT-TSC-USCG 79-5
VESSEL TRAFFIC SERVICE WATCHSTANDER PERFORMANCE IN ROUTINE OPERATIONS
Transportation Systems Center
D. B. Devoe, C. N. Abernethy, J. W. Royal, K. J. Kearns, and R. A. Rudich
CG-D-44-79
Final Report October 1979 84p.

Human Engineering

Human factors specialists observed and measured the performance of watchstanders at four Vessel Traffic Service (VTS) centers: Houston-Galveston, Puget Sound, New Orleans, and San Francisco. Analysis of the data yielded results amenable to mathematical modeling for generalized evaluation and prediction of VTS watchstander performance. The report discusses implications of the data for the design and use of equipment (including computers), communications facilities, operational procedures, and personnel selection and training methods. Fourteen recommendations are offered for consideration in the operation of current VTS's and the planning of future systems.

FEDERAL AVIATION ADMINISTRATION

DOT-TSC-FAA-79-8
REVIEW AND EVALUATION OF NATIONAL AIRSPACE SYSTEM MODELS
Transportation Systems Center
A. R. Odoni, R. W. Simpson
FAA-EM-79-12
DOT-TSC-1491
Final Report October 1979 358p.

Air traffic control
Air traffic control—Bibliography

This report is intended to serve as a guide to the availability and capability of state-of-the-art analytical and simulation models of the National Airspace System (NAS). An extensive literature search produced a listing of 230 reports potentially containing technical descriptions of models developed during the last decade. These reports are classified into primary categories based on applicability of the model to various aspects of the NAS. Capacity/delay models are classified as capacity-oriented runway, delay-oriented runway, complete airport, terminal airspace, air route traffic (including communications), controller workload and performance, and models of major segments of the NAS. Reports describing models primarily concerned with safety-related measures and noise-related measures are categorized separately. Reports were initially screened to eliminate those known to have been superseded by a subsequent report, and those containing inadequate or inconsequential technical information concerning models. The remaining reports (approximately 180) were subjected to a detailed review. The results of this review are documented for each of the 50 distinct models described by the selected reports. Information contained in each model review includes report ID, abstract, input/output parameters, computer-related characteristics, assumptions, quality of documentation, extent of validation, and an evaluation of the model's usefulness and limitations. Another part of the report contains a comparative evaluation of models in the same primary category. These evaluations present an overview of the models contained in each category, summarize the main features of the best models, and document the conclusions and recommendations regarding the models best suited for specific applications.

DOT-TSC-FAA-79-12
TESTS OF AN ATCRBS BASED TRILATERATION SENSOR AT LOGAN INTERNATIONAL AIRPORT
Transportation Systems Center
P. E. Manning
FAA-RD-79-115
Final Report November 1979 64p.

Air traffic control
Radar air traffic control systems

Field test results of accuracy and coverage for an ATCRBS based surface trilateration sensor at Logan International Airport are described. This sensor was previously tested at NAFEC for feasibility and because of a lack of sufficient aircraft traffic and multipath, further tests were recommended at an operational airport. These tests show that a beacon trilateration sensor can accurately determine the position of a transponder equipped vehicle on the surface, extract its beacon code and provide excellent coverage without interference with the operational ATCRBS.

DOT-TSC-FAA-79-18,I
CHICAGO MONOSTATIC ACOUSTIC VORTEX SENSING SYSTEM
Volume I: Data Collection and Reduction
Transportation Systems Center
D. C. Burnham
FAA-RD-79-103,I
Final Report Oct. 1979 32p.

Air traffic control
Radar air traffic control systems

A Monostatic Acoustic Vortex Sensing System (MAVSS) was installed at Chicago's O'Hare International Airport to measure the strength and decay of aircraft wake vortices from landing aircraft. The MAVSS consists of an array of acoustic antennas which measure the vertical profile up to 60 m altitude of the vertical component of the wind. The decay in wake vortex strength is measured as the vortex passes over successive antennas in the array. Volume I describes the MAVSS principles of operation, the hardware developed, and data reduction methods employed.

DOT-TSC-FAA-79-19
POTENTIAL USE OF HIGH FREQUENCY DATA TRANSMISSION FOR OCEANIC AIR TRAFFIC CONTROL IMPROVEMENT
Transportation Systems Center
Martin Nesenbergs
FAA-EM-79-9
RA 78-15
Final Report Sept. 1979 48p.

Air traffic control
Radar air traffic control systems

FEDERAL AVIATION ADMINISTRATION

This report is concerned with the transatlantic Air Traffic Control (ATC) data links in the high frequency (HF) band. The report tries to broaden the appropriate communication system concepts by fortifying them with general parametric objectives. While such a broad approach cannot escape practical constraints and reductions, especially in eventual design and implementation stages, it is nevertheless a useful tool here. It leads one to characterize the HF propagation medium more fully. This in turn enables one to conceive data communications outlines with more advanced structures and with emphasis on exploiting the latest technology, both hardware and software.

A full study should go beyond this initial effort and incorporate several system alternatives, plus their trade-offs in terms of objective gains versus system costs. This brief report concludes with a parametric summary of ATC HF channel issues, operational factors, and the importance of performance specification. Pertinent unresolved issues are also listed at the end.

DOT-TSC-FAA-79-21,I
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS
Volume I: General Design Techniques and Analyses of Single and Coupled Elements
Transportation Systems Center
Frederic R. Morgenthaler
FAA-EM-79-11,I
DOT-TS-15364-1
Final Report Sept. 1979 60p.

Radio beacons
Radio direction finders

Volume I of Theoretical Studies of Microstrip Antennas deals with general design techniques and analyses of single and coupled radiating elements.

Specifically we review and then employ an important equivalence theorem that allows a pair of vector potentials, $\overline{A}$ and $\overline{A}^*$ to be calculated from fields tangential to any surface enclosing all currents and charges.

These potentials serve to calculate the far fields, from which radiation conductance and pattern can be obtained.

For rectangular microstrip patch antennas, we develop novel approximations so as to include the effects of currents induced on the ground planes by fringing fields.

Coupling between two patches sharing the same substrate and ground plane, or else employing separate ones stacked one above the other, is also considered by means of a novel approximation that helps provide physical insight with respect to field patterns, coupling between patches and the like.

As an important by-product of this work, several new approximate formulas are obtained that very accurately predict the electrical characteristics of microstrip transmission lines of arbitrary width and substrate thickness when the dielectric constant of the substrate is also arbitrary.

DOT-TSC-FAA-21, II
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS
Volume II: Analysis and Synthesis of Multi-Frequency Elements
Transportation Systems Center
Frederic R. Morgenthaler
FAA-EM-79-11, II
DOT-TS-15364-2
Final Report September 1979 50p.

Radio beacons
Radio direction finders

Volume II of Theoretical Studies of Microstrip Antennas deals with the analysis and synthesis of several types of novel multiresonant elements with emphasis on dual-frequency operation of rectangular microstrip patch antennas with or without external matching networks.

Specifically, we analyze dual resonances created within a single rectangular patch by means of appropriate dielectric loading and also those associated with a patch capacitively-coupled to either a lumped or distributed matching network. In all cases radiation is obtained from slots in the rectangular patch in combination with open-circuited edges.

Rather than separately design the dual-resonating elements and matching networks and hope for efficient radiation and proper patterns at both frequencies, we favor and herein pursue an integrated synthesis which demands simultaneous fulfillment of the design goals.

A synthesis approach, based upon coupled resonator theory, is also developed and applied to situations in which one resonant element is a rectangular microstrip patch and the second element either a second patch or else a lumped or distributed matching network. Based upon these considerations, several new antenna configurations are proposed that utilize either in line or stacked element geometrics.

FEDERAL AVIATION ADMINISTRATION

DOT-TSC-FAA-79-22
AN INVESTIGATION OF LASER LIGHTING SYSTEMS TO ASSIST AIRCRAFT LANDING
Transportation Systems Center
D. C. Burnham, J. F. Fantasia
FAA-RD-79-97
Final Report Oct. 1979 64p.

Airports — Lighting
Lasers in aeronautics

A model for the visual detectability of narrow light beams was developed and used to evaluate the system performance of two laser lighting system configurations: (1) a laser VASI and (2) a crossed beam glide path indicator. Laboratory experiments confirmed the validity of the model. Using a criterion taken from the Federal Standard for laser safety, the potential hazards of each of the system concepts were evaluated. The following results were obtained for readily available laser power levels: Neither system will work during bright daylight. The laser VASI can be seen at night at the middle marker for visual ranges greater than 5000 ft. The crossed beam system can be seen at night at the middle marker for visual ranges greater than 700 ft.

DOT-TSC-FAA-79-25
TEST PLAN FOR EXPERIMENTAL MEASUREMENTS OF RADIO NOISE AND ELECTROMAGNETIC INTERFERENCE AT LOGAN AND BURLINGTON AIRPORTS
Transportation Systems Center
Peter G. Mauro, John D. Gakis
FAA-RD-79-96
Interim Report Oct. 1979 28p.

Automatic vehicle monitoring
Loran

A test plan is designed to: a) evaluate the performance of several types of LORAN-C receivers in the vicinity of both a large metropolitan and a small rural airport, b) measure the electromagnetic interference in the LORAN-C band (100 ± 50 kHz) at various locations likely to produce radio noise, and c) determine the amplitude, frequency and modulation of all significant interfering signals in the LORAN-C band using as primary measurement equipment, a calibrated antenna system and a spectrum analyzer.

DOT-TSC-FAA-79-26
THEORETICAL FEASIBILITY OF DIGITAL COMMUNICATION OVER OCEAN AREAS BY HIGH FREQUENCY RADIO
Transportation Systems Center
George W. Haydon, Charles M. Rush, and Larry R. Teters
FAA-EM-79-10
RA 78-15
Final Report Nov. 1979 88p.

Radio — Interference
Radio in navigation

The theoretical reliability of digital data transmission via high-frequency radio is examined for typical air traffic routes in the Atlantic and Pacific areas to assist the U.S. Department of Transportation in the evaluation of a system for improving air traffic control over ocean areas. The expected performance of a reference high-frequency data transmission system of 1200 bits per second with a permissible error rate of one in a thousand binary error is expressed as a percentage of time that a given theoretical reliability will be equaled or exceeded.

The expected performance of air-to-air HF systems is also considered, and it is concluded that these systems should work for the reference communication system out to the line-of-sight range of about 800 km for high-flying aircraft.

DOT-TSC-FAA-79-27
WAKE VORTEX CONFERENCE; PROCEEDINGS
Transportation Systems Center
William D. Wood
FAA-RD-79-105
Sept. 1979 330p.

Air traffic control
Radar air traffic control systems

This document is a record of the joint FAA/NASA workshop on wake vortex alleviation and avoidance conducted at the DOT Transportation Systems Center, November 28-29, 1978. The workshop was sponsored by the Federal Aviation Administration to apprise the appropriate specialists of the state of the art and to formulate program recommendations for wake vortex alleviation at the source, for wake vortex avoidance systems, and for operations, and safety regulations.

FEDERAL HIGHWAY ADMINISTRATION

DOT-TSC-FHWA-79-1
EFFECTIVENESS OF SPEED CONTROL SIGNS IN RURAL SCHOOL ZONES AND SMALL COMMUNITIES
Transportation Systems Center
Joseph S. Koziol, Jr., Ann R. Fulchino, Peter H. Mengert, and Gerald Stewart
PB-301 110
FHWA/RD-79/20
Final Report July 1979 155p.

Transportation, Rural
Traffic signs and signals

Results are described of experiments conducted in Mississippi, California, and Oregon testing the effectiveness of speed control signs in rural school zones and small communities on high-speed, two-lane highways. Signs tested included existing signing, a reduced speed ahead sign, speed limit, and reduced speed ahead signs coupled with hazard identification beacons, and a speed violation sign activated when a driver exceeded the speed limit in effect. Also, roadside interviews were conducted at the sites and a questionnaire booklet was administered to groups to assist in determining the ability of each of the signs to increase safety and improve driver awareness of potential hazards. The questionnaire booklet provided information on public reaction and understanding of the signs. Results indicated that the combination of signs and hazard identification beacons and the speed violation sign provided the most substantial improvement in reducing speeds and increasing awareness of roadside conditions for both small communities and school zones.

DOT-TSC-FRA-78-7
A METHODOLOGY FOR EVALUATING THE MAINTENANCE OF HIGH SPEED PASSENGER TRAIN TRUCKS
Shaker Research Corp.
Allen I. Krauter and Richard L. Smith
PB80-177553
FRA/ORD-78/73
DOT-TSC-1308
Final Report Dec. 1978 231p.

Locomotives — Maintenance and repair
Railroads — Maintenance and repair

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

DOT-TSC-FRA-79-1
RAIL-HIGHWAY CROSSING HAZARD PREDICTION RESEARCH RESULTS
Transportation Systems Center
Peter Mengert
PB80-170749
FRA-RRS-80-02
Final Report Dec. 1979 254p.

Railroads—Accidents
Railroads — Crossings — Safety measures

This document presents techniques for constructing and evaluating railroad grade crossing hazard indexes. Hazard indexes are objective formulas for comparing or ranking crossings according to relative hazard or for calculating absolute hazard (conditional expected frequency of grade crossing accidents) on an individual crossing basis. Relative and absolute hazard indexes are constructed and compared in performance with some hazard indexes in general use. The DOT-ARR crossing inventory for all public crossings in the United States and the FRA accident data base for1975 are used. Various measures and displays of performance of hazard indexes in predicting the hazard of crossings as functions of their inventory characteristics and as manifest in the U.S. accident experience of 1975 are given. The levels of performance that may be expected of various hazard indexes in various situations are given. Relative and absolute hazard indexes constructed on this project are exhibited which outperform other hazard indexes tested. Means for shaping a relative hazard index into an absolute hazard index are given. An introductory discussion is provided on the use of accident history in hazard indexes. Preliminary estimates are given some of the parameters involved in that discussion. Theoretical aspects of this report include some discussions of nonlinear regression and nonlinear discriminant analysis as well as some aspects of empirical Bayesian statistics.

DOT-TSC-FRA-79-5
PREVENTION OF ROLLER BEARING-INITIATED BURNOFFS IN RAILROAD FREIGHT CAR JOURNALS
SKF Industries, Inc., King of Prussia, PA.
Technology Services Div.
G. E. Allen, J. R. Lucas, and F. H. Tomlinson
PB-299 735
DOT-TSC-935
FRA/ORD-78/16
Final Report Jan. 1979 275p.

Railroads — Cars — Wheels

The objective of this program was to determine the technical feasibility and cost effectiveness of constructing three separate devices for the prevention of catastrophic roller bearing-initiated, railroad journal failure. (1) Construction of a low cost axle cap bolt which would replace one of the three bolts in a standard bearing assembly, and which would contain a self-powered, maintenance free transmitter to signal a train crew in the event of roller bearing overtemperature, was proven feasible. (2) The prevention of bearing overlubrication by use of automated ultrasonic test methods was seen to be feasible. (3) The early detection of bearing component damage (spalling, brinelling, and particulate contamination) by use of 'Shock Pulse Analysis' techniques was also seen to be feasible.

DOT-TSC-FRA-79-6
ON-BOARD OF FAILURE-PROTECTION REQUIREMENTS FOR RAILROAD-VEHICLE EQUIPMENT
Shaker Research Corp., Ballston Lake, NY
Richard L. Smith and John L. Frarey
PB-297 678
FRA/ORD-78/72
DOT-TSC-1029
Final Report Mar. 1979 196p.

Railroads — Accidents
Railroads — Safety measures

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

DOT-TSC-FRA-79-7, I
WAYSIDE ENERGY STORAGE STUDY
Volume I. Summary
AiResearch Mfg. Co. of California, Torrance
L. J. Lawson and L. M. Cook
PB-293 857
Set: PB-293 856
FRA/ORD-78/78. I
DOT-TSC-1349
Final Report Feb. 1979 79p.

Railroads — Energy consumption
Fly wheels

Volume I summarizes an in-depth application study which was conducted to determine the practicality and viability of using large wayside flywheels to recuperate braking energy from freight trains on long downgrades. The study examined the route structures of nine U.S. railroads and identified various wayside energy storage system (WESS) configurations. The optimum means of transferring energy from the train to the wayside was by means of a high-voltage ac catenary from either regenerative electric locomotives or modified dual-mode (diesel-electric/electric) locomotives. The application of WESS was then analyzed for four specific routes of typical U.S. railroads. These routes and the annual returns on investment (RO1's) resulting from WESS deployment on existing railroads were as follows: Atchison, Topeka, and Santa Fe (Los Angeles to Belen), 27.1 percent; Black Mesa and Lake Powell, 17.3 percent; Conrail (Pittsburgh to Harrisburg), 22.0 percent; Union Pacific (Los Angeles to Salt Lake City), 20.2 percent.

DOT-TSC-FRA-79-7,II
WAYSIDE ENERGY STORAGE STUDY
Volume II: Detailed Description and Analysis
L. J. Lawson and L. M. Cook
PB-293 858
Set: PB-293 856
FRA/ORD-78/78. II
DOT-TSC-1349
Final Report Feb. 1979 291p.

Railroads — Energy consumption
Flywheels

Volume II summarizes an in-depth application study which was conducted to determine the practicality and viability of using large wayside flywheels to recuperate braking energy from freight trains on long downgrades. The study examined the route structures of nine U.S. railroads and identified various wayside energy storage system (WESS) configurations. The optimum means of transferring energy from the train to the wayside was by means of a high-voltage ac catenary from either regenerative electric locomotives or modified dual-mode (diesel-electric/electric) locomotives.

DOT-TSC-FRA-79-7,III
WAYSIDE ENERGY STORAGE STUDY
Volume III: Engineering Economics Analysis: Data and Results
AiResearch Mfg. Co. of California, Torrance
L. J. Lawson and L. M. Cook
PB-293 859
Set: PB-293 856
FRA/ORD-78/78.III
Contract DOT-TSC-1349
Final Report Feb. 1979 570p.

Railroads — Energy consumption
Flywheels

Volume III contains the detail of the engineering economics analysis which showed attractive returns on investment for deployment of WESS on existing U.S. railroads.

DOT-TSC-FRA-79-7,IV
WAYSIDE ENERGY STORAGE STUDY
Volume IV: Dual-Mode Locomotive: Preliminary Design Study
AiResearch Mfg. Co. of California, Torrance
L. J. Lawson and L. M. Cook
PB-293 860
Set: PB-293 856
FRA/ORD-78/78.IV
DOT-TSC-1349
Final Report Feb. 1979 54p.

Railroads — Energy consumption
Flywheels

A preliminary design study was conducted to confirm the technical viability and economic attractiveness of the dual-mode locomotive concept based on the most common U.S. road locomotive, the SD40-2. The study examined the existing characteristics of the base locomotive and ensured that operation in the diesel mode would not be compromised by a locomotive which has a pantograph, transformer, converter, and choke added to permit operation from a 50 kV catenary. The study concluded that the concept is technically viable (although some equipment is only available overseas) and is economically attractive, the top line modification cost being $217,500.

DOT-TSC-FRA-79-11
DEVELOPMENT, FABRICATION, AND TESTING OF INVERTER POWER SYSTEMS FOR METROLINER
Transportation Systems Center
W. J. Holt, J. A. Ross, and J. A. Houdyshel
FRA/ORD-79/42
DOT-TSC-1284
Final Report Nov. 1979 120p.

Local transit

This report documents the development and subsequent fabrication of a solid state auxiliary power conditioning unit for the upgraded Metroliner. The APCU is an inverter of the pulse width modulated type having multiple parallel transistors in a three phase double way bridge configuration. The APCU is packaged to be tested and evaluated in a laboratory environment and proposed to be a prototype of units suitable for replacement of rotary type APU's presently installed in General Electric power system equipped Metroliners.

DOT-TSC-FRA-79-13
A STRUCTURAL SURVEY OF CLASSES OF VEHICLES FOR CRASHWORTHINESS
Transportation Systems Center
Edward Widmayer
FRA/ORD-79-13
DOT-TSC-856
Final Report Sept. 1979 130p.

Railroads — Accidents
Local transit — Accidents

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

DOT-TSC-FRA-79-14
TESTS OF THE AMTRAK SDP-40F TRAIN CONSIST CONDUCTED ON CHESSIE SYSTEM TRACK
Transportation Systems Center
P. Tong, R. Brantman, R. Greif, and J. Mirabella
PB-297 711
FRA/ORD-79/19
Final Report May 1979 251p.

Railroads — Track — Dynamics
Railroads — Track — Design and construction

This report describes tests of an SDP-40F train consist conducted on Chessie System track during June, 1977. The tests consisted of the operation of two typical AMTRAK passenger consists, one powered by two SDP-40F's and the other by two E8's, over a variety of track conditions. The objectives of the tests were to compare dynamic performance of the SDP-40F locomotive with the E8, and to determine the sensitivity of the SDP-40F response to track geometry variations, operational parameters and track configuration changes.

DOT-TSC-FRA-79-17
THE MEASUREMENT OF LOCOMOTIVE NOISE AT EXISTING RAILROAD TEST SITES
Bolt, Beranek and Newman, Inc.
P. J. Remington, M. N. Alakel, J. W. Ernest, and N. R. Dixon
PB80-137334
FRA/ORD-79/55
DOT-TSC-1474
Final Report Nov. 1979 140p.

Noise control

A study was undertaken to examine the feasibility of accurately measuring the noise from locomotives at existing load cell sites in the absence of sites conforming with U.S. Environmental Protection Agency standards. It was found through measurements at seven typical sites and one conforming load cell test site involving ten locomotives that reasonably accurate measurements were possible for the locomotive operating fully loaded at throttle 8. Errors, when they occurred, were due primarily to sound reflecting off nearby buildings. Measurements with the locomotive in idle were generally difficult because of high background noise at these sites. A passby test procedure was also examined and found to provide reasonably accurate measurement of locomotive noise at throttle 8, full load.

DOT-TSC-FRA-79-19
LEGAL EFFECTS OF USE OF INNOVATIVE EQUIPMENT AT RAILROAD-HIGHWAY GRADE CROSSINGS ON RAILROAD'S ACCIDENT LIABILITY
Transportation Systems Center
David S. Glater and Terry K. Mond
FRA-RRS-80-01
Final Report Dec. 1979 52p.

Railroads — Accidents
Railroads — Crossings — Safety measures

This report discusses the effect on a railroad's legal liability for railroad-highway grade crossing accident costs when that railroad uses innovative grade crossing safety equipment. Its purpose is to evaluate the assertion that a railroad's use of innovative warning device technology increases the the likelihood that the railroad will be held liable for accidents at that (or other) crossings.

The methodology employed in carrying out this research involved the identification and analysis of relevant federal and state court decisions. Three significant conclusions resulted from this study. First, railroads do not necessarily increase their legal liability for grade crossing accident costs by deploying innovative grade crossing warning equipment. Second, railroads should carefully monitor government and industry activities demonstrating the feasibility of new warning equipment because such activities may affect their liability exposure. Finally, railroads may deploy new technology at a particular rail-highway crossing in response to accidents at that site without significant adverse effect on their position in relevant litigation.

DOT-TSC-FRA-80-2
RESULTS AND ANALYSIS OF THE SWITCHYARD IMPACT RESULTS
Transportation Systems Center
Oscar Orringer and Pin Tong
PB80-162266
FRA/ORD-80-6
Final Report Jan. 1980 146p.

Hazardous substances — Transportation
Railroads — Safety measures

This report presents the results and analysis of series 3 through 7 and series 10 of the FRA/RPI/AAR Switchyard Impact Tests. The test results and analysis are used to evaluate the head shield and the shelf-E coupler as protective devices for hazardous-materials tank cars.

DOT-TSC-FRA-80-3
A DESCRIPTION OF THE TESTS CONDUCTED AND DATA OBTAINED DURING THE PERTURBED TRACK TEST
Transportation Systems Center
Michael Coltman, Russel Brantman, and Pin Tong
PB80-165822
FRA/ORD-80/15
Final Report Jan. 1980 332p.

Railroads — Track

Railroads — Track — Inspection

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

DOT-TSC-FRA-80-4,I
STATISTICAL REPRESENTATIONS OF TRACK GEOMETRY
Volume I: Main Text
Transportation Systems Center
John C. Corbin
FRA/ORD-80/1.I
DOT-TSC-1211-1
Final Report January 1980 208p.

Railroads — Track

Railroads — Track — Design and Construction

Mathematical representations of railroad track geometry variations are derived from time series analyses of track measurements. Since the majority of track is free of anomalies (turnouts, crossings, bridges, etc.), representation of anomaly-free track is first considered. Anomalies are then represented by using a combination of processes used to describe joints or welds in the anomaly-free track.

In practice, anomaly-free track is constructed by joining many rails of the same length together so that periodic behavior is expected. Results indicate that the geometry of such track structures is completely represented by a periodically modulated random process whose first, second, and higher order statistics are a function of position along the rail relative to a joint or weld.

This process is the synthesis of two simpler processes. The first is a stationary random process completely described by its power spectral density (PSD), which is modeled as a smooth function described by a roughness parameter and a set of corner frequencies (wavelengths). This process gives a complete representation of a homogeneous track structure free of joints or welds. The second process, which represents the joints or welds, involves a shape function, a decay rate away from the peak, and a correlation between joint amplitudes. The sequence of shape amplitudes is also a stationary random process having a non-zero mean. The mean amplitude and the decay rate of the shape function can be estimated from track geometry PSD's.

Roughness parameters, corner frequencies, mean shape amplitudes and decay rates of the processes are related to track classes as defined by FRA Track Safety Standards, and to the measurements prescribed by those standards.

DOT-TSC-FRA-80-4,II
STATISTICAL REPRESENTATIONS OF TRACK GEOMETRY
Volume II: Appendixes
Transportation Systems Center
John C. Corbin
FRA/ORD-80/1,II
DOT-TSC-1211-2
Final Report January 1980 202p.

Railroads — Track

Railroads — Track — Design and construction

This volume contains some of the more detailed data and analyses to support the results and conclusions reached in Volume I of this report. It is divided into appendixes lettered A through J.

Appendix A defines a procedure for evaluating the statistical parameters from field-collected track-geometry data.

Appendixes B and C contain track-geometry data traces and descriptive text used to support various results and conclusions as they apply to rail joints and track anomalies, respectively.

Appendix D contains the curve fits obtained for processed PSD data.

Appendixes E and F describe the analysis used to determine instrument and quantization noise, respectively.

Appendix G is a history of research preceding the effort described in this report.

Appendix H describes formal mathematical procedures needed for complete characterization of a periodically modulated random process.

Appendix I contains data on railhead wear. Appendix J reports on new technology.

DOT-TSC-FRA-80-5,I
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL
Volume I: Description and Planning
Boeing Commercial Airplane Co.
D. V. Lindh, R. Q. Taylor, and D. M. Rose
PB80-182181
Set: PB80-182173
FRA/ORD-80/5-1
DOT-TSC-1048-1
Final Report Feb. 1980 76p.

Railroads — Track
Railroads — Track — Inspection

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

DOT-TSC-FRA-80-5,II
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL
Volume II: Process Parameters and Procedures
Boeing Commercial Airplane Co.
D. V. Lindh and R. Q. Taylor
PB80-182199
Set: PB80-182173
FRA/ORD-80/5-II
DOT-TSC-1048-2
Final Report Feb. 1980 25p.

Railroads — Track
Railroads — Track — Inspection

The bolt-hole cold-expansion process has been applied to railroad rail in laboratory tests and has demonstrated a potential for the reduction of rail-bolt-hole-failure incidence. Limited field tests also have been conducted and are currently under long-term evaluation. Because the process is not common to the rail industry, this procedures manual has been prepared to assist in process implementation. The procedures manual describes the process, and provides instruction and recommendations for field application, and establishes the requirements for bolt-hole and tool-size relationships.

DOT-TSC-FRA-80-5,III
SLEEVE EXPANSION OF BOLT HOLES IN RAILROAD RAIL
Volume III: Field Experiment Results
Boeing Commercial Airplane Co.
D. V. Lindh, R. Q. Taylor, and D. M. Rose
PB80-182207
Set: PB80-182173
FRA/ORD-80/5-II
DOT-TSC-1048-3
Final Report Feb. 1980 111p.

Railroads — Track
Railroads — Track — Inspection

The bolt-hole cold-expansion process has been demonstrated by laboratory tests to significantly affect the initiation and propagation of fatigue cracks from rail bolt holes such that a reduction of the incidence of rail-bolt-hole failure in cold-expanded rail would be expected. A field-verification experiment was implemented in 1977 and reported in Volume I of this report. This volume contains the results of the field experiment, and examination of the fatigue ratio (R) on the observed laboratory fatigue-life improvement of cold-expanded bolt holes, an investigation of crack growth of rails in a vacuum environment, and a comparison of the fatigue performance of cold-expanded bolt holes with rail flash-welds.

DOT-TSC-FRA-80-6
MEASUREMENTS OF WHEEL/RAIL LOADS ON CLASS 5 TRACK
Battelle Columbus Labs.
Donald R. Ahlbeck, Milton R. Johnson, Harold D. Harrison, and James M. Tuten
PB80-196868
FRA/ORD-80/19
DOT-TSC-1051
Final Report Feb. 1980 294p.

Car-wheels

Railroads — Track

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

DOT-TSC-FRA-80-10
RAILROAD R AND D CHALLENGES OF THE 80's OPPORTUNITIES AND OBSTACLES, RAILROAD ENGINEERING CONFERENCE PROCEEDINGS (15th) HELD AT TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MA, ON OCTOBER 21-23, 1979

Transportation Systems Center
PB80-205206
FRA/ORD-80-35
June 1980 125p.

Railroads — Congresses

Conference papers were delivered by various industry and Government officials and centered on three topic areas: The Status of the Northeast Corridor Improvement Project and Passenger R&D; An Overview of Freight Technology Advancements, Obstacles, and Future Opportunities; and Major R&D Opportunities of the 80's. A tour of the Sante Fe-San-Vel concrete crosstie plant in Littleton, Massachusetts, was included as part of the conference program.

DOT-TSC-FRA-80-14
PERSONNEL SAFETY ON ELECTRIFIED RAILROADS

Transportation Systems Center
J. D. Abbas, W. E. Phillips, Jr., A. Kusko, and C. M. King
Prepared in Cooperation with Kusko (Alexander), Inc., Needham, MA
PB80-220858
FRA/ORD-80/36
DOT/TSC-1180
Final Report June 1980 60p.

Electric Railroads

Railroads — Electrification

Railroads — Safety Measures

Potential electrical hazards to fire, police, and rescue personnel responding to emergencies on electrified railways are examined. Data on descriptions of electrical facilities, types of accidents and danger to emergency personnel, and reviews of operating procedures have been obtained during a series of visits to electrified rail and transit systems. Programs to reduce electrical hazards to emergency personnel are proposed. These programs are evaluated by a cost-benefit comparison, and recommendations are selectively made. Joint development of emergency operating plans by rescue and railroad organizations, and installation of direct telephone lines to the power director are recommended as being most cost-effective.

DOT-TSC-FRA-80-15
OPERATIONAL TESTING OF LOCOMOTIVE-MOUNTED STROBE LIGHTS

Transportation Systems Center
John B. Hopkins
Sponsored in part by Federal Railroad Administration, Washington, DC, Office of Research and Development
PB80-224348
FRA/ORD-80-48
Interim Report June 1980 37p.

Locomotives — Headlights

Stroboscope

FEDERAL RAILROAD ADMINISTRATION

The report describes revenue-service tests of locomotive-mounted strobe lights used to make trains more conspicuous to motorists at rail-highway crossings. The testing, conducted in cooperation with four railroads, had the objectives of assuring practicality compatibility with normal operations, validating previous cost estimates, and obtaining a measure of safety effectiveness. Prior research underlying the tests is reviewed briefly.

DOT-TSC-FRA-80-48
SEE
DOT-TSC-FRA-80-15

DOT-TSC-NHTSA-78-27
HISTORIC (1971-1975) COST-REVENUE ANALYSIS OF THE AUTOMOTIVE OPERATIONS OF THE MAJOR U.S. AUTOMOTIVE PRODUCTS MANUFACTURERS
H. H. Aerospace Design Co., Inc., Bedford, MA
R. Kaiser
PB-290 956
DOT-TSC-1310
DOT-HS-803 541
Final Report Jan. 1979 100p.

Automobile industry and trade — United States — Planning

A cost-revenue analysis is performed for the manufacture of automotive vehicles for the four major U.S. automotive manufacturers: American Motors Corp., Chrysler Corp., Ford Motor Co., and General Motors Corp. The analysis used a 'top-down' methodology based principally on corporate operating statements and supporting notes published in corporate annual reports and SEC 10K forms. The study entailed the disaggregation of the consolidated corporate financial data presented and the identification or estimation of data pertinent to automotive operations. In the study, automotive operations were examined at three levels of disaggregation: (a) Worldwide automotive operations; (b) North American (U.S. and Canada) automotive operations; (c) U.S. manufacture of passenger vehicles and light trucks.

DOT-TSC-NHTSA-78-28
HISTORICAL FINANCIAL DATA—DOMESTIC AUTOMOBILE MANUFACTURERS
Little (Arthur D.), Inc., Cambridge, MA
John M. Carroll and Richard P. Schneider
PB-290 976
DOT-TSC-1047
DOT-HS-803 544
Final Report Jan. 1979 272p.

Automobile industry and trade—United States

A historical financial data base was developed for the four major U.S. automobile manufacturers, focusing on the specific operations associated with production and marketing of automobiles and light trucks. The years subject to analysis were 1967-1976. The principal accounting and reporting policies of each manufacturer were examined. The accounts selected for analysis were (1) property, plant and equipment—annual capital investment; (2) special tools—annual capital investment; (3) maintenance, repairs and rearrangements—annual operating cost; (4) research and development—annual operating expense; (5) depreciation and amortization of assets—annual operating cost. Using a process of successive disaggregation, the consolidated corporate financial statements for each manufacturer were analyzed to develop estimates of the specific automobile- and light truck-related amounts. Data and information to assist in the disaggregation process were collected by means of a literature search and discussions with industry analysts. An examination of the sensitivity of each of the accounts to future changes was also performed.

DOT-TSC-NHTSA-78-42
MANUFACTURER'S POLICIES CONCERNING AVERAGE FUEL ECONOMY STANDARDS
Whorf (Robert) and Associates, Elkins Park, PA
Robert P. Whorf
PB-290 977
DOT-TS-13750
DOT-HS-803 720
Final Report Jan. 1979 67p.

Automobiles — Fuel consumption

The form of regulation, i.e., the imposition of standards on the basis of each manufacturer's total production for a given model year, as well as the criteria to be applied by NHTSA in setting the 1981 through 1985 standards, require that very careful attention be given to understanding both the probable responses of each manufacturer and the economic and other consequences of such responses. The AFER (Average Fuel Economy Regulatory) Program at TSC is intended to assist NHTSA in the analysis of options for setting average fuel economy standards and applying the criteria of Title V of the Motor Vehicle Information and Cost Savings Act (Title III of EPCA) for an evaluation of these options.

DOT-TSC-NHTSA-78-47
AN ASSESSMENT OF THE POTENTIAL IMPACT OF COMBUSTION RESEARCH ON INTERNAL COMBUSTION ENGINE EMISSIONS AND FUEL CONSUMPTION
Aerodyne Research, Inc., Bedford, MA
J. L. Kerrebrock and C. E. Kolb
PB-290 953
DOT-HS-803 722
DOT-TSC-1487
ARI-RR-131
Final Report Jan. 1979 92p.

Automobiles — Motors — Exhaust gas
Automobiles — Fuel consumption

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

A review of the present level of understanding of the basic thermodynamic, fluid dynamic, and chemical kinetic processes which affect the fuel economy and levels of pollutant exhaust products of Diesel, Stratified Charge, and Spark Ignition engines is presented. Key areas are identified where insufficient understanding currently prevents the rational development of internal combustion engines with improved performance. A research plan designed to gather the needed data is presented.

DOT-TSC-NHTSA-79-1
SEAT BELTS: 1949-1956
Lexington Technology Associates
Larry Ronan
PB-297 090
DOT-HS-803 911
DOT-TSC-1355
Final Report Apr. 1979 54p.

Automobiles — Safety appliances
Automobiles — Seat belts

The study assesses the impact of the consumer misconceptions, the lack of a seat belt standard, corporate attitudes towards safety, and the role of safety advocates. In addition, the study assesses the validity of the oft-stated hypothesis safety doesn't sell' by examining the results of Ford's 1956 safety car campaign.

DOT-TSC-NHTSA-79-2
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 2. 1978 PONTIAC, 301 CID (4.9 LITERS), 2V.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 772
DOT/TSC-RA-77-07
DOT-HS-803 831
BERC/OP-78/21
Interim Report Feb. 1979 59p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Pontiac 301 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-3
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 3. 1978 AMC, 121 CID (2.0 LITERS), 2V.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
Don E. Koehler
PB-293 773
DOT-HS-803 832
DOT/TSC-RA-77-07
BERC/OP-78/20
Interim Report Feb. 1979 59p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 AMC 121 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emission 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-NHTSA-79-4
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 4. 1978 PONTIAC, 151 CID (2.5 LITERS), 2V.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 774
DOT-HS-803 833
DOT/TSC-RA-77-07
BERC/OP-78/22
Interim Report Feb. 1979 62p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Pontiac 151 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-5
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 5. 1978 CHEVROLET, 200 CID (3.3 LITERS), 2V.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 775
DOT/TSC-RA-77-07
DOT-HS-803 834
Interim Report Feb. 1979 61p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Chevrolet 200 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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 calculation involving ground transportation.

DOT-TSC-NHTSA-79-6
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 6. 1978 VOLKSWAGEN DIESEL, 90 CID (1.5 LITERS), F.1.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 776
DOT-HS-803 835
DOT/TSC-RA-77-07
BERC/OP-78/33
Interim Report Feb. 1979 42p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 VW 90 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-7
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 7, 1978 FORD, 98 CID (1.6 LITERS), 2V.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 777
DOT/TSC-RA-77-07
DOT-HS-803 8361
BERC/OP-78/34
Interim Report Feb. 1979 63p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Ford 98 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-8
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 8. 1978 BUICK, 231 CID (3.8 LITER), 4V TURBOCHARGED
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 778
DOT/TSC-RA-77-07
DOT-HS-803 837
BERC/OP-78/43
Interim Report Feb. 1979 60p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Buick 231 CID turbocharged to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-9
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 9. 1978 FORD, 300 CID (4.9 LITERS), IV.
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 779
DOT-HS-803 838
DOT/TSC-RA-77/07
BERC/OP-78/44
Interim Report Feb. 1979 58p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Ford 300 CID truck engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-10
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. THIRD SERIES — REPORT NO. 10. 1978 HONDA, 98 CID (1.6 LITERS).
Department of Energy, Bartlesville, OK
Bartlesville Energy Research Center
D. E. Koehler and W. F. Marshall
PB-293 780
DOT/TSC-RA-77-07
DOT-HS-803 839
BERC/OP-78/55
Interim Report Feb. 1979 42p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

Experimental data were obtained in dynamometer tests of a 1978 Honda 98 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, 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-NHTSA-79-12
EVALUATION OF AUTOMOBILE DRIVETRAIN COMPONENTS TO IMPROVE FUEL ECONOMY
Little (Arthur D.), Inc.
Donald Hunter and Philip Gott
PB-293 728
DOT-HS-803 840
DOT-TSC-1046
Final Report Mar. 1979 114p.

Automobiles — Transmission devices
Automobiles — Transmission devices, automatic

Wide ratio range automatic transmissions with lockup torque converters could be in production by the early 1980's. In order to evaluate their impact upon fuel economy, emissions, driveability, acceleration, and durability, four 1975 Chrysler automobiles with inertia weights and engine sizes typical of that time period were equipped with Multi-Purpose Test Transmissions. These transmissions could duplicate: current three-speed automatic transmissions; wide range three-speed automatic transmissions; and wide range four-speed automatic transmissions with or without torque converter lockup. Each of the test cars was evaluated in seven different transmission modes for fuel economy, emissions, driveability, acceleration, and durability. Fuel economy test results were compared to computer predicted fuel economists. Predicted values agreed with actual fuel economies within the resolution of the test method. Composite fuel economy improvements of up to 14% were achieved with no chanage in acceleration and durability. Further development work is required to bring emissions and driveability to acceptable levels. Maximum increases in fuel economy due to drivetrain improvements have not been demonstrated due to the possibility for further optimization of engine road load matching and the impacts of emission and driveability modifications.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHTSA-79-13
TECHNOLOGICAL CHANGE IN U.S. AUTOMOBILE INDUSTRY: ASSESSING PAST FEDERAL INITIATIVES
Lexington Technology Associates, MA
William J. Abernathy and Balaji S. Chakravarthy
PB-292 255
DOT-HS-803 543
DOT-TSC-1355
Final Report Jan. 1979 102p.

Automobile industry and trade — Safety measures — Laws and legislation
Automobile industry and trade — Planning

In the future, further reduction in fatalities, fuel consumption and emissions due to automobile use will be needed. To insure that these goals are achieved, it is necessary to understand more thoroughly the role of Federal initiatives and regulation in encouraging the development, implementation and adoption of innovative automobile technology. The study provides an important link in addressing these questions. It examines the pattern of past Federal initiatives in the automobile industry and the effect of those initiatives on innovation. In addition, a framework is developed for assessing the joint consequences of Federal technology creation and market pull initiatives on the diffusion process.

DOT-TSC-NHTSA-79-15
AUTOMOTIVE FUEL ECONOMY AND EMISSIONS EXPERIMENTAL DATA
Jet Propulsion Lab., Pasadena, CA
Mack W. Dowdy and Ronald L. Baisley
PB-293 580
DOT-HS-803 808
DOT/TSC-RA-75-41
JPL-PUB-78-21
Final Report Feb. 1979 217p.

Automobiles — Fuel consumption
Automobiles — Motors — Exhaust gas

The purpose of this effort was to generate experimental data to support an assessment of the relationship between automobile fuel economy and emission control systems. Tests were made at both the engine and vehicle levels. Detailed investigations were made on cold-start emissions devices, exhaust gas recirculation systems, and air injection reactor systems. Based on the results of engine tests, an alternative emission control system and modified control strategy were implemented and tested in the vehicle. With the same fuel economy and NOx emissions as the stock vehicle, the modified vehicle reduced HC and CO emissions by about 20 percent. By removing the NOx emissions constraint, the modified vehicle demonstrated about 12 percent better fuel economy than the stock vehicle.

DOT-TSC-NHTSA-79-18
THE DEVELOPMENT AND INTRODUCTION OF THE AUTOMOTIVE TURBOCHARGER: A CASE OF INNOVATION IN RESPONSE TO FUEL ECONOMY REGULATION
Lexington Technology Associates, MA
Larry Ronan and William Abernathy
PB-299 359
DOT-HS-804 629
DOT-TSC-1355
Final Report Aug. 1979 78p.

Automobiles — Motors (Diesel)
Automobiles — Fuel consumption

This case study examines the evolution of the turbocharger from its invention in 1905 by Dr. A. J. Buechi, to its use on passenger cars in the late seventies. The case makes a number of points. The market for turbochargers has changed over time. In the fifties, suppliers developed a commercial turbocharger for compact, light, high-speed diesel engines which found a large and growing market. Application to the automotive field was slow in coming. Turbochargers found use in competitive racing. Aside from a brief period in the early sixties, the automobile industry did not seriously consider turbochargers for passenger cars until the mid-seventies. Down-sizing and the attendant reduction in engine horsepower in response to the mandated fuel economy standards have created a market for turbochargers. Suppliers played an important role in the success of this innovation.

DOT-TSC-NHTSA-79-19
ANALYSES OF SELECTED AUTOMOTIVE PARTS AND ASSEMBLIES FOR COST AND MATERIAL IMPACTS
Pioneer Engineering and Mfg. Co., Inc.
Robert W. Reinhardt
PB-294 815
DOT-HS-803 842
Final Report Mar. 1979 464p.

Automobiles — Operating costs
Automobiles — Parts

This is a study of selected automotive parts and assemblies analyzed to determine the elements of manufacturing cost and methods of production. Parts from the 1975 Ford Pinto, 1975 Chevelle, 1976 Audi 100LS, and the VW Rabbit are included in the selection of engine and transmission parts used for analyses of costs and materials. In order to make the costing procedures more understandable a review is included of generally accepted cost analysis techniques used by automotive companies to develop comparative or target, costs. The various methods using the cost data bank information, detailed manufacturing process cost techniques as well as design variance studies are discussed. The selected vehicle and engine transmission parts are studied for comparative material cost. Process descriptions include the number of process operations, material, grade of material, rough and finished part weight; cost of raw material, variable cost, and other elements of cost. Groupings by physical characteristics, material, and manufacturing processes are used to study the cost effects for various types of similar parts from different vehicles. In addition, other studies are included to illustrate the cost impacts of alternate materials on various components.

DOT-TSC-NHTSA-79-20
STOCHASTIC ANALYSIS OF FUTURE VEHICLE POPULATIONS
Transportation Systems Center
D. Henry Golomob, and Howard M. Bunch
PB-296 631
DOT-HS-803 656
Final Report May 1979 110p.

Automobile industry and trade
Stochastic analysis

The model, which is called the Future Automobile Population Stochastic Model (FAPS Model), consists of two major components: (1) Model of new car sales. The model of new car sales is the model of automobile demand developed by Wharton Econometric Forecasting Associates, revised to incorporate the new vehicle survival model that was developed. (2) A procedure for specifying future planned and unplanned events. This procedure, which specifies the future values of exogenous parameters of the model, incorporates the uncertainty of these parameters into the model. A computer program of the FAPS Model was written and is documented in the report.

DOT-TSC-NHTSA-79-21
AUTOMOTIVE MANUFACTURER'S COST/REVENUE, FINANCIAL AND RISK ANALYSIS: PROJECTED IMPACT OF AUTOMOBILE MANUFACTURING ON THE PLASTICS INDUSTRY
H. H. Aerospace Design Co., Inc.,
Bedford, MA
Robert Kaiser
PB-300 873
DOT-HS-803 657
DOT-TSC-1333
Final Report Aug. 1979 184p.

Automobile industry and trade
Automobile industry and trade—Planning

The report is part of a study to update the historical and projected cost/revenue analysis of the U.S. domestic automobile manufacturers. It includes the evaluation of the historical and projected financial data to assess the corporate financial position of each manufacturer and the assessment of the extraordinary risks imposed on the manufacturers by Automotive Fuel Economy Standards. In particular, the report includes the effect of changes in the characteristics of the average U.S. automobile on the plastics industry.

DOT-TSC-NHTSA-79-23
THE UNITED KINGDOM AUTOMOBILE INSURANCE MARKET
Economist Intelligence Unit Ltd.
London (England)
PB-296 130
DOT-HS-804 151
DOT-TS-15109
May 1979 41p.

Automobiles—Insurance—Great Britain
Insurance, Automobile—Great Britain

The report represents a limited study of the United Kingdom Automobile Insurance Industry: (1) the structure, size, and relationships within the industry; (2) the basis of premium calculation, rate structure, types of policies, and payment to compensation; (3) marketing of insurance; (4) the role of the two main motorist organizations; (5) individual differences between individual and fleet insurances; and (6) the profitability of the British system.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHTSA-79-28
THE ROLLING RESISTANCE OF PNEUMATIC TIRES
Michigan Univ., Ann Arbor
S. K. Clark, and R. N. Dodge
Prepared in cooperation with National Highway Traffic Safety Administration, Washington, D.C., Office of Research and Development
PB80-149172
DOT-HS-805 523
DOT-TSC-1031
Final Report Dec. 1979 72p.

Automobiles—Tires
Automobiles—Tires—Testing

The report illustrates the important variables which affect passenger tire rolling resistance. The influence of speed, load and inflation pressure is discussed, and test data is presented on the influence of these. The test data encompasses a wide variety of modern tires, bias and radial, over a range of rim diameters and tire aspect ratios. Measurements of tire rolling resistance are discussed and equations presented for converting rolling resistance gotten on drums to the equivalent value on the road.

DOT-TSC-NHTSA-79-29.I
AUTOMOTIVE MANUFACTURING ASSESSMENT SYSTEM
Volume I: Master Product Schedules
Transportation Systems Center
Theodore Taylor, Jr.; Alan R. Cunningham, Madelyn C. Isaccs, Dominic Iannelli
PB80-145634
Set: PB80-145626
DOT-HS-804 460
DOT/TSC-1383
Final Report Nov. 1979 239p.

Automobile industry and trade

Volume I, Master Product Schedules, is part of a four volume set documenting areas of reearch resulting from the development of the Automotive Manufacturing Assessment System (AMAS) for the DOT/Transportation Systems Center. AMAS was designed to assist in the evaluation of industry's capability to produce fuel efficient vehicles. Through extensive research and synthesis of publicly available information, Master Product Timing Schedules were generated to portray chronologically, current and future product changes and technological advances for each domestic auto (1975-1985), light truck (1979-80) and selected import manufacturers (1975-80). The Schedules show (by make, model, and year): all new vehicle introductions, highlighting downsizing; styling changes; and significant technological advances in the areas of engines, transmissions, fuel metering, emission control and safety. Extensive notes and reference lists are tabulated to assist the researcher in obtaining additional information beyond that identified on the schedules.

DOT-TSC-NHTSA-79-29.II
AUTOMOTIVE MANUFACTURING ASSESSMENT SYSTEM
Volume II: Product Schedules of Engine/Drivetrain Combinations
Transportation Systems Center
Theodore Taylor, Jr.; Alan R. Cunningham; Dominic A. Iannelli
PB80-145642
Set: PB80-145626
DOT-HS-804 461
DOT/TSC-1383
Final Report Nov. 1979 142p.

Automobile industry and trade

Volume II, Product Schedules Of Engine/Drivetrain Combinations, is part of a four volume set documenting areas of research resulting from the development of the Automotive Manufacturing Assessment System (AMAS) for the DOT/Transportation Systems Center. AMAS was designed to assist in the evaluation of industry's capability to produce fuel efficient vehicles. Engine/driveline changes are the second most important contribution to fuel economy (weight reduction being the first) and are of major importance towards meeting emission standards. Through extensive synthesis of vehicle specifications and other data, chronological presentations were developed to illustrate engines and transmissions in production, engine/transmission and model/engine combinations, and automatic vs. manual transmission availability. Also shown are the progression of engine/driveline changes from 1975 through 1978; the correlation of these changes with new vehicle introductions; the restrictions on available drivetrain options due to emission requirements; and technological improvements including dieselization, fuel metering, lock-up torque converters, and front-wheel-drive.

DOT-TSC-NHTSA-79-29.III
AUTOMOTIVE MANUFACTURING ASSESSMENT SYSTEM
Volume III: Materials-Weight Analysis
Transportation Systems Center
Theodore Taylor, Jr.; Catherine M. Deans; Madelyn C. Isaacs; and Alan R. Cunningham
PB80-145659
Set: PB80-145626
DOT-HS-804 462
DOT/TSC-1383
Final Report Nov. 1979 401p.

Automobile industry and trade

Volume III, Materials-Weight Analysis, is part of a four volume set documenting areas of research resulting from the development of the Automotive Manufacturing Assessment System (AMAS) for the DOT/Transportation Systems Center. AMAS was designed to assist in the evaluation of industry capability to produce fuel efficient vehicles. Through extensive research and synthesis of publicly available information, detailed abstracts and summaries were generated to describe material applications to automotive vehicles and components with emphasis on technological advances and weight reduction potential for each domestic auto manufacturer, material, and component area. Investigation focuses on analyzing factors affected by fuel economy efforts: current and innovative materials and their component applications; auto manufacturers' and suppliers' development programs; tooling/manufacturing processes; weight savings and fuel economy benefits; and costs involved. Weight reduction progress in the 1977 and 1978 model years is highlighted but announced future plans for each manufacturer are also presented.

DOT-TSC-NHTSA-79-29.IV
AUTOMOTIVE MANUFACTURING ASSESSMENT SYSTEM
Volume IV: Engine Manufacturing Analysis
Transportation Systems Center
Theodore Taylor, Jr.
PB80-145667
Set: PB80-145626
DOT-HS-804 463
DOT/TSC-1383
Final Report Nov. 1979 133p.

Automobile industry and trade

Volume IV—Engine Manufacturing Analysis represents the results of one of four major study areas under the Automotive Manufacturing Assessment System (AMAS) sponsored by the DOT/Transportation Systems Center. AMAS was designed to assist in the evaluation of industry's capability to produce fuel efficient vehicles. An analysis of automotive engine manufacturing was conducted in order to determine the impact of regulatory changes on tooling costs and the production process. The 351W CID V-8 engine at Ford's Windsor No. 1 Plant was the subject of the analysis. A review of plant history and its product is presented along with an analysis of manufacturing operations, including material and production flow, plant layout, machining and assembly processes, tooling, supporting facilities, inspection, service and repair. Four levels of product change intensity showing the impact on manufacturing methods and cost is also presented.

DOT-TSC-NHTSA-79-30
DETERMINATION OF THE TIRE QUALITY FROM NONDESTRUCTIVE INSPECTION
Transportation Systems Center
S. N. Bobo
PB80-185358
HS-804-828
Final Report Nov. 1979 68p.

Automobiles—Tires—Testing

A study was performed to determine the capability of an ultrasonic inspection system developed at TSC to identify anomalies in tires which would cause failure during the Compliance Test and to identify degradation of tires which had passed the Compliance Test by subsequent examination. A population of 1440 tires was used for this work.

The study demonstrated that all tires which failed the Compliance Test had multiple anomalies detected previously by nondestructive inspection, but that it was not possible, a priori, to determine which of these anomalies would lead to failure. A ranking procedure was developed which utilized the results of the nondestructive inspection and other factors to grade and rank each tire. By statistical analysis a threshold grade was determined which separates the groups in which all tires passed the Compliance Test from the groups which contained tires having failed the test. The confidence level in the non-random nature of this threshold is near 99%.

The study also demonstrated that by subsequent nondestructive inspection, 43 tires which had passed the Compliance Test had undergone some degradation.

DOT-TSC-NHTSA-79-31
AUTOMOTIVE MARKETING METHODS AND PRACTICE
Green (Gilbert R.) and Co., Inc., Natick, MA.
Patricia Braden, Seymour Marshak, and Robert Whorf
PB-300-771
DOT-HS-804 522
Final Report Sep 1979 185p.

Automobile industry and trade
Automobile industry and trade—Planning

The report is a comprehensive examination of the current marketing practices, marketing methodologies, and decision-making processes utilized by the domestic automotive industry. The various marketing elements, such as products, consumer behavior, sales, promotion, distribution, advertising, and regulatory constraints are reviewed as they pertain to the automotive industry. Specifically, the report's seven chapters include (1) a review of industry competitive relationships, (2) practical constraints on automotive decision-making, (3) corporate organization for decision-making, (4) understanding the consumer, (5) marketing decision-making, (6) assessment of current problems and issues, and (7) state-of-the-art summary. Four appendices focus on (1) the organization of General Motors Corporation, (2) the organization of Ford Motor Company, (3) the product and market planning process graphics, and (4) an example of a forward product strategy document. Where appropriate, the report highlights the differences in marketing approaches employed by the four automotive manufacturers and some of the adjustments and problems faced by these manufacturers in their marketing pursuits.

DOT-TSC-NHTSA-79-33
PROCEEDINGS OF THE WORKSHOPS ON TECHNOLOGICAL CHANGE IN THE U.S. AUTOMOBILE INDUSTRY, OCTOBER 1977 THROUGH APRIL 1978, AND THE SYMPOSIUM ON TECHNOLOGY, GOVERNMENT AND THE AUTOMOTIVE FUTURE, OCTOBER 19-20, 1978
Harvard Univ., Boston, MA, Graduate School of Business Administration
William J. Abernathy, and Douglas H. Ginsburg
PB80-105463
DOT-HS-804786
DOT-TSC-1384
Final Report July 1979 409p.

Automobile industry and trade—Congresses

The purpose of the meetings was to explore the implications of technological change in the U.S. automotive industry in support of improved policy formulation to meet emerging national needs. Five workshops were conducted in the following areas: (1) Motor Vehicle Regulatory Process, (2) Consumer as a Factor in Motor Vehicle Innovation, (3) the Supply Industry as a Factor in Motor Vehicle Innovation, (4) Changing Incentives for Motor Vehicle Research and Development, and (5) Role of National and Multinational Corporations in Motor Vehicle Innovation. The five key issues emanating from these workshops were the federal R&D policy in the motor vehicle sector, product rating information for consumers, regulatory decision-making, regulation and international trade, and transportation policy.

DOT-TSC-NHTSA-79-35
RAILROAD RETARDER NOISE REDUCTION: STUDY OF ACOUSTICAL BARRIER CONFIGURATIONS
Burlington Northern, Inc., St. Paul, MN.
James A. Morgan, and Uno Ingard
PB-297 502
DOT-HS-804 354
DOT-TSC-1035
Final Report May 1979 93p.

Railroad—Noise
Noise control

Field measurements of noise were made near a railroad retarder system without barriers and with acoustical barriers of various configurations. The configurations tested included acoustically reflective and acoustically absorptive barriers with heights of 4 to 12 feet and lengths extending from 0 to 22 feet beyond retarder entrance and exit. Two of the 12 foot high barriers were also tested with a 1 foot inward projecting acoustical panel lip along the top. It was found that the absorptive barriers reduced retarder noise from a few decibels inside the barriers to as much as 25 decibels at 100 feet from the retarder on the system centerline perpendicular to the tracks. Reflective barriers increased noise inside the barriers and at points outside, but near open ends of, the barriers; and reflective barrier noise reduction at 100 feet on the perpendicular centerline was limited to about 16 decibels. Retarder noise was concentrated in a frequency range between 2 and 3 kilohertz. The analytical study presented provides details on the role of observer location as well as the various aspects of barrier configuration.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHTSA-79-36
CASE STUDY OF THE INNOVATION PROCESS CHARACTERIZING THE DEVELOPMENT OF THE THREE-WAY CATALYTIC CONVERTER SYSTEM
Transportation Systems Center
Daniel Dexter
PB80-119746
HS-804-791
DOT-TSC-1355
Final Report Nov. 1979 52p.

Automobiles—Design and construction
Automobiles—Motors—Exhaust gas

This report traces the development of the three-way catalytic converter system from its origins in automaker and chemical firm research in the 1950's, to present plans preparing the system to be the auto exhaust emission control device most widely used on American cars in the 1980s. Multiple forces led to the decision by major automakers in the late 1970s to adopt the system. Among these forces were tightening exhaust emissions regulations; the development of low-cost, mass-producible system components; and institutional factors including strong systems advocates, internationalization of the auto industry, and the desire of certain technology-oriented automakers to defend their U.S. market shares by adoption of the system. The paper concludes that the three-way converter system may become the dominant auto exhaust emission control device for American-market cars in the 1980s if problems relating to adoption of the system to 6 and 8 cylinder engines, reduction in requirements for precious metals, and the development of secure sources of supply for those metals are resolved.

DOT-TSC-NHTSA-79-37
LIGHT DUTY TRUCK CHARACTERISTICS, HISTORICAL DATA BASE
Chilton Co.
C. Cantwell
PB80-145220
DOT-HS-804 787
DOT-TSC-1338
Final Report Dec 1979 60p.

Trucks
Trucks—Dynamics

The report is a collection of data concerning physical, operating, performance, and market characteristics of light duty trucks for the model years 1972 and 1975 thru 1977. The data is stored on tape in DOT/TSC DEC System 10 computer system. Information was collected from published and unpublished sources with extrapolation and correlations being made when raw data was not available. Vehicles are reported by model year and grouped by manufacturer using production volume, model, body type, engine displacement, transmission and GVWR class attributes as criteria to select representative vehicle configurations. Characteristics are documented for vehicles representative of total U.S. sales of domestic and imported light duty trucks for the model years indicated.

DOT-TSC-NHTSA-79-38
POTENTIAL OF DIESEL ENGINE, 1979 SUMMARY SOURCE DOCUMENT
Transportation Systems Center
T. Trella
PB80-193659
DOT-HS-805 130
Final Report May 1980 166p.

Diesel motor—Design
Diesel motor—Fuel

This document assesses the fuel economy potential of diesel engines in future passenger cars and light trucks. The primary technologies evaluated include: (1) engine control strategy and implementation, (2) the engine design variables, (3) emissions and noise, (4) fuels, (5) lubricants, (6) vehicle-engine matching, and (7) the effects of vehicle characteristics. The major findings are summarized.

DOT-TSC-NHTSA-79-40
POTENTIAL OF DIESEL ENGINE, EMISSION TECHNOLOGY
Transportation Systems Center
Joseph Sturm, and Thomas Trella
PB80-192685
DOT-HS-805 239
Final Report Mar 1980 47p.

Diesel motor—Design
Diesel motor—Technological innovations

This report surveys diesel engine emission technologies applicable to passenger cars and light trucks. The general design and operating features are presented and discussed. Current and state-of-the-art concepts are reviewed with the focus on control of diesel emissions through (1) modification of the combustion process, (2) aftertreatment systems and (3) fuel modifications.

DOT-TSC-NHTSA-79-41
POTENTIAL OF DIESEL ENGINE, DIESEL ENGINE DESIGN CONCEPTS, CONTROL STRATEGY AND IMPLEMENTATION
Transportation Systems Center
T. Trella, and T. Shen
PB80-195746
DOT-HS-805-240
Final Report Mar 1980 61p.

Diesel motor—Design
Diesel motor—Fuel

Diesel engine design concepts and control system strategies are surveyed with application to passenger cars and light trucks. The objective of the study is to indicate the fuel economy potential of the technologies investigated. The engine design parameters discussed are related to the engine configuration, combustion process, valving, friction, compression ratio, and heat transfer. Various engine control strategies and control implementation are considered.

DOT-TSC-NHTSA-79-42
POTENTIAL OF DIESEL ENGINES, FUELS AND LUBRICATION TECHNOLOGY
Fiat Centro Richerche, Turin (Italy)
Giorgio Cornetti
PB80-197098
DOT-RS-805 241
DOT-TSC-1424
Final Report Mar 1980 62p.

Diesel Fuels
Diesel motor—Fuel

The chemical and physical properties of diesel fuel are reviewed along with their relationships to the fuel economy and emissions of diesel powered automobiles and light trucks. The fuels considered include both conventional and alternative diesel fuels. Additives are surveyed and their impacts on combustion and overall engine performance are discussed. The fuel economy potential of future lubricants is investigated, particularly (1) upgraded mineral oils, (2) synthetic oils, and (3) colloidal suspension in mineral oils.

DOT-TSC-NHTSA-79-43
AMBIENT TEMPERATURE, FUEL ECONOMY, EMISSIONS, AND TRIP LENGTH
Department of Energy, Bartlesville, OK.
Bartlesville Energy Research Center
B. H. Eccleston
PB-298 847
DOT-HS-803 668
DOT/TSC-RA-76-48
Final Report Aug. 1979 122p.

Automobiles—Fuel consumption
Automobiles—Exhaust gas

This report examines the relationship among automotive fuel economy, ambient temperature, cold-start trip length, and drive-train component temperatures of four 1977 vehicles. Fuel economy exhaust emission, and drive-train temperatures were measured at temperatures of 20F, 45F, 70F, and 100F using 1975 Federal Test Procedure (75 FTP) and the EPA highway fuel economy test (HWFET).

DOT-TSC-NHTSA-79-45
NOISE ABATEMENT TECHNIQUES FOR CONSTRUCTION EQUIPMENT
Society of Automotive Engineers, Inc.
William J. Toth
PB-300 948
DOT-HS-803 293
DOT-TSC-915
Final Report Aug 1979 187p.

Construction Equipment—Noise Control
Construction Equipment—Testing

The primary objective of this work was to transit technology developed in the area of truck noise reduction to that of construction equipment. Included is information gathered from previous contracts, surveys of manufacturers, a noise impact ranking by equipment type, engine and equipment test results, specific information to enable equipment owners to reduce noise from their equipment, and recommendations dealing with reasonable noise level goals for used equipment. Work accomplished under this contract involved the compilation of

comprehensive specifications for diesel engines greater than 50 horsepower used in the construction industry, the development of a comparative muffler selection procedure, and the collection of costs for mufflers and complete exhaust systems. A noise impact ranking was developed to characterize equipment types with respect to degree of noise pollution. This ranking was based on the average machine noise level, the typical percentage of time the machine was at full load, the average production rate per year based on production figures of the last ten years, and proximity of machine use to human population. Using the noise impact rating system, front-end loaders, tractors, and backhoes (excavators) were identified as the three machines of the greatest impact. Detailed tests conducted on two classes of tractors, a front-end loader and a backhoe, identified the contributions of the various major component noise sources to overall machine noise levels. Results indicate that construction equipment produced since the late 1960's have utilized reasonable muffling such that exhaust noise is not generally the dominant noise source.

DOT-TSC-NHTSA-79-47
ULTRASONIC INSPECTION OF TEN RETREADED TIRES AND THIRTY-TWO CASINGS
Transportation Systems Center
Stephen Bobo
PB80-130503
HS-805-019
Final Report Nov. 1979 30p.

Automobiles—Tires—Testing

TSC examined 42 tires ultrasonically. Of these, 10 reportedly had belt-edge separations which had been identified and measured prior to retreading (control group). The remaining 32 were reportedly used casings in good condition ready for retreading. The ultrasonic data were analyzed and numerical scores from 1 (poor) to 9 (excellent), were assigned to tread, belts, sidewalls, and carcass for each tire. The tires were ranked in order of overall numerical scores. In the control group there were 5 tires with a belt score of 5; 4 tires with a belt score of 7 or less.

In the group of 32 casings the belt scores were as follows; 3 for one casing, 4 for two casings, 5 for one casing, 6 for five casings, 7 for five casings, 8 for eight casings, 9 for 10 casings. If the threshold score which separates defective casings from the remainder is taken to be 7 (on the basis that all tires in the control group had separations), then 16 tires of the 32 are suspect.

DOT-TSC-NHTSA-79-48
REPORT OF PRE AND POST ROAD TEST ULTRASONIC INSPECTION RESULTS ON 134 PASSENGER TIRES
Transportation Systems Center
George Berube
PB80-128721
HS-805-029
Final Report Nov. 1979 38p.

Automobiles—Tires—Testing

A study was conducted to compare ultrasonic inspection data from 134 tires prior and subsequent to road tests in order to determine whether excessive tread wear could be related to characteristics detected by the ultrasonic inspection. Analysis of data on all tires after road test resulted in the finding that nine of the tires exhibited substantial changes which may be related to abnormal tread wear.

DOT-TSC-NHTSA-79-49, I
AN ANALYSIS OF THE AUTOMOBILE MARKET: MODELING THE LONG-RUN DETERMINANTS OF THE DEMAND FOR AUTOMOBILES
Volume I: The Wharton EFA Automobile Demand Model
Wharton EFA, Inc.
George R. Schnik, and Colin J. Loxley
PB80-143316
DOT-HS-804 847
DOT-TSC-1072
Final Report Dec 1979 164p.

Automobile Industry and Trade
Automobiles—Marketing

An econometric model is developed which provides long-run policy analysis and forecasting of annual trends, for U.S. auto stock, new sales, and their composition by auto size-class. The concept of 'desired' (equilibrium) stock is introduced. 'Desired stock' and its composition by size-class are related to numerous economic and demographic variables using cross-section data. Among them is a new 'capitalized cost per mile' measure, which expresses all costs over time relative to miles driven, discounted back to the present. New registrations, total and by class, and scrappage are found to be strongly related to 'desired stock' relative to actual stock, with other influences operating as 'speed of adjustment' factors. Fuel efficiency is analyzed in detail, relating mpg by class to physical vehicle characteristics and technological

developments. Purchase prices and options expenditures are analyzed and all cost measures distinguished by foreign vs. domestic origin as well as by size-class. Volume I summarizes and describes the study, and contains a forecast through 2000. Volume II contains extensive simulation analysis, with public policy implications. Volume III contains data and methodology appendices.

DOT-TSC-NHTSA-79-49, II
AN ANALYSIS OF THE AUTOMOBILE MARKET: MODELING THE LONG-RUN DETERMINANTS OF THE DEMAND FOR AUTOMOBILES.
Volume II: Simulation Analysis Using the Wharton EFA Automobile Demand Model
Wharton EFA, Inc.
George R. Schink, and Colin J. Loxley
PB80-165608
DOT-HS-804 848
DOT-TSC-1072
Final Report Dec 1979 353p.

Automobile industry and trade
Automobiles—Marketing

An econometric model is developed which provides long-run policy analysis and forecasting of annual trends, for U.S. auto stock, new sales, and their composition by auto size-class. The concept of 'desired' (equilibrium) stock is introduced. 'Desired stock' and its composition by size-class are related to numerous economic and demographic variables using cross-section data. Among them is a new 'capitalized cost per mile' measure, which expresses all costs over time relative to miles driven, discounted back to the present. New registrations, total and by class, and scrappage are found to be strongly related to 'desired' stock relative to actual stock, with other influences operating as 'speed of adjustment' factors. Fuel efficiency is analyzed in detail, relating mpg by class to physical vehicle characteristics and technological developments. Purchase prices and options expenditures are analyzed and all cost measures distinguished by foreign vs. domestic origin as well as by size-class. Volume I summarizes and describes the study, and contains a forecast through 2000. Volume II contains extensive simulation analysis, with public policy implications. Volume III contains data and methodology appendices.

DOT-TSC-NHTSA-79-49, III
AN ANALYSIS OF THE AUTOMOBILE MARKET: MODELING THE LONG-RUN DETERMINANTS OF THE DEMAND FOR AUTOMOBILES.
Volume III: Appendices to the Wharton EFA Automobile Demand Model
Wharton EFA, Inc.
George R. Schink, and Colin J. Loxley
PB80-166580
DOT-HS-804 855
DOT-TSC-1072
Final Report Dec 1979 274p.

Automobile industry and trade
Automobiles—Marketing

An econometric model is developed which provides long-run policy analysis and forecasting of annual trends, for U.S. auto stock, new sales, and their composition by auto size-class. The concept of 'desired' (equilibrium) stock is introduced. 'Desired stock' and its composition by size-class are related to numerous economic and demographic variables using cross-section data. Among them is a new 'capitalized cost per mile' measure, which expresses all costs over time relative to miles driven, discounted back to the present. New registrations, total and by class, and scrappage are found to be strongly related to 'desired stock' relative to actual stock, with other influences operating as 'speed of adjustment' factors. Fuel efficiency is analyzed in detail, relating mpg by class to physical vehicle characteristics and technological developments. Purchase prices and options expenditures are analyzed and all cost measures distinguished by foreign vs. domestic origin as well as by size-class. Volume I summarizes and describes the study, and contains a forecast through 2000. Volume II contains extensive simulation analysis, with public policy implications. Volume III contains data and methodology appendices.

DOT-TSC-NHTSA-79-51
CORRELATION BETWEEN ULTRASONIC NONDESTRUCTIVE INSPECTION AND WHEEL TEST OF 34 RETREADED TIRES
Transportation Systems Center
S. N. Bobo
PB80-131816
HS-805-030
Final Report Nov. 1979 88p.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Automobiles—Tires—Testing

This report covers a test in which 34 retread tires were inspected using reflection ultrasound nondestructive inspection, wheel tested and then subjected to failure analysis by sectioning. The results of this work demonstrate for the first time the ability of ultrasound to identify and classify defects in tires which lead to failures.

The nondestructive inspection (NDI) carried out on all 34 tires identified five tires which had major flaws, predominantly separations, and five tires with minor flaws. The wheel test was an 8-hour full-load 55 MPH test in which six of the 34 tires failed. All six failed tires were analyzed by an outside contractor and the results compared with flaw assessments made by nondestructive inspection. All six failed tires came from the ten identified by NDI as having flaws. Five of the six were tires listed as having major flaws by NDI with agreement between nondestructive inspection and failure analysis. Recommendations arising from the study are that the work be used more extensively to support NHTSA's ongoing rule enforcement activities; particularly in the area of identifying and defining separations as cited in FMVSS 109 and buff damage as cited in FMVSS 117.

DOT-TSC-NHTSA-79-52
POTENTIAL OF SPARK IGNITION ENGINE, 1979 SUMMARY SOURCE DOCUMENT
Transportation Systems Center
T. Trella, R. Zub, and R. Colello
PB80-191034
DOT-HS-805 132
Final Report Mar 1980 208p.

Internal combustion engines, Spark ignition
Internal combustion engines, Spark ignition—Fuel consumption

This report provides an assessment of the potential for spark ignition engines passenger cars and light trucks. The assessment includes: tradeoffs between fuel economy and emissions; improvements in spark ignition engine efficiency; improvements in engine parasitics; improvements due to transmissions; effect of aerodynamic drag and tire rolling resistance on fuel economy; effect on performance and fuel economy of weight and axle ratio; lubricant improvements; impact of fuels; and noise considerations.

DOT-TSC-NHTSA-79-53
POTENTIAL OF SPARK IGNITION ENGINE, EFFECT OF VEHICLE DESIGN VARIABLES ON TOP SPEED, PERFORMANCE, AND FUEL ECONOMY
Transportation Systems Center
Ralph W. Zub, Carol M. Neckyfarow, William M. Lew, and Ralph G. Collelo
PB80-191836
DOT-HS-805 133
Final Report Mar 1980 56p.

Automobiles—Design and construction
Internal combustion engines, Spark ignition

The purpose of this report is to evaluate the effect of vehicle characteristics on vehicle performance and fuel economy. The studies were performed using the VEHSIM (vehicle simulation) program at the Transportation Systems Center. The computer simulation offers repeatability and can predict minute changes in fuel economy based on relatively small vehicle alterations. The degree to which each vehicle parameter is modified is based upon projections presented in current literature. The results are assessed and an explanation of the interaction of the vehicle design characteristics on performance is presented.

DOT-TSC-NHTSA-79-54
WEIGHT REDUCTION POTENTIAL OF AUTOMOBILES AND LIGHT TRUCKS: 1979 SUMMARY SOURCE DOCUMENT
Transportation Systems Center
Hsi-Sheng Hsia, and James A. Kidd
PB80-193543
DOT-HS-805-131
Final Report Mar 1980 194p.

Automobiles—Design and construction
Motor vehicles—Design and construction

The purpose of this report is to provide an assessment of the potential for weight reduction for passenger cars and light trucks (including pickup trucks, vans, and utility vehicles of GVWR up to 8500 pounds) in the 1980 to 2000 model year period. Various aspects of vehicular performance are addressed. Four weight reduction scenarios involving material substitution are presented with increasing technological sophistication. In addition to the baseline data, dominant case assessments for high strength steel, fiber reinforced plastic, aluminum, and hybrid reinforced plastics are provided.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

DOT-TSC-NHTSA-79-55
POTENTIAL OF SPARK IGNITION ENGINE, ELECTRONIC ENGINE AND TRANSMISSION CONTROL
Little (Arthur D.), Inc.
Frank J. Garofalo
PB80-192701
DOT-HS-805 134
DOT-TSC-1046
Final Report Mar 1980 105p.

Electronic control
Internal combustion engines, Spark ignition

This report identifies, evaluates, and documents the characteristics and functions of significant electronic engine and powertrain control systems. Important considerations in the assessment are the powertrain variables controlled, the technology utilized, and the fuel economy gains achieved. A detailed analysis, by engine class and control system technology, is made in order to quantify specific advantages of various electronic systems and their capability to achieve increased engine efficiency and vehicle fuel economy. An attempt is made to identify the minimum technology required to move from the 1978 emission standards of 1.5 HC/15.0 CO/2.0 NOx to the 1981 emission standard of .41 HC/3.4 CO/1.0 NOx with no fuel economy losses. This 1981 standard and the level of technology required to achieve it represents a baseline from which an analysis of further potential fuel economy gains via electronic control systems is made.

DOT-TSC-NHTSA-79-62, I
DATA BASE FOR LIGHT-WEIGHT AUTOMOTIVE DIESEL POWER PLANTS.
Volume I: Executive Summary
Volkswagenwerk A.G., Wolfsburg (Germany, F.R.)
B. Wiedermann, and H. Schmidt
PB80-204399
DOT-HS-805 276
DOT-TSC-1193
Final Report December 1979 47p.

Automobile industry and trade
Diesel motor
Diesel motor—Design and construction

The effects on fuel economy, emissions, passenger car safety and other variables due to the installation of light-weight Diesel powerplants were studied. Experimental data was obtained on naturally aspirated and turbocharged Diesel engines installed in subcompact and compact passenger vehicles. The data includes fuel economy as a function of engine type and horsepower, as a function of vehicle inertia weight and as a function of regulated emission constraints. Unregulated emissions have been characterized during the course of the work. The compatibility of the Diesel engine studied with passenger car structures incorporating advanced frontal crashworthiness capabilities was also verified. Volume I, the Executive Summary, presents a summary of the data obtained and a review of the important conclusions.

DOT-TSC-NHTSA-79-62, II
DATA BASE FOR LIGHT-WEIGHT AUTOMOTIVE DIESEL POWER PLANTS.
Volume II: Discussion and Results
Volkswagenwerk A.G., Wolfsburg (Germany, F.R.) Research Div.
B. Wiedemann and R. Schmidt
PB80-204407
DOT-HS-805 277
DOT-TSC-1193
Final Report December 1979 505p.

Automobile industry and trade
Diesel motor
Diesel motor—Design and construction

The effects on fuel economy, emissions, passenger car safety and other variables due to the installation of light-weight Diesel powerplants were studied. Experimental data was obtained on naturally aspirated and turbocharged Diesel engines installed in subcompact and compact passenger vehicles. The data includes fuel economy as a function of engine type and horsepower, as a function of vehicle inertia weight and as a function of regulated emission constraints. Unregulated emissions have been characterized during the course of the work. The compatibility of the Diesel engine studied with passenger car structures incorporating advanced frontal crashworthiness capabilities was also verified. Volume II, the main body of the report, provides a discussion of the fuel economy and emissions obtained, a description of the engine/vehicle systems tested and the results of factory driveability tests.

DOT-TSC-NHTSA-79-62, III
DATA BASE FOR LIGHT-WEIGHT AUTOMOTIVE DIESEL POWER PLANTS.
Volume III: Miscellaneous Data
Volkswagenwerk, A.G., Wolfsburg (Germany, F.R.) Research Div.
B. Wiedemann, and R. Schmidt
PB80-204415
DOT-HS-805 278
DOT-TSC-1193
Final Report December 1979 205p.

Automobile industry and trade
Diesel motor
Diesel motor—Design and construction

The effects of fuel economy, emissions, passenger car safety and other variables due to the installation of light-weight Diesel powerplants were studied. Experimental data was obtained on naturally aspirated and turbocharged Diesel engines installed in subcompact and compact passenger vehicles. The data includes fuel economy as a function of engine type and horsepower, as a function of vehicle inertia weight and as a function of regulated emission constraints. Unregulated emissions have been characterized during the course of the work. The compatibility of the Diesel engine studied with passenger car structures incorporating advanced frontal crashworthiness capabilities was also verified. Volume II, the appendixes, presents miscellaneous data used during the program.

DOT-TSC-NHTSA-80-5
ASSESSMENT OF ENVIRONMENTAL IMPACTS OF LIGHT DUTY VEHICLE DIESELIZATION
Aerospace Corp.
L. Forrest, W. B. Lee, and W. M. Smalley
Sponsored in part by National Highway Traffic Safety Administration, Washington, DC. Office of Research and Development.
PB80-200759
ATR-79(7740)-1
DOT-HS-805-373
DOT-TSC-1530
Final Report June 1980 345p.

Automobiles—Environmental aspects
Diesel motor exhaust gas

This report provides a first-level assessment of the environmental effects which might result if diesel vehicles in large numbers were produced and sold, thereby changing the mix of vehicles in the in-use fleet so that a substantial fraction were diesel-powered in future years. The study emphasizes the impacts of diesel exhaust emissions on air quality, especially particulates and odor. Impacts are projected to the year 2000, based on several selected scenarios for the growth in diesel population. Two types of air quality analyses are conducted; areawide and local site. The areawide analysis examines pollutant dump effects in three metropolitan city areas. The local analysis investigates pollutant concentrations in several critical urban sites: the heavily traveled freeway, the street canyon, and the enclosed parking garage. A general description of the methodology is provided. Results are presented in terms of trends in the emission inventories for the city-wide analysis and as pollutant concentration profile for the local site analysis. The areawide analysis indicated that dieselization would increase urban TSP by less than 3%, while air quality relative to HC, CO and NOx would improve. The local site analysis shows that dieselization would produce diesel particulate concentrations ranging from 9 to 13 micrograms/cubic meter at long term exposure locations in the freeway and street canyon sites and 24 micrograms/cubic meter in the enclosed parking garage. Odor effects in a nominal diesel-gasoline vehicle mix are found to be negligible.

DOT-TSC-NHTSA-80-6
LIGHT DUTY TRUCK WEIGHT REDUCTION EVALUATION
Pioneer Engineering and Mfg. Co., Inc.
Norman F. Ludtke
PB80-224132
DOT-HS-805 459
DOT-TSC-1451
Final Report August 1980 205p.

Trucks—Design and construction
Trucks—Weight

This contract covers the identification of Types, Makes and Models which constitute the Light Truck world fleet. The attributes which describe the critical functional aspects of trucks of this size are established and specifications to define the attributes obtained. Methods of comparison of attributes are developed to provide a means of comparison leading to the selection of the most efficient design for each type of vehicle. The potential for reduction of function is also evaluated. The weight reduction potential for each selected vehicle type is determined based on size reduction, redesign and material substitution methods. Based on the preceding Product Dependent Weight reductions, related reductions in Power and Weight Dependent weights are determined to provide a total weight reduction potential. Effects of the weight reduction are provided.

DOT-TSC-NHTSA-80-9
PERFORMANCE CHARACTERISTICS OF 1977 FORD 300 CID ENGINE
Transportation Systems Center
Joseph Boziuk
PB80-155419
DOT-HS-805-220
Final Report February 1980 46p.

Automobiles—Motors—Testing
Ford automobile

Experimental data were obtained in dynamometer tests of a 1977 Ford 300 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM).

DOT-TSC-NHTSA-80-10
PERFORMANCE CHARACTERISTICS OF 1977 AMERICAN MOTORS 304 CID ENGINE
Transportation Systems Center
Joseph Boziuk
PB80-155484
DOT-HS-805 221
Final Report February 1980 47p.

American Motors automobile
Automobiles—Motors—Testing

Experimental data were obtained in dynamometer tests of a 1977 AM 304 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM).

DOT-TSC-NHTSA-80-11
PERFORMANCE CHARACTERISTICS OF 1977 GENERAL MOTORS 350 CID ENGINE
Transportation Systems Center
Joseph Boziuk
PB80-170012
DOT-HS-805-222
Final Report February 1980 48p.

Automobiles—Motors—Testing
General Motors automobile

Experimental data were obtained in dynamometer tests of a 1977 GM 350 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM).

DOT-TSC-NHTSA-80-12
PERFORMANCE CHARACTERISTICS OF 1977 CHRYSLER 318 CID ENGINE
Transportation Systems Center
Joseph Boziuk
PB80-155336
DOT-HS-805 223
Final Report February 1980 45p.

Automobiles—Motors—Testing
Chrysler automobile

Experimental data were obtained in dynamometer tests of a 1977 Chrysler 318 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady-state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM).

DOT-TSC-NHTSA-80-13
RESULTS OF ENERGY-LOSS MEASUREMENTS ON PASSENGER CAR TIRES OPERATING IN THE FREE-ROLLING AND BRAKING/TRACTION MODES
Calspan Advanced Technology Center
L. Bogdan
PB80-165251
DOT-HS-805 224
DOT-TS-15361, DOT-TS-15581
Final Report February 1980 57p.

Automobiles—Tires—Testing
Tires, Rubber—Traction

This report described the results of tests on twelve passenger car tires performed on Calspan's Tire Research Facility (TIRF). The tests were used to measure energy loss under three different test conditions: (1) with the tire in a straight, free-rolling condition; (2) with the tires subjected to driving/braking torques required by conformance to the Federal Urban Driving Cycle (LA-4); and (3) with the tires subjected to driving/braking torques required by conformance to the Federal Highway Fuel Economy Test (HFET). The sample set of tires was representative of current original equipment, and ranged in size from a P155/80D13 to an HR78-15.

OFFICE OF THE SECRETARY OF TRANSPORTATION

DOT-TSC-OST-79-1, VOL. I
FREIGHT TRANSPORTATION ENERGY USE.
Volume I: Summary and Baseline Results
CACI, Inc.—Federal, Arlington, VA
Michael S. Bronzini
PB-301 153
SET: PB-301 152
DOT-TSC-1252-1
Final Report July 1979 60p.

Freight and freightage—Fuel consumption
Freight and freightage—Mathematical models

The overall design of the TSC Freight Energy Model is presented. A hierarchical modeling strategy is used, in which detailed modal simulators estimate the performance characteristics of transportation network elements, and the estimates are input to a multimodal transportation network model which emulates system performance. The purpose of the model is to predict the impacts of changes in modal technology and operations on transportation energy use, costs, service levels, and on shipper modal choice decisions. The model can also generate energy-optimal freight transportation usage patterns and predict the consequences to carriers and shippers of energy-use optimization. Model calibration results for a base year (1972) and baseline estimates for the year 1990 are presented.

DOT-TSC-OST-79-1, VOL. 2
FREIGHT TRANSPORTATION ENERGY USE.
Volume II: Methodology and Program Documentation
CACI, Inc.—Federal, Arlington, VA
Michael S. Bronzini, and Roger C. Miller
PB-301 154
SET: PB-301 152
DOT-TSC-1252-2
Final Report July 1979 227p.

Freight and freightage
Freight and freightage—Fuel consumption

The structure and logic of the transportation network model component of the TSC Freight Energy Model are presented. The model assigns given origin-destination commodity flows to specific transport modes and routed, thereby determining the traffic load placed upon each network element, and produces transportation cost, transit time, and energy-use estimates at several levels of detail. User and programmer instructions, including input data formats, program computation methods, and program output descriptions and examples are provided.

DOT-TSC-OST-79-1, VOL. 3
FREIGHT TRANSPORTATION ENERGY USE.
Volume III: Freight Network and Operations Database
CACI, Inc.—Federal, Arlington, VA
Michael S. Bronzini
PB-301 155
Set: PB-301 152
DOT-TSC-1252-3
Final Report July 1979 136p.

Freight and freightage
Freight and freightage—Fuel consumption

The data sources, procedures, and assumptions used to generate TSC national freight network and operations database are documented. National rail, highway, waterway, and pipeline networks are presented, and estimates of facility capacity, travel speed, fuel consumption, and average cost are made. Commodity characteristics and interregional flows are also presented.

DOT-TSC-OST-79-1, VOL. 4
FREIGHT TRANSPORTATION ENERGY USE.
Volume IV: Analysis of Selected Energy Conservation Options
CACI, Inc.—Federal, Arlington, VA
Michael W. Bronzini
PB-301 156
SET: PB-301 152
DOT-TSC-1252-4
Final Report July 1979 140p.

Freight and freightage
Freight and freightage—Fuel consumption

The TSC Freight Energy Model is applied to a preliminary analysis of two energy conservation options: (1) increased use of Run-Through TOFC rail service; and (2) use of double 40-foot trailers on all divided highways. These options are examined primarily within the limited context of competition for movement of intercity freight which presently moves in single trailer highway service.

OFFICE OF THE SECRETARY OF TRANSPORTATION

DOT-TSC-OST-79-3, I
COMPARISON OF SPECIAL GROUP EXPERIENCES IN ESTABLISHING INDEPENDENT MOTOR CARRIER BUSINESSES.
Volume I: Executive Summary
Transportation and Economic Research Associates, Inc., Arlington, VA
Sponsored in part by Office of the Assistant Secretary for Policy and International Affairs (DOT), Washington, DC. Office of Transportation Regulation
PB-300 537
DOT-TSC-1636
Final Report August 1979 14p.

Trucks
Freight and freightage

The report summarizes the experiences and special problems of minority trucking firms. The firms are classified as unregulated local truckers, unregulated owner-operators, and regulated interstate common carriers. Although the general findings reflect small business problems that affect minorities and non-minorities alike, minority truckers seem to have more trouble developing financial resources. The most important finding is that minority common carriers have found it nearly impossible to acquire operating authority through the regular channels—generally, they purchase their operating rights.

DOT-TSC-OST-79-3, II
COMPARISON OF SPECIAL GROUP EXPERIENCES IN ESTABLISHING INDEPENDENT MOTOR CARRIER BUSINESSES,
VOLUME II: The Main Text
Transportation and Economic Research Associates, Inc. Arlington, VA
Sponsored in part by Office of the Assistant Secretary for Policy and International Affairs (DOT), Washington, DC. Office of Transportation Regulation
PB-300 538
DOT-TSC-1636
Final Report August 1979 123p.

Trucks
Freight and freightage

The report examines the experiences and special problems of minority trucking firms. The firms are classified as unregulated local truckers, unregulated owner-operators, and regulated interstate common carriers. Random samples are developed for minority and non-minority firms in each category, and the selected companies are surveyed. Although the general findings reflect small business problems that affect minorities and non-minorities alike, minority truckers seem to have more trouble developing financial resources. The most important finding is that minority common carriers have found it nearly impossible to acquire operating authority through the regular channels—generally, they purchase their operating rights.

DOT-TSC-OST-79-4
LIGHT RAIL TRANSIT: STATE-OF-THE-ART OVERVIEW
Transportation Systems Center
PB80-103641
Final Report May 1977 82p.

Local transit
Local transit — Planning

This document presents an overview of light rail transit, an urban transit alternative which has the potential to help fill the need for flexibility in public transportation. Existing and proposed U.S. and Canadian light rail transit systems are described with a historical perspective. The technical components and service characteristics of this mode are analyzed. The document also deals with a number of planning and implementation issues, including economics of operation, and various environmental and social concerns.

RESEARCH & SPECIAL PROGRAMS ADMINISTRATION

DOT-TSC-RSPA-78-23
A COMPARATIVE STUDY OF THE RIDE QUALITY OF TRACKED RAM AIR CUSHION VEHICLE (TRACV) SUSPENSION ALTERNATIVES
Princeton Univ., NJ.
Dept. of Mechanical and Aerospace Engineering
R. A. Luhrs, L. M. Sweet, and H. C. Curtiss, Jr.
PB-297 840
DOT-TSC-682
Interim Report June 1979 132p.

Railroads — Passenger-cars — Design and construction — Mathematical models

A linearized model of the pitch-heave dynamics of a Tracked Ram Air Cushion Vehicle is presented. This model is based on aerodynamic theory which has been verified by wind tunnel and towed model experiments. The vehicle is assumed to be equipped with two controls which can be configured to provide various suspension system characteristics. The ride qualities and dynamic motions of the rigid vehicle moving over a guideway described by roughness characteristics typical of highways is examined in terms of the rms values of the vertical acceleration in the foremost and rearmost seats in the passenger cabin and the gap variations at the leading and trailing edges of the vehicle. The improvement in ride qualities and dynamic behavior which can be obtained by passive and active suspension systems is examined and discussed. Optimal regulator theory is employed to design the active suspension. The predicted rms values of the vertical acceleration in the one-third octave frequency bands are compared with the vertical ISO Specification. It is shown that marked improvements in the ride qualities can be obtained with either the passive or active suspension systems.

DOT-TSC-RSPA-79-1
EFFECTS OF THE RIDE ENVIRONMENT ON PASSENGER ACTIVITIES: A FIELD STUDY ON INTERCITY TRAINS
Transportation Systems Center
Anna M. Wichansky
PB-293 389
Final Report January 1979 351p.

Human engineering
Railroads — Passenger traffic

A three-part field study of passenger activities (e.g., reading, writing, talking, sleeping) was conducted on intercity Amtrak trains in the north-eastern United States to determine the relationships between the ride environment, subjective passenger comfort and satisfaction, and overt passenger behavior. From observations of 7000 revenue passengers over a one-year period, a stable relative frequency distribution of 12 categories of passenger activity in three effort classes was established. Reading and viewing were observed most often; handcrafts and games were seldom observed. An Amtrak survey of ride quality and activity preferences was also conducted using over 800 revenue Northeast Corridor passengers. Although passengers rated the ride as comfortable, ride motions were perceived to interfere with performance of visual/motor tasks (e.g., Reading and Writing). Passengers' preferences for activities were also found to increase with trip distance. In order to quantify ride quality/activity relationships, observations of passenger activity were made simultaneously with measurements of vibration in six degrees of freedom, acoustic noise, temperature, relative humidity, and illumination aboard 77 Amtrak vehicles. Correlational analyses revealed that rotational (rather than linear) motions were associated with low frequencies of motor and conversational activity and high levels of rest behavior. Activity levels also varied with vehicle type and time of day. Multiple regression techniques were used to develop linear equations of physical ride quality and trip variables which account for 20% of the variance in the relative frequencies of various types of activities.

DOT-TSC-RSPA-79-2
A STUDY OF TERRESTRIAL RADIO DETERMINATION, APPLICATIONS AND TECHNOLOGY
Massachusetts Inst. of Tech.,
Cambridge Electronic Systems Lab.
J. E. Ward, M. E. Connelly, and A. K. Tetewsky
PB-293 481
DOT-TSC-1274
Final Report February 1979 207p.

Automatic vehicle monitoring
Loran
Telecommunication systems

This report describes the results of a study of terrestrial radio determination (TRD) applications and technology. Considerable emphasis has been placed on automatic automotive vehicle location on monitoring (AVL or AVM) systems because almost all of the system designs, tests, and operational installations over the past decade have been in these areas. Land vehicle applications considered include law enforcement, taxicabs, public transportation, emergency services, and trucking. The four basic TRD technologies—hyperbolic, multilateration, proximity, and dead reckoning—are discussed and compared. Particular points of comparison are accuracy, coverage area, measurement rates, communication requirements,

vehicular capacity, and fixed installations required. Also discussed are the pros and cons of centralized vs. decentralized systems, multi-user systems, the advantages of hybridization among TRD technologies to achieve system goals in particular applications, and the results of Loran-C measurements made in Boston as part of the study. The subject of TRD communication has received particular attention, since in many TRD systems, communications on land-mobile radio channels are presented, existing TRD communications are described and compared, and some suggestions for improvement, perhaps involving development and FCC authorization of new types of radio channels, are presented. Conclusions are presented on the potential benefits of TRD, and on the actions that U.S. Government agencies might take in regard to fostering TRD developments and applications.

DOT-TSC-RSPA-79-3
THE COSTS AND BENEFITS OF A MID-CONTINENT EXPANSION OF LORAN-C
Transportation Systems Center
R. L. Wiseman, and C. M. Veronda
PB-294 614
Final Report March 1979 177p.

Loran
Navigation — Safety measures

Loran-C chains currently in operation or approved for construction will soon cover not only the U.S. coastal and Great Lakes waters, but also 63 percent of the land area and 92 percent of the population of the contiguous 48 states. The mid-continent expansion of Loran-C, representing the completion of nationwide coverage, could be provided at an initial cost of $22 million plus $1.1 million a year in operations and maintenance expenses. These costs would be less than 20 percent of the existing facilities investment already in place and operated by the Coast Guard. The results of the study indicate $125 million in Loran-C land user benefits as compared to $52 million in user and Loran-C chain costs during the 1982 to 1990 time period. Significant benefits were found in emergency medical services ($52M), rural fire suppression ($22M), police management ($17M), and highway accident location and traffic records ($14M). Using a 10 percent discount rate and benefit estimates restricted to the mid-continent area, other cost-effective applications (benefit-to-cost ratio higher than five) were: nuclear materials security, aerial spraying, biomass inventory, and forest and wildfire suppression. These estimates were obtained through extensive discussions with seven federal agencies (HEW, FHWA, NHTSA, DOE, etc.), many state and local agencies, and industry. The results are conservative and represent only the public (as opposed to private) benefits of a limited number of potential land applications of Loran-C.

DOT-TSC-RSPA-79-6
FREIGHT TRANSPORTATION PETROLEUM CONSERVATION OPPORTUNITIES—VIABILITY EVALUATION
Transportation Systems Center
Domenic J. Maio
PB-294 676
Final Report March 1979 125p.

Freight and freightage
Transportation — Freight

This report develops a comprehensive perspective of current and near-term future energy demand in U.S. freight transportation. Synthesis of studies of many agencies indicate that the annual petroleum fuel demand for freight transportation in 1985 will be 5 billion gallons greater than that in 1975, even with a 7 billion gallon a year savings from conservation measures. This represents an increase in freight's share of the U.S. total transportation fuel demand from 23% to 29% because of continued freight traffic growth and the greater savings potential in passenger systems. Freight transport by rail, by highway and by rail/highway intermodal services receives the most attention in this report because these modes offer the greatest promise for significant fuel savings. Fuel consumption and conservation estimates include both intercity and local truck operations, but intercity operations of the competitive, heavy-duty trucks and general merchandise trains are the primary focus because about 60% of the potential truck fuel savings and virtually all of the rail savings in 1985 are projected to come from intercity operations. Attention is focused on considerations of the transport market place supply and demand interactions in the evaluation of alternative government policies for fuel conservation in freight systems. An overall evaluation approach is presented, analytical tools appraised, and several government policy alternatives are given a preliminary assessment. The results suggest that the most productive conservation strategies are those that focus on technological and operational improvements within the rail and highway modes having estimated savings of 28% and 18% respectively. Shifts of traffic to intermodal rail services although economically viable may prove counterproductive in certain markets in terms of energy consumption.

RESEARCH & SPECIAL PROGRAMS ADMINISTRATION

DOT-TSC-RSPA-79-7
HYBRID OPTIMIZATION IN URBAN TRAFFIC NETWORKS
Massachusetts Inst. of Tech., Cambridge Lab. for Information and Decision Systems
Han-Ngee Tan, Stanley B. Gershwin, and Michael Athans
PB-297 146
DOT-TSC-1456
Final Report April 1979 123p.

Traffic engineering
Traffic flow

The hybrid optimization problem is formulated to provide a general theoretical framework for the analysis of a class of traffic control problems which takes into account the role of individual drivers as independent decision makers. Different behavioral models for flow distribution are examined. Necessary conditions for this problem are derived, and a physical interpretation of these conditions is provided. Possible directions for the development of algorithms applicable for solving large-scale hybrid optimization problems are proposed. A procedure for computing the upper and lower bounds of the optimal cost of the hybrid optimization problem is outlined.

DOT-TSC-RSPA-79-8
THE EFFECTS OF PRIMARY POWER TRANSMISSION LINES ON THE PERFORMANCE OF LORAN-C RECEIVERS EXPERIMENTAL TERRESTRIAL APPLICATIONS
Transportation Systems Center
Peter G. Mauro, and John D. Gakis
PB-301 367
Final Report July 1979 171p.

Loran

Tests were conducted to measure the effect generated by high-voltage transmission lines with and without supervisory carrier signals on the performance of typical LORAN-C receivers which might be used for land vehicle applications of the LORAN-C Navigation System. The tests were performed on four high voltage transmission line configurations owned and operated by the Tennessee Valley Authority. Transmission lines were tested with 60Hz power impressed and absent and carrier signals impressed and absent. Data are plotted for three secondary time differences measured using the East Coast LORAN-C chain. Carolina Beach was the master and Nantucket, Mass., Jupiter, Florida, and Dana, Indiana were the secondaries. The test area chosen had extremely good LORAN-C signal coverage. In general, with the carrier of and line de-energized, acceptable receiver performance was obtained to within approximately plus or minus 100 meters from the center of the line. With the line energized, usable performance degrades to a point about plus or minus 200 meters and with asynchronous carrier signals performance is unreliable at distances less than plus or minus 300 meters. With synchronous interference the receivers would not operate properly at 1000 meters either side of the line.

DOT-TSC-RSPA-79-10
INVESTIGATION OF THE DYNAMICS OF A MAGLEV VEHICLE TRAVERSING A FLEXIBLE GUIDEWAY: THEORY AND EXPERIMENT
MITRE Corp., McLean, VA
Roger M. Katz
PB-295 786
DOT-TSC-1263
Final Report April 1979 136p.

Magnetic levitation vehicles — Testing
Magnetic suspension

This report presents the results of a research program conducted jointly by the United States Department of Transportation and the Federal Republic of Germany Ministry for Research and Technology. The object of this program was to study the dynamics of a maglev vehicle traversing a flexible guideway. Work in the U.S. was carried out at MITRE/Metrek in McLean, Virginia; work in the FRG was carried out at Trans-rapid-EMS in Munich. Two types of experiments were conducted using the full-scale KOMET test track in Manching, Germany. In the first, sinusoidal guideway deviations were deliberately introduced, and the KOMOT vehicle was run over these at various speeds up to 324 KM/HR. The second type of test involved removing pier supports from the test track in order to make it more flexible. Theoretical predictions of the dynamic motions from a MITRE computer program are compared to the experimental results.

DOT-TSC-RSPA-79-16
PROCEEDINGS OF THE WORKSHOP ON TRANSPORTATION/URBAN FORM INTERACTIONS HELD AT CAMBRIDGE, MA ON AUGUST 14-15, 1978
Transportation Systems Center
David Kahn
PB-297 565
Final Report June 1979 288p.

Urban transportation

Contents:

DOT-TSC-RSPA-79-17
THE AERODYNAMICS OF TRACKED RAM AIR CUSHION VEHICLES — EFFECTS OF PITCH ATTITUDE AND UPPER SURFACE FLOW

Transportation Systems Center
T. M. Barrows, H. C. Curtiss, Jr., W. F. Putman

DOT-TSC-682
Final Report October 1979 142p.

Railroads — Track — Inspection
Tunneling — Safety measures

Three types of experiments were conducted on geometrically similar models of a Tracked Ram Air Cushion Vehicle (TRACV). The first consisted of wind tunnel tests with the vehicle model positioned within a short segment of stationary guideway. In the second series of tests, the vehicle model was towed through a 300-foot guideway and the equilibrium position was measured as a function of model weight and center-of-gravity location. Techniques for deriving stability information from these data are described. The third type of test utilized a moving carriage which held the model at a fixed orientation relative to the guideway. The data from these tests indicate some aerodynamic interference between the carriage and the flow over the upper surface of the model.

Simplified theories are developed for the flow over the upper surface of the model and for the effect of pitch attitude on the flow under the lower surface. The level of agreement between the theory and the various testing techniques is discussed.

DOT-TSC-RSPA-79-18
NETWORK AGGREGATION IN TRANSPORTATION PLANNING MODELS

Mathtech, Inc.
Russell R. Barton, and Donald W. Hearn

PB-297 138
DOT-TSC-1443
Final Report June 1979 144p.

Transportation — Planning — Mathematical Models
Transportation Planning — Addresses, essays, lectures

This report contains six papers addressed at mathematical and computational aspects of an extraction aggregation model often employed in transportation planning studies. This model concerns the optimal flowing of an extracted subnetwork of a given network. Nonlinear decompositions are developed, duality theory is explored as a tool for measuring error, and heuristic methods are tested. An overview section summarizes prior work on network aggregation and the six papers of this report.

DOT-TSC-RSPA-79-21
IMPLICATION OF FUEL-EFFICIENT VEHICLES ON RIDE QUALITY AND PASSENGER ACCEPTANCE: WORKSHOP PROCEEDINGS, WOODS HOLE, MASSACHUSETTS, SEPTEMBER 6-8, 1978

Transportation Systems Center
Anna M. Wichansky, and A. R. Kuhlthau
Prepared in cooperation with Virginia Univ., Charlottesville, Dept. of Civil Engineering

PB80-100506
NASA-CP-2096
Final Report August 1979 119p.

Transportation — Energy conservation — Congresses
Transportation — Social aspects
Vehicles — Social aspects

The report summarizes the proceedings of the 1978 workshops on passenger ride acceptance/fuel economy tradeoffs jointly funded by the U.S. Department of Transportation and the National Aeronautics and Space Administration. Four workshops were conducted under the auspices of the Transportaion Research Board's Committee A3C11 on Ride Quality and Passenger Acceptance at the National Academy of Sciences Summer Study Center, Woods Hole, Massachusetts, from September 6-8, 1978. Topics of discussion included ride

quality and passenger acceptance problems associated with enhanced fuel efficiency of automobiles (Group A) and aircraft (Group B); shifts in intermediate range (100-500 miles) travel from automobiles to public transit (Group C); and implications of increased size disparity for ground transport freight and passenger vehicles using shared guideways (Group D). In each group, major problem areas were identified and strategies for conducting pertinent research were outlined. A glossary of technical terms and a list of workshop participants are also included in the report.

DOT-TSC-RSPA-79-25
DYNAMIC URBAN GROWTH MODELS
Transportation Systems Center
P. M. Allen, J. L. Deneubourg, M. Sanglier, F. Boon, and A. de Palma
DOT-TSC-1460
Final Report December 1979 120p.

Transportation — Planning
Transportation — Planning — Mathematical models

This report describes the further development of the dynamic models of urban evolution derived from concepts of self-organization that have recently emerged in the physical sciences. The first section contains the new inter-urban model which describes the evolution of an interacting hierarchy of urban centers and the development of internal structure within each center. It is shown how mutual interactions between elements of the system lead to a self-organization of the system through successive instabilities of the collective structure. The second section introduces the techniques of Boolean algebra to describe the evolution of the internal structure of a city and how these techniques may be used by urban planners. The final section illustrates the importance of behavioral fluctuations in transportation mode choice showing how a system reorganizes itself when critical size thresholds are exceeded.

DOT-TSC-RSPA-79-26
MAJOR RAILROAD ACCIDENTS INVOLVING HAZARDOUS MATERIALS RELEASE, COMPOSITE SUMMARIES 1969-1978
Transportation Systems Center
Theodore S. Glickman
Final Report November 1979 140p.

Railroads — Accidents
Railroads — Safety measures

This report presents composite summaries describing 75 major railroad accidents in which hazardous materials were released. The selected accidents occurred during the years 1969-1978. The data contained in the individual summaries were derived from various government and private agency reports and files. Categories used to classify the information in the summaries are: Events, Cause of Accident, Cause of Hazardous Material Release, Casualties, Damages, Notification and Response, Observations and Recommendations.

DOT-TSC-RSPA-80-1
STATIC EVALUATION OF A NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) (MAGNAVOX Z-SET) RECEIVER, MAY-SEPTEMBER, 1979
Transportation Systems Center
John F. Canniff, and Christopher B. Duncombe
PB80-193550
Final Report May 1980 98p.

Radio in navigation
Satellites — Testing

(GPS) single channel sequential receiver (Magnavox Z-Set). These tests were performed at the Coast Guard District 11 office in Long Beach, CA from May to September 1979. The objective of these tests was to obtain base-line performance data on the NAVSTAR GPS system in a static environment for later comparison with the results of dynamic testing on board a ship. Results showed that the Z-Set operated reliably and that the accuracy with which the set calculated its three dimensional position equalled or exceeded the accuracy with which it is specified to operate.

DOT-TSC-RSPA-80-4
AN ASSESSMENT OF THE RISKS PRESENTED BY CARBON FIBER COMPOSITES RELEASED FROM MOTOR VEHICLE FIRES
Little (Arthur D.), Inc.
D. B. Rosenfield, J. Fiksel, and A. Kalelkar
Sponsored in part by DOT.
N80-20311
NASA-CR-15920/,
NAS1-15380
March 1980 87p.

Air pollution
Carbon fibers

A risk assessment was conducted to estimate the potential losses through 1993 due to the usage of carbon fiber (CF) composites in U.S. motor vehicles, including automobiles and trucks. A methodology was developed to compute estimated

dollar losses by county and equipment type, using a Poisson model for the incident of equipment failures. This approach incorporated data on the geographic distribution of potentially vulnerable facilities, as well as the mean CF exposure levels at which various equipment would fail. The results were then statistically aggregated to produce a national risk profile for estimated annual losses in 1993. The expected loss was $5,567 per year (1977 dollars), and the likelihood of exceeding $500,000 in annual losses was estimated to be at most one in ten thousand. The sensitivity of these results to major input parameters was investigated, and it was found that under extreme worst-case assumptions the annual loss would increase to about $1.5 million.

DOT-TSC-RSPA-80-5
DYNAMIC RESPONSE OF FINITE LENGTH MAGLEV VEHICLES SUBJECTED TO CROSSWIND GUSTS
Transportation Systems Center
Devendra P. Garg, and Timothy M. Barrows
PB80-181373
Final Report March 1980 63p.

Magnetic levitation vehicles
Magnetic levitation vehicles — Dynamics

A two-degree-of-freedom model for magnetically levitated finite length incorporating sway and yaw dynamics is formulated. Aerodynamic lateral forces and yawing moments on the vehicle resulting from constant speed wind gusts are computed using analytical techniques. Computer simulations are run for three vehicle speeds and three apparent mass factors. It is shown that higher apparent mass factors can be instrumental in reducing peak displacements and acceleration levels. The guidance-to-lift ratio is not as much affected by an increase in apparent mass factor as are the displacements and accelerations.

DOT-TSC-RSPA-80-10
ASSESSMENT OF THE RISKS ASSOCIATED WITH THE USE OF CARBON FIBERS IN SURFACE TRANSPORTATION
Transportation Systems Center
W. T. Hathaway, K. M. Hergenrother, and C. E. Bogner
PB-80-208309
Final Report June 1980 108p.

Air pollution
Carbon fibers

This report presents the results of an assessment of the potential risks associated with the use of carbon-fiber composites in the surface transportation system and the development of a data base on the vulnerability of the surface transportation system to air-borne carbon fibers. In conducting the risk assessment, TSC estimated the potential usage rate of carbon-fiber composites in surface transportation, the frequency and severity of vehicle fires and the expected carbon-fiber release from the composite in a fire. In developing the data base on the vulnerability, TSC reviewed and analyzed the electrical and electronic systems present in the various surface-transportation modes.

DOT-TSC-RSPA-80-11
FIRE TESTS OF AUTOMOTIVE GRADE CARBON FIBER COMPOSITES
Scientific Service, Inc.
C. Wilton, J. Boyse, and J. Zaccor
PB80-221690
Final Report June 1980 64p.

Carbon fibers
Carbon fibers — Testing

This report presents the results of a fire test study on selected composite materials containing carbon fibers that are planned for use, or that have a high potential for use, in automobiles and other vehicles. The study objectives were to determine the quantity and distribution of carbon fibers released during exposure of the composites to fires. The test data indicated that automobile fires, per se, are unlikely to be the cause of serious risk from single-fiber release. However, the possibility of automobile fires occurring in combination with other factors, such as wind and fire fighting, rescue, and disposal operations could result in additional fiber release.

DOT-TSC-RSPA-80-13
STATISTICAL METHODS FOR PASSIVE VEHICLE CLASSIFICATION IN URBAN TRAFFIC SURVEILLANCE AND CONTROL
Massachusetts Inst. of Tech., Cambridge, Lab. for Information and Decision Systems
Paul K. Houpt
PB80-208622
DOT-TSC-1685
Final Report June 1980 83p.

Traffic engineering — Statistics
Traffic surveys

A statistical approach to passive vehicle classification using the phase-shift signature from electromagnetic presence-type vehicle detectors is developed with digitized samples of the analog phase-shift signature, the problem of classifying vehicle type is formulated as a problem in classical maximum likelihood hypothesis testing. Computer algorithms for performing classification are developed and evaluated using data from ten different vehicle types. Simulation of the algorithms using these data has shown very favorable detection performance over a wide range of signal-to-noise ratio with high detection probabilities and low frequency of misclassification. A methodology for algorithm simplification and calibration is proposed which may permit implementation on simple (e.g., microprocessor based) signal-processing hardware.

DOT-TSC-RSPA-80-14
CARGO TANK REGISTRATION STATISTICS
Transportation Systems Center
Paul F. Doyle
PB80-217169
Final Report July 1980 424p.

Freight and freightage — Classification — Statistics
Freight and freightage — Tables and ready-reckoners

This report is a presentation of the data collected by the Bureau of Motor Carrier Safety of the Federal Highway Administration under Title 49, Code of Federal Regulations, Part 177,824 (f), reporting requirements for MC330 and MC331 Cargo Tanks. Included in the report is the data depicted in graphical form such as pie charts, bar graphs, and linear graphs, as well as detailed listings.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-78-18
TRANSIT SERVICE RELIABILITY
Transportation Systems Center
Mark Abkowitz, et al.
PB 292 152
UMTA-MA-06-0049-78-1
DOT-TSC-1083
Final Report December 1978 194p.

Local transit

This report presents a comprehensive overview of the subject of transit service reliability and provides a framework for a program of demonstrations and research studies which could be carried out under the Service and Methods Demonstration program. Major subject areas include the impact of service reliability, from the operator's perspective, empirical measures of service reliability, causes of service reliability problems, techniques for improving service reliability, and recommendations for further research. Several findings are reported herein, namely: 1) transit service reliability is a significant determinant of traveler mode and departure time choices; 2) service reliability is crucial in influencing the costs of providing transit service; and 3) current evaluation measures are not able to capture the variety of impacts of service reliability on travel behavior and operator costs. Several proposed measures are recommended herein for use in future evaluation studies.

Numerous causes of reliability problems are identified, some which appear to be inherent in the specific transit service concept, and others which are more environmental in nature. A review of previous and current analyses reveals inconclusive findings in determining the relative importance and magnitude of each cause. Several strategies are considered to improve service reliability of fixed route, and demand responsive transit systems. These strategies are directed at alleviating the initial cause of unreliability or serve as a corrective measure when the reliability problem has already developed.

DOT-TSC-UMTA-78-43
NOISE ASSESSMENT OF THE BAY AREA RAPID TRANSIT SYSTEM
Boeing Vertol Co., Philadelphia, PA
S. L. Wolfe, H. J. Saurenman, and P. Y. N. Lee
PB-292 397
UMTA-MA-06-0025-78-10
DOT-TSC-850
Interim Report October 1978 313p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise on and near the San Francisco Bay Area Rapid Transit System (BART). BART has approximately 75 miles of two-way revenue track (of which 19.7 miles are in subway) and 34 stations. Noise data is given for specific measurements made in cars, in stations and along the non-subway wayside at appropriate locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data is discussed explicitly. Measurement and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-44
NOISE ASSESSMENT OF THE GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY HEAVY RAIL TRANSIT SYSTEM
Boeing Vertol Co., Philadelphia, PA
R. H. Spencer, and E. G. Hinterkeuser
PB-292 331
UMTA-MA-06-0025-78-12
DOT-TSC-850
Interim Report October 1978 172p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise climate on and near the Greater Cleveland Regional Transit Authority (RTA), formerly the Cleveland Transit System (CTS), Airport Line. The RTA urban rail transit line has approximately 19 miles of two-way revenue track (of which about one mile is in subway), and 18 stations. Noise level data is given for specific measurements made in cars, in stations, and along the non-subway wayside at appropriate locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data are discussed explicitly. Measurements and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-45
NOISE ASSESSMENT OF THE PORT AUTHORITY TRANSIT CORPORATION LINDENWOLD RAIL TRANSIT LINE
Boeing Vertol Co., Philadelphia, PA
R. H. Spencer, and E. G. Hinterkeuser
PB-292 319
UMTA-MA-06-0025-78-9
DOT-TSC-850
Interim Report October 1978 190p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise climate on and near the Port Authority Transit Corporation (PATCO) Lindenwold High Speed Line. The PATCO urban rail transit line has approximately 14.2 miles of two-way revenue track (of which about four miles are in subway), and 12 stations. Noise level data is given for specific measurements made in cars, in stations, and along the non-subway wayside at appropriate locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data are discussed explicitly. Measurement and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-46
NOISE ASSESSMENT OF THE SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY HEAVY RAIL TRANSIT SYSTEM
Boeing Vertol Co., Philadelphia, PA
R. H. Spencer, and E. G. Hinterkeuser
PB-292 320
UMTA-MA-06-0025-78-11
DOT-TSC-850
Interim Report October 1978 364p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise climate on and near the Southeastern Pennsylvania Transportation Authority, (SEPTA), Broad Street Subway and Market-Frankford Elevated Line. The two SEPTA urban rail transit lines have approximately 22.6 miles of two-way revenue track (of which 13.1 miles are in subway), and 53 stations. Noise level data are given for specific measurements made in cars, in stations and along the non-subway wayside at appropriate locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data are discussed explicitly. Measurement and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-47
ASSESSMENT OF CURRENT U.S. DEPARTMENT OF TRANSPORTATION FIRE SAFETY EFFORTS
Transportation Systems Center
W. T. Hathaway, and I. Litant
PB-299 110
UMTA-MA-06-0051-79-4
Final Report July 1979 144p.

Transportation — Safety measures

The Urban Mass Transportation Administration (UMTA), has undertaken the task of assessing the entire area of fire research to determine how to provide means to reduce the fire threat in transit systems, and thus, to provide a safer means of transportation for the traveling and commuting public. This report presents the results of that assessment by the Transportation Systems Center (TSC). The study identifies and recommends suitable remedial actions and reflects the present state of transportation fire safety efforts. Emphasis has been placed on Federal Government efforts, and particularly those by the Department of Transportation (DOT). Although the assigned task is directed at fire safety in transit systems, the assessment encompasses all transportation-related fire safety. The intent of this approach has been to emphasize the similarities which exist among the problems and in the programs of the modes. In many instances, the programs of one mode will benefit one or more of the other modes.

DOT-TSC-UMTA-78-48,I
ELECTRICAL INSULATION FIRE CHARACTERISTICS
Volume I: Flammability Tests
Boeing Commercial Airplane Co.
L. E. Mayor, A. M. Taylor, and J. A. York
PB-204 840
UMTA-MA-08-0035-79-1
DOT-TSC-1221
Final Report December 1978 247p.

Local transit — Fires and fire prevention
Local transit — Safety measures

In the crowded, confined environment of a rapid transit vehicle, it is essential that smoke emission from all sources be mini-

mized. The adoption of test standards and guidelines for wire and cable used in those vehicles must be undertaken in an organized, well-coordinated program in which flammability, smoke emission, toxic gas evolution, and circuit integrity are treated as interrelated components of a system. As a result of this need, standard flammability, smoke emission, and circuit integrity tests were developed for electrical wire and cable insulating materials used in rapid transit system vehicles and wayside and track installations. The objective of the program was to determine if any of the currently used materials can provide a fire safe environment in terms of two flame propagation, smoke emission, and gas evolution, and determine whether any of these can meet criteria which will be established by taking into account the fire hazards inherent in transit systems. Wire and cable insulating materials currently in use on rapid transit systems and new polymeric materials proposed for such systems, were requested from manufacturers who had given indication of interest in the program. These samples were tested and ranked with respect to their performance during the tests. The report presents a discussion of the need for such standard tests. The criteria for the selection of a test method, the development of the test details, and a description of the standard tests. The study concludes that the objectives of the program have been achieved. Other conclusions and recommendations are presented.

DOT-TSC-UMTA-78-48, II
ELECTRICAL INSULATION FIRE CHARACTERISTICS
Volume II: Toxicity
Civil Aeromedical Inst., Oklahoma City, OK
Charles H. Crane, Boyd R. Endecort, Donald C. Sanders, and John K. Abbott
PB-294 941
UMTA-MA-06-0025-79-2
DOT/TSC-RA-77-15, DOT/TSC-RA-77-16
Final Report December 1979 102p.

Combustion — Testing
Local transit — Fires and fire prevention

The purpose of this research was to determine the relative inhalation toxicity of the thermal degradation products or gaseous pyrolysis of selected types of electrical wiring insulations. The specific materials to be evaluated were supplied by the Boeing Commercial Airplane Company and were selected from a much larger population on the basis of prior testing of properties other than toxicity. The contract work-statement required that toxicity be evaluated utilizing the basic principles of a system designed at the Civil Aeromedical Institute (CAMI) that was used for an earlier study of aircraft interior materials. The relative toxicities of the combustion products of 14 electrical wiring insulations were evaluated using animal incapacitation as a measure of toxicity. One gram insulation samples were pyrolyzed in a quartz combustion tube connected in-line with a 12.6-L-exposure chamber by an air re-circulation assembly to form a closed exposure system. Each material was pyrolyzed under three thermal degradation conditions and the time-to-incapacitation for the shortest time condition was used to rank the materials in the order of their relative potential toxicity. A rank order for all 14 materials is presented on the basis of potential toxicity for equal weights of insulation and relative ranking by toxicity for equal lengths of conductor is presented for those materials supplied on conductors of equal gauge. Techniques are suggested for converting measured toxicity of an insulation on wire of one size to the equivalent toxicity of the same insulation on wire of a different size. The report presents cautions and limitations on the discipline of combustion toxicology and presents suggestions for future research.

DOT-TSC-UMTA-78-49
INDUCTIVE COMMUNICATION SYSTEM DESIGN SUMMARY
Boeing Aerospace Co.
Todd N. Johnstone
PB-295 413
UMTA-MA-06-0048-78-6
DOT-TSC-1275
Final Report September 1978 187p.

Electric Railroads — Communication Systems
Telecommunication systems — Design and construction

The report documents the experience obtained during the design and development of the Inductive People Mover. The Inductive Communications System is used to provide wayside-to-vehicle and vehicle-to-wayside communications for command and control signaling. To aid future designers, system design and supporting analyses are discussed.

DOT-TSC-UMTA-78-50
EXPERIMENTAL VERIFICATION OF A PNEUMATIC TRANSPORT SYSTEM FOR THE RAPID EVACUATION OF TUNNELS, PART II. TEST PROGRAM
Colorado School of Mines, Golden
James W. Martin and Robert T. Feddick
PB-295-032
UMTA-MA-06-0025-78-14
DOT-TSC-1144
Final Report December 1978 154p.

Pneumatic-tube transportation
Tunneling — Design and construction

This study is the final phase of a muck pipeline program begun in 1973. The objective of the study was to evaluate a pneumatic pipeline system for muck haulage from a tunnel excavated by a tunnel boring machine. The system was comprised of a muck preparation unit, solids feeder and air blower, telescoping pipes and 500 feet of 10-inch diameter pipe. The system transported up to 100tph ranging from 1/2 inch to more than 3 inches. The system components were tested for reliability and flexibility, wear and maintenance requirements, capacity, noise and dust levels, effect of moisture content, extensibility, and power requirements. The system was found to be low in capital cost, easy to operate, and readily extensible. The pneumatic pipeline was power-intensive and susceptible to elbow wear. For the pneumatic transport of coarse muck, moisture content was more important than particle size. Noise levels were high at the blower and muck preparation unit could be reduced in actual practice. The system was found to be reliable except for the elbow wear.

DOT-TSC-UMTA-78-51-1
THE ROCHESTER NEW YORK INTEGRATED TRANSIT DEMONSTRATION
Volume I: Executive Summary
Systan, Inc.
Roy E. Lave and Michael A. Holoszyc
PB-296-875
Set: PB-296-874
UMTA-NY-06-0048-78-1
DOT-TSC-1084
Final Report March 1979 82p.

Demand responsive transportation — Rochester
Paratransit services — New York — Rochester

The Rochester Integrated Transit Demonstration (RITD) was designed to assess the roles of demand-responsive transit in the region-wide transit system that includes an extensive fixed-route bus network. The demonstration extended transit service into suburban areas by using integrated mixes of fixed-route and paratransit services. Four types of innovations were demonstrated: system integration; equipment; and fares, marketing, and promotion. This report describes the conduct of and the impacts resulting from the implementation of a family of demand-responsive transit services and several related innovations in Greece and Irondequoit, New York (two suburbs of Rochester). The report covers the time period beginning with the implementation of PERT (Personal Transit) services in August 1973 through July 1977. The report contains a description of the implementation process and the impacts of individual services and innovations on the level of service provided, transit demand, and transit productivity. The implications of the Rochester experience are summarized for the benefit of other localities considering the implementation of similar services.

DOT-TSC-UMTA-78-51-2
THE ROCHESTER NEW YORK INTEGRATED TRANSIT DEMONSTRATION
Volume II: Evaluation Report
Systan, Inc.
Roy E. Lave and Michael A. Holoszyc
PB-296 876
Set: PB-296 874
UMTA-NY-06-78-2
DOT-TSC-1084
Final Report March 1979 383p.

Demand responsive transportation — Rochester
Paratransit services — New York — Rochester

The report describes the conduct of and the impacts resulting from the implementation of a family of demand-responsive transit services and several related innovations in Greece and Irondequoit, New York, two suburbs of Rochester.

DOT-TSC-UMTA-78-51-3
THE ROCHESTER NEW YORK INTEGRATED TRANSIT DEMONSTRATION
Volume III: Appendices
Systan, Inc.
Roy E. Lave and Michael A. Holoszyc
PB-296 877
Set: PB-296 874
UMTA-NY-06-0048-78-3
DOT-TSC-1084
Final Report March 1979 197p.

Demand responsive transportation — Rochester
Paratransit services — New York — Rochester

The report describes the conduct of and the impacts resulting from the implementation of a family of demand-responsive transit services and several related innovations in Greece and Irondequoit, New York, two suburbs of Rochester. Volume Three contains the appendices, including a glossary, copies of measurement instruments, and tabulations of survey results.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-78-52
NOISE ASSESSMENT OF THE CHICAGO TRANSIT AUTHORITY RAIL RAPID TRANSIT SYSTEM
Illinois Univ. at Chicago Circle
Marshall L. Silver, Robert C. Buchus, and Roland Priemer
PB-292 834
UMTA-MA-06-0025-79-8
DOT-UMTA-IL-11-007
Final Report January 1979 305p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise on and near the Chicago Transit Authority (CTA) urban rail transit lines. The CTA urban rail lines consist of approximately 86 miles of two-way revenue track (of which 9.6 miles are in subway) and 155 stations. Noise data are given for specific measurements made in cars, in stations, and along the non-subway wayside at selected locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data is discussed explicitly. Measurement and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-53
NOISE ASSESSMENT OF THE NEW YORK CITY RAIL RAPID TRANSIT SYSTEM
Polytechnic Inst. of New York, Brooklyn
Dept. of Transportation Planning and Engineering
William R. McShane, Simon Slutsky, and Martin F. Huss
PB-292 498
UMTA-MA-06-0025-79-7
Interim Report January 1979 359p.

Subways — Noise
Noise control
Railroads — Noise

The report describes the noise climate on and near the New York City Transit Authority (NYCTA) urban rail system, including the Staten Island Rapid Transit Operating Authority (SIRTOA). Noise level data is also presented for the Port Authority Tran Hudson (PATH) urban rail system. The NYCTA (including SIRTOA) urban rail system has 485 stations and approximately 246 route miles, of which 137 miles are underground. Noise level data are given for specific measurements made in cars, stations and along the above ground wayside at approximate locations. The rationale for choice of measurement sites and the methodology for arriving at the summary noise distributions from the data is discussed explicitly. Measurement and analysis instrumentation and procedures are also described.

DOT-TSC-UMTA-78-54
EVALUATION OF PASSENGER COUNTER SYSTEM FOR AN AVM EXPERIMENT
Volume II: Test Data
Gould Information Identification, Inc.
A. Balaram, G. Gruver, and H. Thomas
PB-294 200
UMTA-MA-06-0041-79-2
DOT-TSC-1237
Final Report February 1979 168p.

Automatic vehicle monitoring
Buses

This report contains the test data of the evaluation of passenger counter sensors (PCS) for use in transit buses. It contains many laboratory field test data sheets that describe each specific test that was conducted, the number of samples involved, and the conditions under which each test was performed, as well as sheets depicting the data recording format and data analysis.

DOT-TSC-UMTA-78-77
ANALYSIS OF LIFE-CYCLE COSTS AND MARKET APPLICATIONS OF FLYWHEEL ENERGY-STORAGE TRANSIT VEHICLES
Transportation Systems Center
D.L. Goeddel, and G. Ploetz
PB-300 289
UMTA-MA-06-0044-78-2
Final Report July 1979 180p.

Fly-Wheels

The Urban Mass Transportation Administration (UMTA) has recently completed the Phase I activities of its Flywheel Energy Storage Program involving an analysis of the operational requirements and the conceptual design of flywheel energy storage vehicles for transit service. Flywheel energy storage systems are being proposed as a means of reducing the energy requirements of fixed-route, multi-stop, urban transit vehicles. The Phase I studies have paved the groundwork for the suc-

ceeding program phase which include the design, fabrication, test, and evaluation of prototype flywheel vehicle systems for demonstrations in transit service. As part of the overall program UMTA has requested the Transportation Systems Center (TSC) to conduct an independent assessment of the life cycle costs and the potential market applications of flywheel storage vehicles within the urban transit industry. This report documents the results of these analyses. It examines the economic viability and the potential market applications of these proposed concepts within urban transit operations. The report presents a description of the structure, the approach, and the assumptions of the analysis; defines the design characteristics, the system capital costs, and the annual recurring operations/maintenance costs associated with the conventional diesel bus, the trolly bus, and the three flywheel-powered vehicle systems considered in the study; describes the results of the life-cycle analysis and the sensitivity of these results due to variations of key assumed input variables; and discusses the potential demand and the market applications of flywheel energy storage vehicles within transit service operations.

DOT-TSC-UMTA-79
CONSTRUCTION OF URBAN RAIL TRANSIT SYSTEMS: THE CHALLENGE OF MORE COST EFFECTIVE CONSTRUCTION
Pacific Consultants
Roger W. Dewey
Conference Proceedings Held at Williamsburg, Virginia on December 7-8, 1978
PB80-130479
UMTA-MA-06-0100-79-7
DOT-TSC-1526
September 1979 106p.

Railroads — Cost of construction — Congresses

The goal of the conference was to seek input from the construction community on improving the use of public funds and insight into identifying new ways to control and reduce cost of construction of urban rail transit systems in the United States. The conference was organized into four sections and addressed the following topics: Transportation Overview, Transit Assistance Program, Technology Development and Deployment, and Policy; Owners' Point of View, Designers' Point of View, and Contractors' Point of View; Insurance and Bonding Value Engineering, Construction Management; and Management R&D Review, Technology R&D Review, and Test Sections.

DOT-TSC-UMTA-79-1
PRT (PERSONAL RAPID TRANSIT) IMPACT STUDY. THE PHASE I PRT IMPACT ON MORGANTOWN TRAVEL TRAFFIC AND ASSOCIATED ACTIVITIES
West Virginia Univ., Morgantown
Samy E. G. Elias and Richard E. Ward
PB-300-341
SET: PB-300 340
UMTA-MA-06-0026-79-1
DOT-TSC-1316
Final Report July 1979 88p.

Automated guideway transit — Morgantown, West Virginia
Personal rapid transit — Morgantown, West Virginia

A new and revolutionary public transportation system, the Morgantown Personal Rapid Transit (PRT) System began regular passenger service operation in Morgantown, West Virginia, in October 1975. This is a study of the impact of Phase I Morgantown PRT, the first fully automated transportation system operational in a city environment. The study was designed to record the effect of the system operation on traffic and associated activities in the areas adjacent to the PRT. The intent of the study was to provide information useful to other areas contemplating the Automated Guideway Transit (AGT) type installations. The PRT system served approximately 38% of the Morgantown residents. During the course of the study, it was concluded that the system was a major force in influencing travel habits, and that residents of the service area used autos for their trips less often than they did prior to the PRT. Compared to the bus system, which it replaced, the PRT is carrying more than the bus's previous share of the total trips.

DOT-TSC-UMTA-79-2
PRT (PERSONAL RAPID TRANSIT) IMPACT STUDY. OPERATIONAL PHASE
Volume I: Travel Analysis
West Virginia Univ., Morgantown
Samy E. G. Elias and Richard E. Ward
PB-300 342
SET: PB-300 340
UMTA-MA-06-0026-79-2
DOT-TSC-1316
Final Report July 1979 98p.

Automated guideway transit — Morgantown, West Virginia
Personal rapid transit — Morgantown, West Virginia

URBAN MASS TRANSPORTATION ADMINISTRATION

To study the impact of the Personal Rapid Transit (PRT) on Morgantown, a substantial amount of data was collected in an attempt to capture the state of transportation related conditions before and after passenger service. This report contains an analysis of the latter set of data; namely, that collected in the spring of 1977. The data described in this report, together with those reported in the Pre-PRT Phase, allows assessment of the PRT system impacts on the city of Morgantown. The completed assessment provides other cities considering implementation of AGT systems, sufficiently detailed information to determine whether they can effectively and efficiently utilize a Morgantown type PRT system to satisfy their transportation needs.

DOT-TSC-UMTA-79-3
PRT (PERSONAL RAPID TRANSIT) IMPACT STUDY. OPERATIONAL PHASE
Volume II: Data Collection Procedure and Coding Manual
West Virginia Univ., Morgantown
Samy E. G. Elias and Richard E. Ward
PB-300 343
SET: PB-300 340
UMTA-MA-06-0026-79-3
DOT-TSC-1316
Final Report July 1979 119p.

Automated guideway transit — Morgantown, West Virginia
Personal rapid transit — Morgantown, West Virginia

The report documents the procedures used by researchers at West Virginia University (WVU) in collecting data which describes transportation-related conditions in Morgantown, West Virginia following the commencement of passenger service on Phase I of the Morgantown Personal Rapid Transit (PRT) System. The record of data collection and data processing decisions given here provides essential documentation for researchers who may be performing subsequent analysis of the data.

DOT-TSC-UMTA-79-4
ECONOMIC FACTORS IN TUNNEL CONSTRUCTION
Underground Technology Development Corp.
E. L. Foster, R. McDonald, W. Wightman, and I. Taporoff
Prepared in cooperation with Singstad, Kehart, November, and Hurka, New York.
PB-294 726
UMTA-MA-06-0025-79-10
DOT-TSC-1106
Final Report February 1979 306p.

Tunnels — Design and construction
Tunnels — Design and construction — Costs

This report described a new cost estimating system for tunneling. The system is designed so that it may be used to aid planners, engineers, and designers in evaluating the cost impact of decisions they may make during the sequential stages of planning and design of urban transportation tunnels, in developing a cost estimating technique and method, an extensive review was made of currently available estimating systems. Techniques were adapted from the systems studied where applicable, and new methodologies were developed as needed for optimization. A detailed estimating technique is used in which units of effort are converted to obtain a base cost for a standard tunnel constructed in 1976 in Washington, DC. Correction factors may then be applied to obtain the costs in other time frames and geographic locations. The use of units of effort provides a technical base which does not change rapidly with time, but may be updated as changes in technology and productivity occur.

DOT-TSC-UMTA-79-7
STREETS FOR PEDESTRIANS AND TRANSIT: AN EVALUATION OF THREE TRANSIT MALLS IN THE UNITED STATES
Crain and Associates
Richard Edminster and David Koffman
PB-295 728
UMTA-MA-06-0049-79-1
DOT-TSC-1081
Final Report February 1979 255p.

City planning — Transportation
Shopping malls — Transportation

The report represents the second phase of a two-phase project designed to acquaint the planning community with the concept of transit malls and to provide information about three of the most important and interesting transit mall projects to a wider audience. The first phase of the study consisted of a site report: Streets For Pedestrians and Transit: Examples of Transit Malls in the United States (PB-278-487), which described the characteristics and histories of six transit malls. This second evaluation phase is more analytic in nature and quantifies the benefits and disbenefits of the three major transit malls in Philadelphia, Pennsylvania; in Minneapolis, Minnesota; and in Portland, Oregon. The transit malls in each of these cities was first reviewed in the site report. This evaluation is concerned with the impact of the three malls on pedestrians, on transit service, on excluded or restricted general traffic, and on economic conditions, particularly on retail sales in the immediate

vicinity of the mall. This report contains the results of analysis on the following topics: maintenance and construction costs; transit service improvement including bus speed, reliability, coverage, capacity, ridership, productivity, and system understanding; the level of service provided pedestrians and waiting transit patrons; environmental impacts; pedestrian and bicyclist safety; traffic diversion; parking; goods delivery; and economic impacts. This report documents fifteen major conclusions regarding the transit malls.

DOT-TSC-UMTA-79-8
WMATA RAPID TRANSIT VEHICLE ENGINEERING TESTS
Federal Railroad Administration
Pueblo, CO
K. J. Simmonds and F. H. Henderson
PB-298 978
UMTA-MA-06-0025-79-14
Final Report May 1979 122p.

Subways — Cars — Testing
Local transit — Planning

TSC has been instrumental in preparing standardized test procedures for evaluation of rail transit vehicles, using the TTC's 9.1 mile Transit Test Track, with the objective of providing a common baseline for the comparative evaluation of rapid transit vehicles asnd vehicle systems. The test program reported herein was carried out by the TTC to the guidelines of these procedures. The test program data gave a comprehensive evaluation of the WMATA rapid transit car in the categories of Performance, Power Consumption, Spin/Slide Protection, Noise, Ride Roughness, Power System Interactions, and Simulated Revenue Service.

DOT-TSC-UMTA-79-9
COST SAVINGS POTENTIAL OF MODIFICATIONS TO THE STANDARD LIGHT RAIL VEHICLE SPECIFICATION
Lea (N. D.) and Associates, Inc.
T. J. McGean, C. P. Elms, F. A. F. Cooks and W. Bamberg
PB-295 070
UMTA-MA-06-0025-79-11
DOT-TSC-1495
Final Report February 1979 173p.

Railroads — Cars — Construction
Railroads — Cars — Prices

This report describes an assessment of the Standard Light Rail Vehicle (SLRV) specification to determine whether the relaxation or modification of some requirements could result in a significant reduction in vehicle costs. A Technique of Assessment by Structured Interviewing was applied to include judgments and ideas by each facet of the industry concerning modifications to the specification which would be acceptable and could reduce car costs. A five-stage filtering process was used to select 20 cost reducing modifications from an initial list of 640 candidate specification modifications. The large list resulted from an in-depth review of the current specification. The final set of 20 areas were analyzed quantitatively to estimate cost savings of 16 percent are shown to result by implementing the 15 specification modifications which are termed as having acceptable impact upon mission performance. The remaining five modifications have major impact upon mission performance (e.g., unidirectional operation, doors on only one side simplified friction brakes, no articulation and elimination of compressed air). Cost savings of 25 percent are shown to result from specifying a bidirectional, non-articulated car with simplified friction brakes and no compressed air, and which also incorporates the 15 specification modifications with acceptable impact on mission performance.

DOT-TSC-UMTA-79-10
NATIONAL ASSESSMENT OF URBAN RAIL NOISE
Transportation Systems Center
Gregory Chisholm, Herbert Bogen, Michael Dinning, and Michael Primeggia
PB-295 752
UMTA-MA-06-0099-79-2
Final Report March 1979 303p.

Noise — Measurement
Noise control
Railroads — Noise

This report summarizes seven individual noise assessments of the urban rail transit systems in Boston, New York City, Philadelphia, Lindenwold (N.J.), Cleveland, Chicago, and San Francisco. The assessments were performed by DOT and contractor research teams using a noise measurement methodology developed at TSC and tested on the MBTA in Boston. Sound level measurements were taken inside the transit car, in stations, and in the community situated near the rail rights-of-way. For the purpose of this national assessment report, measured noise level data have been extrapolated to characterize sound levels at all places on each of the systems. Distributions of noise levels for each transit system are compiled in terms of the acoustic measures L(A) (Max.), L(eq), and L(dn). In addition, noise levels in the wayside

community (including trains) are compared with estimated ambient community noise levels which would exist if train noise were not present. Finally, estimates are made of the number of persons exposed to the various levels of noise in the transit car, station, and wayside community. Distributions of noise levels and noise exposure are presented for a composite rail system, made up of all seven transit systems. Several Government and industry noise level guidelines applicable to rail transit systems are discussed. Sound level distributions for each of the seven systems are compared with noise level goals developed by the American Public Transit Association.

DOT-TSC-UMTA-79-11
800 MHz COMMUNICATIONS SURVEY OF THE LOS ANGELES AREA
Gould Information Identification, Inc.
A. Balaram, W. Heathcock, and R. Halovsky
PB-295 043
UMTA-MA-06-0041-79-5
DOT-TSC-1237
Final Report March 1979 108p.

Automatic vehicle monitoring
Radio — Monitoring receivers — Testing

A survey was conducted to determine the suitability of using the 800-900 MHz band as the primary carrier of digital communication data pertaining to the Multi-User AVM (Automatic Vehicle Monitoring) Program. Testing was conducted on the six selected routes of the Southern California Rapid Transit District (SRTD) and specified wide area segments in the city of Los Angeles. The field testing involved usage of a test vehicle, communication equipment, both on the vehicle and at the base station, and data acquisition equipment. Results on the area coverage, large and small scale signal variations, message error mechanisms, antenna polarizations, usage of different base station sites, usage of different baud rates, and comparison with model prediction were obtained. The study also involved taking field measurements of such parameters as the noise level, the signal level, signal/noise ratio, throughput, and message errors. The results of the 800 MHz Survey indicate that: (1) Multiple base stations will be required to provide the specified coverage of the six selected SCRTD bus routes; (2) the results indicate that the use of a circularly polarized antenna system does not reduce the effects of fast fades compared to a vertically polarized antenna system; and (3) Baud rates between 1000 and 1800 BPS can be used effectively for the transmission of digital data using commercial 800 MHz mobile radios presently on the market.

DOT-TSC-UMTA-79-12
GUIDELINES FOR THE DESIGN AND EVALUATION OF HUMAN FACTORS ASPECTS OF AUTOMATED GUIDEWAY TRANSIT SYSTEMS
Transportation Systems Center
Anna M. Wichansky and E. Donald Sussman
PB-294 817
UMTA-MA-06-0081-79-1
Final Report March 1979 197p.

Automated guideway transit — Design and construction
Human engineering — Transportation

This document has been compiled to provide guidance in the planning, design, fabrication, and evaluation of human factors aspects of Automated Guideway Transit (AGT) Systems, including Downtown People Mover (DPM) systems. It is based on the present state of knowledge in the area covered and as such it draws on: (1) past and ongoing research; (2) applicable national and international codes and standards; and (3) current practice in transportation construction, law enforcement, fire safety, and military operations. Design concepts such as passenger safety, security, comfort, and convenience are discussed in relation to various AGT subsystems, including the vehicle, the guideway, the command and control center, and the terminal. Potential interactions between AGT systems and the surrounding community are considered. The guidelines also address such issues as accommodation of elderly and handicapped passengers, design to facilitate emergency evacuation, determination of acceptable levels of ride quality, and the optimal assignment of command and control tasks to humans and machines. The appendix summarizes the major guidelines presented in the text in a convenient checklist format; it is intended for use in the planning and evaluation of existing and proposed AGT systems. The bibliography provides reference for the reader who needs more detailed information than that provided in the guide.

DOT-TSC-UMTA-79-13
VIBRATION TESTS ON TRANSIT BUSES
Gould Information Identification, Inc.
J. Anderson and H. Thomas
PB-295 091
UMTA-MA-06-0041-79-6
DOT-TSC-1237
Final Report March 1979 56p.

Automatic vehicle monitoring
Buses — Electric equipment — Testing

URBAN MASS TRANSPORTATION ADMINISTRATION

The objective of this vibration measurement program was to quantify the vibration environment which would be experienced by Automatic Vehicle Monitoring (AVM) equipment when installed on buses during typical city route service operations. Two buses were utilized in this measurement program: a General Motors Corporation Model 3100 provided by the Southern California Rapid Transit District, and a Flexible Corporation Model 207 provided by the City Transit of Fort Worth, Texas. The approach taken involved instrumenting the buses and representative electronic hardware on the buses with calibrated accelerometers and recording the output of these accelerometers while driving the buses over selected test routes at specified speeds. In general, the tests have provided a definition of the vibration environment typical of transit buses used in city route service. Vibration amplitudes of the levels measured in the program do not pose a threat to the satisfactory operation of equipment produced according to industrial equipment design practice and fabrication methods. The data measurement system used in this program provided data of sufficient detail to accomplish the basic objectives. In evaluating this program, the authors stated that more accurate and more extensive comparisons of the data would have been made possible by a continuous correlation of calibrated bus speed with data signals. It is recommended that this be incorporated into any future tests of this nature.

DOT-TSC-UMTA-79-14
A QUANTITATIVE METHOD FOR ANALYZING THE ALLOCATION OF RISKS IN TRANSPORTATION CONSTRUCTION
Massachusetts Inst. of Tech.
Raymond E. Levitt, David B. Ashley, Robert D. Logcher, and Michael W. Dziekan
PB-295 099
UMTA-MA-06-0100-79-1
Final Report April 1979 156p.

Engineering — Transportation
Railroads — Construction

The report presents a conceptual model of risk that was developed to analyze the impact on owner's cost of alternate allocations of risk among owner and contractor in mass transit construction. A model and analysis procedure are developed, based on decision analysis but extending the standard methodology to include: (1) explicit consideration of risk as an incentive to perform, and (2) the interaction between two decision-makers (owner and contractor) trading risk for price.

DOT-TSC-UMTA-79-15
SIMULATION OF AN URBAN BATTERY BUS VEHICLE
Transportation Systems Center
John J. Stickler
PB-300 306
UMTA-MA-06-0093-79-1
Final Report July 1979 89p.

Buses — Mathematical models
Computer simulation — Transportation

This report describes the computer simulation of a battery-powered bus as it transverses an arbitrary mission profile of specified acceleration, roadway grade, and headwind. The battery-bus system components comprise a DC shunt motor, solid-state power conditioning unit with regeneration capability, and a battery source consisting of a multi-unit lead acid battery. The computer model determines vehicle tractive effort and power consumption and computes actual vehicle speed for a given mission profile. The program output data is tabulated in a form which allows easy recognition of the various operational modes and power-limited regimes. The computer model uses a 'modularization' format which facilitates the simulation of alternate propulson systems involving the interchange of one system component for another. The model is applied to simulate the propulsion characteristics of a typical bus operating over a specified drive cycle. The results of this study demonstrate the applicability of the battery bus model for predicting bus propulsion characteristics under simulated drive conditions. This report provides charts depicting the plotting program, input data required by the Battery Bus Performance Program , Fortran source listings and data files, as well as a Glossary.

DOT-TSC-UMTA-79-16
DIESEL BUS PERFORMANCE SIMULATION PROGRAM
Transportation Systems Center
Glenn Larson and Harry Zuckerberg
PB-295 524
UMTA-MA-06-0044-79-1
Final Report April 1979 204p.

Buses—Mathematical models
Diesel motor—Fuel consumption

A diesel bus performance computer simulation program was developed. This program provides information on acceleration, velocity, horsepower, distance traveled, and fuel consumption as a function of time from the originating station.

The program was written for diesel engine operation although heat engines other than diesel may be substituted. Fuel economy calculations, using the program, agree well with available measurements on urban buses and may be considered as representative of a baseline urban bus. Component submodels and vehicle coefficients used in the program have been carefully structured to represent current urban buses. This report includes a general description of the simulation program and the type of input data it required along with the results obtained by simulating a typical transit bus.

DOT-TSC-UMTA-79-17
PRELIMINARY SPECIFICATIONS FOR STANDARD CONCRETE TIES AND FASTENINGS FOR TRANSIT TRACK
Portland Cement Association, Skokie, IL
Construction Technology Labs.
Armir N. Hanna
PB-297-850
UMTA-MA-06-0100-79-3
DOT-TSC-1442
Final Report March 1979 50p.

Railroads — Ties
Railroads — Track — Design and construction

These revised specifications cover requirements for component materials, manufacturing procedures, and handling of monoblock and two-block concrete (prestressed) cross ties, pads, and insulators for rapid transit use. It also includes requirements for rapid transit use. It also includes requirements for rail fastenings for securing running rails, and the inserts for anchoring both the rail fastenings and the traction power contact rail support bracket. These specifications are preliminary and will be modified, as necessary, on the basis of intrack tests. This report includes Appendix A: Details of Concrete Ties, Appendix B: 'Report of New Technology,' and a Listing of References.

DOT-TSC-UMTA-79-18
MEASUREMENT PROGRAM FOR EVALUATION OF CONCRETE TIES AND FASTENINGS IN TRANSIT TRACK
Portland Cement Association, Skokie, IL
Construction Technology Labs.
Amir N. Hanna
PB-297-570
UMTA-MA-06-0100-79-2
DOT-TSC-1442
Final Report March 1979 42p.

Railroads — Ties
Railroads — Track

This report outlines a measurement program to obtain data on the performance of standard tie designs and associated fastening systems under field service conditions. In addition, the program identifies limited data to be obtained from a wood tie track for comparison. Recommendations are presented for a measurement program for monitoring, over an extended duration, the performance of different cross tie track systems under typical transit conditions. The following topics are discussed herein: type of data to be collected; type of instrumentation to be installed; type of equipment required for data acquisition; test schedule; and criteria for evaluating test data. The recommendations presented in this report are applicable to wood and concrete cross-tie track systems.

DOT-TSC-UMTA-79-19
ASSESSMENT OF OPERATIONAL AUTOMATED GUIDEWAY SYSTEMS— AIRTRANS, PHASE II
Transportation Systems Center
C. W. Watt, D. Elliott, D. Dunoye, T. Dooley, and W. S. Kwok
Prepared in cooperation with Department of Transport, Paris (France)
PB80-182538
UMTA-MA-06-0067-79-1
Final Report January 1980 338p.

Automated guideway transit
Automated guideway transit — Dallas-Fort Worth Airport

This study, Phase II, completes the assessment of AIRTRANS, the automated guideway system located at the Dallas-Fort Worth Airport. The Phase II assessment report: 'Assessment of Operational Automated Guideway Systems— AIRTRANS (Phase I)' (PB-261 339), covered concepts, history, technical evaluation, and performance through September, 1976. The work for Phase II was performed between June 1977 and June 1979, and has four main areas of coverage: (1) changes in system configuration including the addition of employee service and the modifications of the failure management and control systems; (2) the availability, reliability, and maintainability history of the system and its components; (3) the operational safety history of the system; and (4) a life cycle cost study of the system. Availability was not defined in the original AIRTRANS specification, and several definitions have been used.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-79-20
IMPLEMENTING THE ROCHESTER COMMUNITY TRANSIT SERVICE DEMONSTRATION
Systan, Inc., Los Altos, CA
Michael Holoszyc and Debra A. Newman
PB-298 979
UMTA-NY-06-0048-79-1
DOT-TSC-1416
Interim Report May 1979 140p.

Local transit — New York — Rochester
Urban transportation

The report describes the implementation process and the early impacts of the Rochester Community Transit Service demonstration in four suburbs of Rochester, New York. The demonstration project is an outgrowth of an earlier one which ended in October 1977. The new demonstration will continue until July 1979. In the first demonstration a variety of demand-responsive services were operated in two Rochester suburbs—Greece and Irondequoit. In the new demonstration, the door-to-door dial-a-ride service was expanded in July 1978 to two additional suburbs—Brighton and Henrietta, and the handicapped service became a regionwide operation over a four-month period starting in July 1978. In addition, all four dial-a-ride service areas will eventually have computerized scheduling and dispatching using a dedicated minicomputer. The new demonstration is largely concerned with two institutional innovations developed by the Rochester-Genessee Regional Transportation Authority to deal with the problems of high operating costs and insufficient local funding availability. These innovations are the use of a competitively selected private operator and the shifting of the funding responsibility to the suburban towns served by dial-a-ride. The report describes the events leading to these innovations, their implementation, and their results and implications thus far.

DOT-TSC-UMTA-79-23
URBAN RAIL NOISE ABATEMENT PROGRAM: A DESCRIPTION
Transportation Systems Center
L. G. Kurzweil and W. N. Cobb
PB-295545
UMTA-MA-06-0099-79-1
March 1979 26p.

Noise control
Noise pollution

This report presents the background, current activities, and future plans for the Urban Rail Noise Abatement Program. This program, sponsored by the Office of Technology Development and Deployment of the Urban Mass Transportation Administration (UMTA) was initiated in 1972 and has been technically managed since its inception by the Transportation Systems Center. The problem of urban rail noise and vibration is described and the rationale for the UMTA funded program is given. The body of the report presents a definition of the program objectives, a discussion of the program organization, and a description of past, current, and future program activities. Major accomplishments of the program to date are listed in the final section.

DOT-TSC-UMTA-79-24
LABORATORY EVALUATION OF CONCRETE TIES AND FASTENINGS FOR TRANSIT USE
Portland Cement Association, Skokie, IL.
Construction Technology Labs.
Amir N. Hanna
PB-297 533
UMTA-MA-06-0100-79-8
DOT-TSC-1442
Final Report March 1979 79p.

Railroads — Ties — Design and construction

This report was prepared as part of an ongoing research effort by the Urban Mass Transportation Administration (UMTA) to develop standard concrete ties for rapid transit use. The overall objective of this contract was to fabricate and evaluate, by laboratory tests, standard ties of different designs intended for transit use. Two tie designs, a pretensioned monoblock and post-tensioned two-block, together with preliminary specifications for tie manufacture were developed in an earlier study by the Transit Development Corporation. Objectives of the investigation were to evaluate, by laboratory tests, the adequacy of: each of three fastening systems; each of the tie designs; and the assembled track components with ties supported on ballast and subjected to simulated rapid transit loading. Work performed to accomplish these objectives included fabrication of prestressed concrete ties and testing of ties, fastenings, and assembled track components.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-79-25
NOISE RATING CRITERIA FOR ELEVATED RAPID TRANSIT STRUCTURES
Bolt Beranek and Newman, Inc., Cambridge, MA
Theodore J. Schultz
PB-297 419
UMTA-MA-06-0099-79-3
DOT-TSC-1531
Interim Report May 1979 146p.

Railroads — Noise
Noise control

The purpose of this report is to recommend criteria for rating the noise radiated from elevated rapid transit structures during train passages, so that different types of structures can be inter-compared with respect to their noise impact on the immediate neighborhood, or alternatively, so that noise abatement programs for elevated structures may be developed on a rational basis. In developing these criteria, the report also summarizes information that is applicable to the rating of rail transportation noise in general. The report examines the requirements for descriptors that would be suitable for rating elevated structure noise, reviews existing noise ratings, concludes that the only suitable candidates are the average sound level (Leq) and the day-night average sound level (Ldn) and examines and resolves the possible disadvantages of these choices. The report also reviews studies that have been made to determine the impact of rail transportation noise on the community, compares subjective response to rail noise with that due to road traffic and aircraft noise, and finds these responses to be nearly the same. Finally, the report delineates and illustrates application of the so-called Fractional Impact Method to assessment of the community impact of elevated structure noise, based on the results of numerous social surveys on noise, and widely used by the Environmental Protection Agency for environment impact statements.

DOT-TSC-UMTA-79-26
THE SHARED-RIDE TAXI SYSTEM REQUIREMENTS STUDY
DAVE Systems, Inc. Anaheim, CA.
TRANSMAX Div.
G.J. Fielding, B.E. Potter, A.U. Simpson, P.L. Tuan, and P.J. Wong
PB-299-231
UMTA-MA-06-0054-79-4
DOT-TSC-1272
Final Report May 1979 167p.

Urban transportation
Taxicabs — Economic aspects

Shared-ride taxi (SRT) is different from the exclusive-ride taxi (ERT) in that the taxi may be shared by unrelated passengers with different origins/destinations. By simultaneously serving more than one passenger, SRT may improve vehicle productivity, permit fare reductions, and increase taxicab ridership. SRT may also serve as an integrated transit feeder to conventional transit in suburban communities, thereby attracting new ridership to both SRT and transit. The major objective of the study is to develop the system requirements and perform a functional design of the computer control system (CCS) for an automated shared-ride taxi system. A secondary objective is to identify the environmental and system context in which these requirements are applicable. The study provides substantial evidence that the SRT-CCS concept is not only technically feasible and within the present state-of-the-art but also economically attractive for SRT fleets of 50 vehicles or more. Certain technical problem areas have been identified and should be resolved, but they do not appear to be unsolvable or to jeopardize the technical success of the concept. Appendix A of this report provides a bibliography that covers the entire study, not just this final report.

DOT-TSC-UMTA-79-27, Vol. 1
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. FINAL TEST REPORT.
Volume I: Introduction
Boeing Vertol Co., Philadelphia, PA.
Surface Transportation Systems Dept.
PB-301 146
SET: PB-301 145
UMTA-MA-06-0025-79-3
DOT-TSC-1062
Final Report February 1979 74p.

Local transit—Planning
Subways—Cars—Testing

The Standard Light Rail Vehicle (SLRV) is a 71-foot vehicle, articulated to negotiate curves down to 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and performance is standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accommodation. Engineering testing on the SLRV was conducted by the Boeing Vertol Company at the Transportation Test Center Pueblo, Colorado in accordance with the General Vehicle Test Plans (GSP-064), which are designed to provide the data necessary for quantitative comparison of different transit cars. This report presents the results of the series of

tests conducted. The general objective of the test program was to establish a data baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Plans in testing urban rail vehicles. Volume I contains a description of the SLRV Test Program and the vehicle, and a summary of the test results.

DOT-TSC-UMTA-79-27, VOL. 2
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. FINAL TEST REPORT.
Volume II: Performance and Power Consumption Tests.
Boeing Vertol Co., Philadelphia, PA.
Surface Transportation Systems Dept.
PB-301 147
SET: PB-301 145
UMTA-MA-06-0025-79-4
DOT-TSC-1062
Final Report February 1979 66p.

Local transit—Planning
Subways—Cars—Testings

The SLRV (Standard Light Rail Vehicle) is a 71-foot vehicle, articulated to negotiate curves down to 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and performance is standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accommodation. This report presents the results of the series of tests conducted. The general objective of the test program was to establish a baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Palns in testing urban rail vehicles. Volume II contains detailed descriptions and discussions of the engineering tests performed on samples of the SLRV.

DOT-TSC-UMTA-79-27, VOL. 3
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. FINAL TEST REPORT.
Volume III: Ride Quality, Noise, and Radio Frequency Interference Tests.
Boeing Vertol Co., Philadelphia, PA.
Surface Transportation Systems Dept.
PB-301 148
SET: PB-301 145
UMTA-MA-06-0025-79-5
DOT-TSC-1062
Final Report February 1979 178p.

Local transit—Planning
Subways—Cars—Testing

The SLRV (Standard Light Rail Vehicle) is a 71-foot vehicle, articulated to negotiate curves down to a 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and performance is standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accommodation. This report presents the results of the series of tests conducted. The general objective of the test program was to establish a baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Plans in testing urban rail vehicles. Volume III contains detailed descriptions and discussions of the engineering tests performed on samples of the SLRV.

DOT-TSC-UMTA-79-27, VOL. 4
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. FINAL TEST REPORT.
Volume IV: Data Logs.
Boeing Vertol Co., Philadelphia, PA.
Surface Transportation Systems Dept.
PB-301 149
SET: PB-301 145
UMTA-MA-06-0025-79-6
DOT-TSC-1062
Final Report February 1979 67p.

Local transit—Planning
Subways—Cars—Testing

The SLRV (Standard Light Rail Vehicle) is a 71-foot vehicle, articulated to negotiate curves down to a 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and peformance are standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accommodation. This report presents the results of the series of tests conducted. The general objective of the test program

was to establish a baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Plans in testing urban rail vehicles. The test program was divided into five categories: performance; power consumption; ride roughness; noise; and radio frequency interference.

DOT-TSC-UMTA-79-28
ALLEVIATION OF PRESSURE PULSE EFFECTS FOR TRAINS ENTERING TUNNELS
Jet Propulsion Lab., Pasadena, CA.
Bain Dayman, Jr., Harold P. Holway, Andrew G. Hammitt, Curtis E. Tucker, Jr., and Allan E. Vardy
PB-299 155
UMTA-MA-06-0100-79-10
DOT-RA-N-02-612-0397
Final Report June 1979 235p.

Subways—Cars—Testing
Tunnels—Design and construction
Human engineering

This study was carried out for the Transportation Systems Center of the U.S. Department of Transportation on behalf of the Urban Mass Transportation Administration in order to determine to what degree it is possible to attenuate the effects of pressure pulses on the passengers in trains entering tunnels. The emphasis of this study is on the approach of modifying the normal, abrupt entry portal of the constant diameter single track tunnel. In order to understand this approach, which requires the tailoring of a tunnel portal, it was first necessary to have an analytical model in which confidence exists in its capability to predict realistic pressure pulse histories of trains entering tunnels having porous and/or flared entry portals. To accomplish this, the best available theoretical information along with small-scale laboratory experiments were used to update an existing computer program. Then, this program was used to demonstrate effective portal configurations. Although reasonable modifications to the tunnel entrance portal may not decrease the magnitude of the pressure rise, they are very effective in reducing the discomfort to the human ear by decreasing the rate of pressure rise to what the normal ear can accommodate. A brief qualitative comparison is made of this portal modification approach with other approaches: decreasing the train speed during the tunnel entry and sealing the cars. The optimum approach, which is dependent upon the conditions and the requirements of each particular rail system, is likely to be the portal modification one for the subway transit system.

DOT-TSC-UMTA-79-29
MATERIALS HANDLING FOR URBAN TUNNELING IN ROCK
Holmes and Narver, Inc., Orange, CA
J. M. Duncan, L. A. Giamboni, H. V. Schneider, and P. E. Sperry
PB-299 117
UMTA-MA-06-0100-79-9
DOT-TSC-1281
Final Report May 1979 349p.

Tunneling
Tunneling—Cost control

An examination of prior forecasts of tunnel construction provides an estimate of 2.4 million feet of rock tunnel to be constructed during the 1976-2000 period. Tunnel projects for the near term (1980+) and far term (1990+) periods are defined for study. The flow and characteristics of materials handled are defined for the tunnel projects. The state-of-the-art and status of R & D programs for materials handling are reviewed. Based on extensive interviews with representatives of tunnel contractors, equipment manufacturers, government agencies, and consultants, the application of various methods of material handling to tunneling is discussed, including conventional rail haulage, crane and hoist lifting, and horizontal transport and lifting by hydraulic and pneumatic pipeline and by conveyor. Total job cost estimates using these modes of material transport are obtained (with material handling costs isolated) by modification of an estimating technique used for preparing contractor bid estimates. A comparison of the results indicates that major cost savings through substitution of alternative material handling modes should not be anticipated. R & D program elements are recommended to assure that material transport will not become the limiting factor as the rate of tunnel excavation increases in future years.

DOT-TSC-UMTA-79-30
COMPARISON OF FUEL ECONOMY AND EMISSIONS FOR DIESEL AND GASOLINE POWERED TAXICABS
Transportation Systems Center
K. M. Hergenrother
PB-298 609
UMTA-MA-06-0066-79-1
Final Report July 1979 30p.

Automobiles—Motors (Diesel)—Exhaust gas
Taxicabs

URBAN MASS TRANSPORTATION ADMINISTRATION

The objective of this study was to assess potential improvements in fuel economy and exhaust emissions by dieselization of the taxi fleet in a large urban area. Sixty-six diesel powered taxicabs and an equal number of gasoline powered cabs were operated for 120,000 miles each in three taxicab fleets in New York City. Identical cabs were powered with either 198 CID diesel engines or 225 CID gasoline engines. Test results from all cabs were used to determine fuel economy and exhaust emissions. On the road, the diesel cabs had 50 percent better fuel economy than the gasoline cabs; the diesel exhaust emissions (HC, CO, NOx) were lower than the gasoline exhaust emissions over the life of the test. Emission from the diesels did not appreciably degrade with vehicle age; emission from the gasoline cabs increased appreciably.

DOT-TSC-UMTA-79-32
COMPUTER SIMULATION OF AN ELECTRIC TROLLEY BUS
Transportation Systems Center
John J. Stickler
UMTA-MA-06-0093-80-1
Final Report December 1979 66p.

Buses
Buses—Simulation Methods

This report describes the computer simulation of an electric trolley bus as it traverses an arbitrary mission profile of specified acceleration, roadway grade, and headwind. The models for the different bus components are examined and the impact of cam-control on trolley bus performance is reviewed. The simulation model is used to generate power-propulsion characteristics for a trolley bus operating over different urban drive cycles. Program listings, including a CALCOMP subroutine for graphic display, are presented in the appendix.

DOT-TSC-UMTA-79-33
IN-SERVICE PERFORMANCE AND COSTS OF METHODS TO CONTROL URBAN RAIL SYSTEM NOISE: SECOND TEST SERIES REPORT
Transportation Systems Center
Hugh H. Saurenman
PB80-132996
UMTA-MA-06-0099-79-4
DOT-TSC-1053
Interim Report October 1979 194p.

Railroads—Noise
Noise Control

This report presents the results of the final four phases of the seven-phase program whose purpose is to determine the acoustic and economic effectiveness of resilient wheels, ring-damped wheels, wheel truing, and rail grinding for reducing wheel/rail noise on urban rail transit systems. In-car and wayside noise data on both curved and tangent track are presented and discussed. In addition, the report presents information on ground-borne vibration measurements that were performed at the same time as some of the acoustical tests and a summary of the propulsion equipment was found to limit the reduction of wheel/rail noise that could be observed in this study.

All of the testing for this project has been performed on the Market-Frankford Line of the Southeastern Pennsylvania Transportation Authority (SEPTA) rail transit system.

DOT-TSC-UMTA-79-34
PROCEEDINGS OF THE URBAN RAIL VEHICLE CRASHWORTHINESS WORKSHOP—APRIL 1978
Transportation Systems Center
R. J. Madigan, and M. M. Chen
PB80-127327
UMTA-MA-06-0025-79-9
DOT-TSC-1511
October 1979 272p.

Railroads—Accidents
Railroads—Safety measures

This document contains the proceedings of the Urban Rail Vehicle Crashworthiness Workshop held at the Transportation Systems Center, Cambridge, Massachusetts, April 13-14, 1978. The workshop brought together researchers, manufacturers, users, and government representatives to exchange information on crashworthiness both to share knowledge and to provide input as to further research needs.

DOT-TSC-UMTA-79-35
EXTRUDED TUNNEL LINING SYSTEM, PHASE I—CONCEPTUAL DESIGN AND FEASIBILITY TESTING
Transportation Systems Center
Brian J. Doherty, Douglas, W. Ounanian, Kenneth R. Maser
PB80-118011
UMTA-MA-06-0100-79-11
DOT-TSC-1516
Final Report September 1979 210p.

Tunneling
Tunneling—Design and construction

This report describes the work completed during the first phase of a three phase program to design, develop, fabricate, test and demonstrate a system for placing a continuousy extruded tunnel lining.

The report presents a state-of-the-art review of related construction practices, concrete technology and tunnel liner design methods. The extruded tunnel lining system (ETLS) conceptual design is described. In addition, the results of a development program carried out to formulate a rapid setting concrete for use with the ETLS and a test program to demonstrate the ability to slipform and place that concrete under pressure in a closed form are reported.

The ability to slipform a well consolidated slab of the rapid setting Very High Early Cement (VHEC) concrete was demonstrated. The slipformed concrete gained strength rapidly and was self-supporting approximately one hour after the initial addition of water to the concrete.

DOT-TSC-UMTA-79-37
SERVICE AND METHODS DEMONSTRATION PROGRAM
Transportation Systems Center
Bruce D. Spear, Mark Abkowitz, Robert Casey, Michael Couture, and Lawrence Doxsey
PB80-110281
UMTA-MA-06-0049-79-8
UMTA-MA-06-0049
Annual Report August 1979 314p.

Urban transportation—Management
Urban transportation—Planning

The Urban Mass Transportation Administration (UMTA) Service and Methods Demonstration (SMD) Program was established in 1974 to provide a consistent and comprehensive framework within which innovative transportation management techniques and transit services coud be developed, demonstrated and evaluated, and the resultant findings disseminated in a timely manner to transportation planners, policymakers, and transit operators. The program focuses on strategies that involve the imaginative use of traffic management, pricing and marketing techniques, transit service variations, and existing technology to produce improvements which require relatively low levels of capital investment, and which can be implemented within a short time frame. This report documents the SMD program for Fiscal Year 1978. Program activities and accomplishments are reviewed for each of the following areas: conventional transit service improvements; pricing and service innovation; paratransit; transportation services for special user groups; evaluation methodology; and information dissemination. Results of current demonstration projects and special studies of innovative service concepts are summarized.

DOT-TSC-UMTA-79-38
SUMMARY OF CAPITAL AND OPERATIONS AND MAINTENANCE COST EXPERIENCE OF AUTOMATED GUIDEWAY TRANSIT SYSTEMS COSTS AND TRENDS FOR THE PERIOD 1976-78. SUPPLEMENT 1
Lea (N. D.) and Associates, Inc.
F. A. F. Cooke, C. P. Elms, D. U. Muoth, H. Theumer, and T. M. Dooley
PB80-146483
UMTA-IT-06-0188-79-1
DOT-UT-70090
October 1979 60p.

Automated guideway transit
Local transit — Cost of operation

This cost supplement is presented in the form of a series of tables and figures which summarize the data obtained as well as the results of analysis. Comments and explanatory notes relative to tables/figures are made where appropriate. Also included herein is information on operating and maintenance and capital costs for bus and rail transit; it indicates how AGT cost experience compares with the conventional modes. This report summarizes operations and maintenance cost experience for the following Automated Guideway Transit systems for the period 1976-1978; Airtrans, Dallas/Fort Worth Airport, Texas; Morgantown People Mover, Morgantown, West Virginia; Satellite Transit System, Seattle-Tacoma International Airport, Washington; Passenger Shuttle System, Tampa International Airport, Florida; and WEDway People Mover System, Disney World, Florida. Capital cost data on these and the following additional systems are also reviewed: People Mover, Atlanta-Hartsfield International Airport, Georgia; Busch Gardens People Mover, Williamsburg, Virginia; Satellite Transit Shuttle, Miami International Airport, Florida; AGT System, Fairlane Town Center, Dearborn, Michigan; and UMI Tourister AGT System, King's Dominion, Ashland, Virginia.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-79-39, 1
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS,
Volume 1: Executive Summary
Multisystems, Inc.
M. Flusberg, H. R. Menhard, J. Walker, and K. Sobel
PB80-125479
Set: PB80-125461
UMTA-MA-06-0054-79-5
DOT-TSC-1334
Final Report September 1979 73p.

Paratransit services
Paratransit services — Estimates

Integrated Paratransit (IP) is a concept which involves the integration of conventional fixed-route transit with flexibly routed paratransit services to provide the most effective area-wide transit coverage. The report estimates the benefits and costs associated with different IP options in different settings and compares these results with those of other transportation alternatives. Based on the results of the various components of analysis in this study, a variety of conclusions about IP service can be reached. The conclusions suggest that in some circumstances integrated paratransit may be an effective strategy for improving overall mobility.

DOT-TSC-UMTA-79-39, 2
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS.
Volume 2: Introduction and Framework for Analysis
Multisystems, Inc.
M. Flusberg, H. R. Menhard, J. Walker, and K. Sobel
PB80-125487
Set: PB80-125461
UMTA-MA-06-0054-79-6
DOT-TSC-1334
Final Report September 1979 77p.

Paratransit services
Paratransit services — Estimates

The study represents the first systematic attempt to estimate the potential impacts of a wide range of IP options in different settings. The output of this study should provide local decision makers with a better understanding of the varied impacts an IP system might have. In addition, the study has attempted to identify potentially promising IP options and policies (as well as those options which show little promise) which may lead to the next round of paratransit demonstrations. Finally, the study has identified those instances where IP is, and those where it is not, the most appropriate way to improve public transportation services in a given area.

DOT-TSC-UMTA-79-39, 3
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS.
Volume 3: Scenario Analyses
Multisystems, Inc.
M. Flusberg, H. R. Menhard, J. Walker, and K. Sobel
PB80-125495
Set: PB80-125461
UMTA-MA-06-0054-79-7
DOT-TSC-1334
Final Report September 1979 358p.

Paratransit services
Paratransit services — Estimates

This is the third volume of a six-volume report documenting the results of a study entitled 'Benefit-Cost Analysis of Integrated Paratransit Systems.' This volume provides detailed results of a series of scenario analyses designed to determine the impacts of various integrated paratransit (IP) configurations and other, more conventional, alternatives in a variety of settings. These transportation options are analyzed for the year 1980; the IP scenarios are also analyzed for the year 2000.

DOT-TSC-UMTA-79-39, 4
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS.
Volume 4: Issues in Community Acceptance and IP Implementation
Multisystems, Inc.
M. Flusberg, H. R. Menhard, J. Walker, and K. Sobel
PB80-125503
Set: PB80-125461
UMTA-MA-06-0054-79-8
DOT-TSC-1334
Final Report September 1979 122p.

Paratransit services
Paratransit services — Estimates

The report describes various factors which influence community acceptance of integrated paratransit (IP) systems. In order to fully explore past events in those communities which have already accepted IP, a case study approach has been used. Seven well known IP systems were selected for analysis, based on system size, extent of community acceptance, and availability of data. Given the experiences in each case study, certain generalizations have been made about factors which seem common to each site, and comparisons have been made to show the resultant influences of different policies or other factors at the local level.

DOT-TSC-UMTA-79-39, 5
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS.
Volume 5: The Impacts of Technological Innovation
Multisystems, Inc.
M. Flusberg, H. R. Menhard, J. Walker, and K. Sobel
PB80-125511
Set: PB80-125461
UMTA-MA-08-0054-79-9
DOT-TSC-1334
Final Report September 1979 78p.

Paratransit services
Paratransit services — Estimates

A number of new technologies have been implemented with or proposed for paratransit systems. As part of the overall IP benefit cost study, the potential impact of two such technologies, digital communications and computer dispatching, have been analyzed in detail and are reported here. In addition, some preliminary analyses have been conducted on the potential impacts of computer-aided dispatching, computer control of radio channels, automated control-to-passenger communications, automated passenger information systems, automatic vehicle monitoring, and a new paratransit vehicle.

DOT-TSC-UMTA-79-39, 6
BENEFIT-COST ANALYSIS OF INTEGRATED PARATRANSIT SYSTEMS
Transportation Systems Center
MSI: M. Flusberg, H. R. Menhard, J. Walker, K. Sobel;
ARI: D. Teixera; CSI: S. Lerman, W. Pecknold, D. Nestle
PB80-125529
Set: PB80-125461
UMTA-MA-06-0054-79-5.VI
DOT-TSC-1334
Final Report September 1979 138p.

Local Transit
Carpools and carpooling

This study systematically estimates potential impacts of a range of integrated transit/paratransit options and policies in a variety of settings and compares them with impacts of transportation alternatives.

The study concludes that, in general, integrated paratransit with fares closer to fixed-route transit than exclusive-ride taxi will result in net paratransit operating deficits. However, in some instances, the benefits of integrated paratransit options in terms of improved service levels and mobility, reduced auto expenditures and other impacts appear to offset these operating deficits. Necessary factors for this include high paratransit productivities, possibly achieved by implementing hybrid, fixed-route/demand responsive service; and low operating costs, possibly achieved by contracting with private operators. Integrated paratransit was found to have a positive but insignificant impact in reducing automobile usage and ownership, but no measurable impact on vehicle miles travelled, fuel consumption, or emissions. Promising locations for paratransit implementation are those areas with population densities between 3,000 and 6,000 persons per square mile and limited existing transit service. The most promising paratransit concepts appear to be checkpoint many-to-many service, route deviation service, automated doorstop service with high vehicle densities and vanpool service. The results of the study further suggest that paratransit service demand is sensitive to fare; fare increases above $.25 were determined to be counterproductive, while free transfers from feeder services to line haul became an inducement to use paratransit. The study also concluded that digital communications and automated dispatching systems are potentially cost-effective technological innovations.

This is the sixth and last volume in the series of volumes comprising the final report. This volume includes five technical appendices which document the methodologies used in the benefit-cost analysis.

DOT-TSC-UMTA-79-40
MECHANICAL TUNNELING IN SOLID ROCK
Eldenoessische Technische Hochschule,
Zurich (Switzerland)
Werner Rutschmann
PB80-221013
UMTA-MA-06-0100-79-12
DOT-TSC-1281
Final Report May 1980 245p.

URBAN MASS TRANSPORTATION ADMINISTRATION

Tunneling

Tunneling — Design and construction

Although machines tunneling originated in the United States (1856) and was used with great success, it has since been used in other countries, namely Europe, where the greatest density of tunnel boring machines can be found today. This report is a complete translation of the German book Mechanischer Tunnelvortrieb in Festgestein, and it represents the first comprehensive work on mechanical tunnel cutting (tunnel boring). The emphasis herein is on mechanical tunnel boring in medium and high-strength as well as in abrasive rock, and thus on full face excavation of radially symmetric cross sections. This document is intended for construction managers, design and project engineers, as well as for students. This report introduces the principles of mechanized tunneling and provides detailed guidelines for practical application. The subject is introduced with a detailed review of technical aspects and terms relating to mechanized tunneling. It discusses the mechanics of rock cutting and implications on machine performance. Two related issues—the stability of underground openings and rock mass classification for tunneling—are presented and serve to familiarize the reader with aspects other than rock cutting that affect machine tunneling. All this forms the basis for a comprehensive description of the entire mechanized tunneling system and its operation. The report also provides recommendations for bid preparation and project execution as well as a discussion of application limits.

DOT-TSC-UMTA-79-41
U.S. TRANSIT TRACK ASSESSMENT AND RESEARCH NEEDS
Transportation Systems Center
E. G. Cunney & P. L. Boyd, ENSCO, Inc.,
and J. A. Woods, London Transport International, Ltd.
PB80-196892
UMTA-MA-06-0100-79
DOT-TSC-1502
Final Report December 1979 200p.

Railroads — Track

Railroads — Track — Design and construction

This report covers a study of transit track made as part of the current research effort of the Urban Mass Transportation Administration of the U.S. Department of Transportation. The study was initiated to identify new technology and research tasks that may help increase the performance, reliability and safety of urban rapid transit systems, and to help ensure that track research provides maximum benefits to the transit industry.

The report describes track conditions and current practices in track design, construction, maintenance and inspection; potential opportunities for improvements; favorable technology that is available but not commonly used in transit track systems; and research and support tasks to fill identified needs. The report also describes the evaluation of research and support tasks for relative importance, the analysis of their costs and benefits, and a recommended implementation plan for a track research program.

DOT-TSC-UMTA-79-43
IN-SERVICE PERFORMANCE AND COSTS OF METHODS TO CONTROL URBAN RAIL SYSTEM NOISE
Transportation Systems Center
Hugh J. Saurenman, Robert L. Shipley, George Paul Wilson
PB80-129216
UMTA-MA-06-0099-80-1
Final Report December 1979 138p.

Railroads — Noise

Noise control

This is the final report of a study evaluating the acoustic and economic effectiveness of five methods of controlling wheel/rail noise and vibration on urban rail transit systems. Evaluations of rail grinding, wheel truing, resilient wheels, ring-damped wheels and welded vs. jointed rail were performed under revenue service conditions on the Market-Frankford Line of the Southeastern Pennsylvania Transportation Authority (SEPTA) rail transit system. This report summarizes the noise, vibration and cost results of the study and compares the measurement results with similar studies performed at other transit systems. Tests of the propulsion equipment noise showed that the propulsion equipment noise limited the reduction of wheel/rail noise that could be observed in this study. The general conclusions regarding noise and vibration control are: grinding rail without visible corrugations or other large scale roughnesses will result in only small reductions of noise and vibration; truing wheels without visible wheel flats or other large scale roughnesses will result in 0 to 5 dB noise reduction and 0 to 10 dB reduction of ground vibration; resilient wheels are very effective at reducing wheel squeal but provide only small reductions of noise on tangent track; resilient wheels can provide significant reductions of ground vibration above 20 Hz; ring-damped wheels are very effective at reducing wheel squeal as long as the rings are free in the grooves; ring-damped wheels do not provide significant reductions of noise on tangent track; welded rail is 10 dB quieter than jointed rail. The economic evaluation was based upon SEPTA operations and costs incurred during the test program. This data was

supplemented by information obtained from other North American transit systems and equipment and wheel manufacturers. Life-cycle cost equations were developed for the various control methods.

DOT-TSC-UMTA-79-44
FIELD EVALUATION OF FRACTURE CONTROL IN TUNNEL BLASTING
Transportation Systems Center
A. F. McKown, W. L. Fourney, P. E. Sperry, D. E. Thompson
PB80-149297
UMTA-MA-06-0100-79-14
DOT-TSC-1579
Final Report December 1979 170p.

Tunneling
Tunneling—Design and construction

This report describes the procedures and results of field tests of fracture control, a procedure for achieving fracture plane control in tunnel blasting. Fracture control procedures modify conventional drill and blast techniques in three ways. First, side notches extending the length of the drill hole are employed to control the initiation site for the cracks which produce the fracture plane. Second, the pressure in the drill hole is maintained between specified limits by using cushioned charges of low explosive. Third, stemming length is increased to avoid venting which could cause premature arrest of the crack producing the controlled fracture plane.

The results of the test program indicate that, when compared with conventional smooth blasting techniques, fracture control techniques offer the advantages of (1) reduction of the number of perimeter holes and the amount of explosive used, (2) improved structural integrity of the remaining rock, (3) reduction in overbreak, and (4) reduction in vibration levels resulting from perimeter hole detonations.

When applied to opening cuts, it was found that fracture control techniques can reduce the number of holes and the amount of explosives as compared with conventional methods, while maintaining equivalent vibration levels and advance.

More field testing should be carried out to (1) test the fracture control procedures and document blasting design parameters in various rock types, and (2) develop and test a single pass combination drill bit and notching tool to reduce the cost of notching the drill and make fracture contol techniques more economically desirable.

DOT-TSC-UMTA-79-45
MORGANTOWN PEOPLE MOVER (MPM) OPERATING, AVAILABILITY, AND MAINTENANCE HISTORY, OCTOBER 1976 THROUGH JUNE 1978
Transportation Systems Center
C. W. Watt
PB80-121460
UMTA-MA-06-0081-79-2
Final Report October 1979 100p.

Automated guideway transit—Morgantown, West Virginia
Local transit—West Virginia—Morgantown

The report covers the period of operation, dependability, and maintenance history of the Morgantown system (now known as the Morgantown People Mover—MPM) from October 1976 through June 1978. System performance in general improved greatly during this period. System availability on an annual basis rose from .880 for the year 1975-76 to .977 for the year 1977-78. Single vehicle reliability, as expressed in terms of mean time between downtime events, rose from approximately 150 hours at the end of the second year. The graphs in the report show that performance varied from month to month, but the trend was upward. Sixty-nine component failure types or other causes accounted for all the downtime recorded during the last year. About 61 percent of all the downtime events were due to only 17 causes. The other 39 percent were spread over 53 causes. A complete computer printout of the entire Morgantown data base is found in the Appendix of the report.

DOT-TSC-UMTA-79-47, 1
EVACUATION AND RESCUE IN AUTOMATED GUIDEWAY TRANSIT
Volume I: Data Collection, Scenarios, and Evaluation
Vought Corp.
David E. Benjamin
PB80-195761
UMTA-MA-06-0048-79-2
DOT-TSC-1314
Final Report December 1979 84p.

Automated guideway transit
Local transit—Safety measures

The objective of one segment of this program, the Systems Safety and Passenger Security (SS&PS) Study, is the development of guidelines for the assurance of actual and perceived passenger safety and security in AGT systems. In conventional transportation systems, transportation personnel

can help to evacuate and rescue passengers. AGT systems, however, because of their unmanned nature and unique configurations, present a number of problems related to evacuation and rescue. Operation of AGT systems with elevated guideways also presents significant problems. Serious injuries and loss of life can result from situations in which inadequate means of evacuating and rescuing passengers exist. The purpose of this portion of the SS&PS program was to identify these problems and where possible, recommend solutions. This document is Volume I of the final report on evacuation and rescue in AGT, and describes the methodology used in developing evacuation and rescue guidelines.

DOT-TSC-UMTA-79-47,2
EVACUATION AND RESCUE IN AUTOMATED GUIDEWAY TRANSIT,
Volume II: Guidebook
Vought Corp.
David E. Benjamin
PB80-195779
UMTA-MA-06-0048-79-3
DOT-TSC-1314
Final Report December 1979 97p.

Automated guideway transit
Local transit — Safety measures

The objective of one segment of the AGTT program, the Systems Safety and Passenger Security (SS&PS) Study, is the development of guidelines for the assurance of actual and perceived passenger safety and security in AGT systems. The evacuation and rescue task of the project has as its objective the production of a guidebook detailing the most effective methods and procedures for providing evacuation and rescue in AGT systems. In conventional transportation systems, transportation personnel can help to evacuate and rescue passengers. AGT systems, however, because of their unmanned nature and unique configurations present a number of problems related to evacuation and rescue. Operation of AGT systems with elevated guideways also present significant problems. Serious injuries and loss of life can result from situations in which inadequate means of evacuating and rescuing passengers exist. The purpose of this portion of the SS&PS program was to identify these problems and where possible, recommend solutions. The Guidebook is Volume II of the final report on evacuation and rescue in AGT and provides guidelines and other information relative to evacuation and rescue of passengers from AGT systems. The report addresses a description of the problems and solutions as they exist on conventional and AGT systems, a discussion of the types of planning that are required to produce satisfactory evacuation and reduce solutions, and recommendations of suitable methods and procedures for AGT evacuation and rescue.

DOT-TSC-UMTA-79-48, 1
PASSENGER SAFETY AND CONVENIENCE SERVICES IN AUTOMATED GUIDEWAY TRANSIT
Volume I: Data Collection, Scenarios, and Evaluation
Vought Corp.
Robert L. Dauber
PB80-167059
UMTA-MA-06-0048-79-4
DOT-TSC-1314-1
Final Report December 1979 83p.

Automated guideway transit
Local transit — Safety measures

The major objective was to produce a guidebook detailing the most effective methods and procedures for the accommodation of Systems Safety and Passenger Security. The primary intent of this document is to provide guidance associated with abnormal occurrences that have an impact on routine passenger services or safety. The report discusses literature and personal interview findings documenting methods and procedures for detecting and resolving Passenger Safety and Convenience Service (PS&CS) problems in current transit operations; scenarios depicting potential PS&CS problems applicable to the AGT systems; selection of methods and procedures from current practices for detecting and resolving PS&CS problems in AGT; analysis and evaluation of the effectiveness and recommended methods and procedures for accommodating PS&CS problems in AGT.

DOT-TSC-UMTA-79-48, 2
PASSENGER SAFETY AND CONVENIENCE SERVICES IN AUTOMATED GUIDEWAY TRANSIT,
Volume II: Guidebook
Vought Corp.
Robert L. Dauber
PB80-167067
UMTA-MA-06-0048-79-5
DOT-TSC-1314-2
Final Report December 1979 133p.

Automated guideway transit
Local transit — Safety measures

Current practices have been reviewed, analyzed, and evaluated for their effectiveness in accommodating Passenger Safety and Convenience Services (S&CS) problems in AGT. These practices for providing PS&CS in both conventional and AGT have been assessed as applicable to highly automated transit systems. These guidelines have been developed suggesting methods and procedures to provide these services for AGT systems. The final objective of this guidebook is to provide the most effective methods and procedures for ensuring passenger safety and convenience services in AGT systems. Its contents provide guidance for AGT system planners, designers, operators, and evaluators in identifying potential problems and assessing proposed methods and procedures.

DOT-TSC-UMTA-79-49
IMPROVED DESIGN OF TUNNEL SUPPORTS: EXECUTIVE SUMMARY
Transportation Systems Center
Herbert H. Einstein, Amr S. Azzouz, Charles W. Schwartz, and Walter Steiner
Prepared by Massachusetts Inst. of Techn., Cambridge, Dept. of Civil Engineering
PB80-134547
UMTA-MA-06-0100-79-15
DOT-TSC-1489
Final Report December 1979 55p.

Tunneling
Tunneling—Design and construction

The report focuses on improvement of design methodologies related to the ground-structure interaction in tunneling. The design methods range from simple analytical and empirical methods to sophisticated finite element techniques as well as an evaluation of tunneling practices in Austria and Germany. The purpose of this report is to provide the tunneling profession with improved practical tools in the technical or design area. These design tools provide more accurate representation of the ground-structure interaction in tunneling. The Executive Summary is the first of six publications to be published on the Improved Design of Tunnel Support. Volumes 1 through 5 will be published in March, 1980. This Executive Summary summarizes improvements in the methodology available to tunnel designers with the objective of reducing the cost of tunnel construction in the United States. This report summarizes each of the five volumes—Volume 1: Simplified Analysis for Ground-Structure Interaction; Volume 2: Aspects of Yielding in Ground-Structure Interaction; Volume 3: Finite Element Analysis of the Peachtree Center Station in Atlanta; Volume 4: Tunneling Practices in Austria and Germany; and Volume 5: Empirical Methods for Rock Tunneling—Review and Recommendations.

DOT-TSC-UMTA-79-50
SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS: CLASSIFICATION AND DEFINITION OF AGT (AUTOMATED GUIDEWAY TRANSIT) SYSTEMS
General Motors Technical Center
R. A. Lee, and F. S. A. Alberts
PB80-226509
UMTA-MA-06-0048-80-3
DOT-TSC-1220
Final Report February 1980 165p.

Automated guideway transit
Local transit—Classification

The report describes the development of an AGT classification structure. Five classes are defined based on three system characteristics: service type, minimum traveling unit capacity, and maximum operating velocity. The five classes defined are: Personal Rapid Transit (PRT); Small Vehicle Group Rapid Transit (SGRT); Intermediate Vehicle GRT (GRT); Large Vehicle GRT (LGRT); and Automated Rail Transit (ART). All classes except LGRT and ART are further stratified on the basis of speed, resulting in a total of eight subclasses. Forty-four existing and proposed AGT systems are summarized and used to define ten representative systems in terms of nominal values and range of selected characteristics. A summary of the system information compiled and used to complete this task is presented in Appendix A of this report. This report also provides a bibliography, list of text references, and a glossary of terms.

DOT-TSC-UMTA-79-52
FACTORS CONTRIBUTING TO THE RETENTION OF SEATED PASSENGERS DURING EMERGENCY STOPS
Dunlap and Associates Inc.
Harold H. Jacobs
PB80-195134
UMTA-MA-06-0048-79-6
DOT-TSC-1314
Final Report March 1980 75p.

Automated guideway transit
Local transit—Safety measures

In order to examine specific Automated Guideway Transit (AGT) developments and concepts, the Urban Mass Transportation Administration has undertaken a new program of studies and technolgy investigations known as the Automated Guideway Transit Technology (AGTT) Program. The objec-

tive of one segment of this program, the Systems Safety and Passenger Security (SS&PS) study, is the development of guidelines for the assurance of actual and perceived passenger safety in AGT systems. The prime objective of this deceleration and jerk research study was to provide AGT system planners, designers, and operators with guideline information on the acceleration levels at which seated AGT passengers might be expected to be thrown from their seats during emergency stops. A series of seven experiments was conducted to examine the variables that could contribute to a safe emergency stop on an AGT system. Sixty subjects, conforming to a desired range, experienced emergency decelerations in a test vehicle controlled by an automated braking system. The independent variables examined were seat contour and covering, seat orientation and tilt, footrests and armrests, and rate of change of deceleration (jerk). The dependent variables were the deceleration level at which subjects moved from sensors that were imbedded in the experimental seat and subject ratings.

DOT-TSC-UM927-R9742
AN ANALYSIS OF USER COST AND SERVICE TRADE OFFS IN TRANSIT AND PARATRANSIT SERVICES

Cambridge Systematics, Inc.
J. Louviere, and G. Kocur
PB80-192412
UMTA-MA-06-0049-79-10
DOT-TSC-1405
Final Report August 1979 208p.

Paratransit services
Paratransit services—Ohio—Xenia

The Xenia Model Transit Service served as a test of several alternative transit services operated in a small city setting. This project was undertaken as an aid to the evaluation of transit and paratransit systems in Xenia, Ohio, and as a test of a net technique for assessing travel demand. The technique, direct utility assessment, was designed to test a new method for assessing user trade-offs in costs and service based on attitudinal methods. A trade-off survey was administered as part of a home interview survey. Data from the trade-off survey were used to develop separate equations for each sample respondent to explain and describe their trade-offs over transit fare, travel time, walk distance, type of service, and headway. An aggregate equation was also developed, assuming that all respondents shared common trade-offs. These equations were employed to retrospectively predict changes in transit system patronage (since 1974). Both sets of models performed well, producing forecasts that were in the same direction and range of experience, although magnitudes were somewhat different.

DOT-TSC-UMTA-80-1
FIELD EVALUATION OF ADVANCED METHODS OF SUBSURFACE EXPLORATION FOR TRANSIT TUNNELING

Bechtel Corp.
D. E. Thompson, J. T. Humphrey, L. W. Young Jr., and C.F. Wall
Prepared in cooperation with Haley and Aldrich, Inc., Cambridge, MA
PB80-200496
UMTA-MA-06-0100-80-1
DOT-TSC-1570
Final Report June 1980 405p.

Tunneling—Cost control
Tunneling—Design and construction

This report presents the results of a field evaluation of advanced methods of subsurface exploration on an ongoing urban rapid transit tunneling project. The objective of this study is to evaluate, through a field demonstration project, the feasibility, applicability, reliability, and cost effectiveness of selected advanced methods of subsurface exploration and instrumentation to produce data usable for rapid transit tunnel design and construction within the time, cost and schedule constraints common to the industry. Numerous methods of subsurface exploration, including hole advancement techniques, sampling procedures, and geophysical logging tools, were used to predict stratigraphy within a test section on an urban rapid transit project under construction. A test section on the Massachusetts Bay Transportation Authority Red Line Extension-Northwest , Cambridge, Massachusetts, was selected to evaluate methods of subsurface exploration used to investigate stratigraphy, ground water levels, bedrock structure, and other geotechnical parameters. The site represents a typical urban setting with the test section located under a major, four-lane divided street, with structures adjacent on both sides.

DOT-TSC-UMTA-80-2
SIMULATION MODELS FOR THE ELECTRIC POWER REQUIREMENTS IN AN AUTOMATED GUIDEWAY TRANSIT SYSTEM

Transportation Systems Center
G. H. Williams
PB80-193386
UMTA-MA-06-0048-80-2
Final Report April 1980 137p.

Automated guideway transit
Local transit—Computer programs

This report describes a computer simulation model developed at the Transportation Systems Center to study the electrical power distribution characteristics of Automated Guideway Transit (AGT) systems. The objective of this simulation effort is to provide a means for determining the power distribution requirements of AGT systems and for evaluating their performances under varied operating conditions. Typical systems which could be modeled include the Morgantown Personal Rapid Transit System, the Dallas-Fort Worth Airtrans System, or one of the proposed Downtown People Movers. This report specifically describes a Fortran computer program which models the electric power requirements for a typical AGT system.

DOT-TSC-UMTA-80-5
PREDICTING AUTOMATED GUIDEWAY TRANSIT SYSTEM STATION SECURITY REQUIREMENTS
Rouse (W. V.) Associates, Ltd.
C. Ray, D. Stuart, D. Thomson, V. Rouse, and J. Botts
PB80-194244
UMTA-MA-06-0048-80-4
DOT-TSC-1454
Final Report March 1980 148p.

Automated guideway transit
Local transit—Safety measures

This study addresses the issues of personal security on Automated Guideway Transit (AGT) Systems, as they might be deployed in typical urban residential and nonresidential settings. Based upon a literature review, it outlines basic characteristics of existing transit crime; compares station design concepts for AGT and conventional rail transit; reviews the key environmental characteristics of AGT stations which may influence crime potential; inventories both existing and proposed countermeasures for transit crime reduction; identifies additional neighborhood resources which might be mobilized as countermeasures; reviews available techniques for predicting transit crime; and reviews techniques available for both predicting transit crime and assessing countermeasures' effectiveness and offers recommendations for analysis strategies to be employed in local AGT studies. Traditional as well as innovative analysis techniques are covered. This report recommends a general approach for AGT station security requirements analysis which can be used by localities in site-specific AGT planning and engineering studies. This report provides a list of references as well as an annotated bibliography.

DOT-TSC-UMTA-80-7
PROCEEDINGS OF A WORKSHOP ON TUNNEL LINING DESIGN HELD AT CAMBRIDGE, MASSACHUSETTS ON MARCH 12-13, 1979
Pacific Consultants
PB80-171366
UMTA-MA-06-0100-30-2
DOT-TSC-1526
December 1979 234p.

Tunnel lining—Design and construction
Tunnels—Congresses
Tunnels—Design and construction

This workshop provided a forum for the identification and discussion of problems in the design and construction of tunnels centering around six topics, namely: Lining Design, Qualification, Geotechnical Investigations, Observational Approach, Specifications, and Constructibility and Cost Considerations. A position paper on each topic is arranged together with appropriate discussions from the working group members. In addition to background information regarding the planning of this workshop, this report also contains the keynote address, position papers, names and addresses of subcomittee members, as well as information about the six topics discussed at the workshop.

DOT-TSC-UMTA-80-8
IDENTIFICATION OF THE FIRE THREAT IN URBAN TRANSIT VEHICLES
Transportation Systems Center
W. T. Hathaway, and A. L. Flores
PB80-217631
UMTA-MA-06-0051-80-1
DOT-MA-06-0051
Final Report June 1980 109p.

Local transit—Fires and fire prevention
Local transit—Safety measures

To improve mass transportation, UMTA asked the Transportation Systems Center (TSC) to assess the overall fire threat in transit systems and to identify and recommend suitable remedial actions. This report presents the identification of the fire threat in urban transit vehicles. The study is based on site visits/surveys to nine representative U.S. transit properties, namely: Massachusetts Bay Transportation Authority (MBTA); Bay Area Rapid Transit District (BART); New York City Transit Authority (NYCTA); San Francisco Municipal Railway (MUNI); Southern California Rapid Transit District (RTD-

Los Angeles); Denver Rapid Transit District (RTD-Denver); Metropolitan Atlanta Rapid Transit Authority (MARTA); Washington Metropolitan Area Transit Authority (WMATA); and Chicago Transit Authority (CTA). The data collected from the nine transit properties represented all bus and rail rapid transit fire and smoke incidents which occurred at those transit properties during the calendar year 1978. Data was obtained from daily logs, operator reports, accident reports, police reports, and maintenance reports. These data are supplemented by fault tree diagrams and scenarios in identification of the fire threat. These are based on actual transportation fire and smoke incidents in TSC files, data analysis, interviews with transit personnel, and the use of maintenance manuals. Following a description of the TSC data acquisition methodology, the data are analyzed and discussed along with the relationship of the fault trees and scenarios to the identification of countermeasures.

DOT-TSC-UMTA-80-9
PHASE I MORGANTOWN PEOPLE MOVER IMPACT EVALUATION
Transportation Systems Center
Shang Hsiung, and Mary D. Stearns
PB80-187768
UMTA-MA-06-0026-80-1
Final Report March 1980 154p.

Automated guideway transit
Local transit—West Virginia—Morgantown—Evaluation

The Morgantown system belongs to a generic class of systems known as Automated Guideway Transit (AGT). The report presents a summary of the system and service characteristics impacts of the system. The major areas of discussion of this report include an overview of the system and the evaluation effort associated with it, a description of the system performance and service characteristics, system ridership, system finances, system impacts, and an identification of experiences that are transferable to other applications of AGT.

DOT-TSC-UMTA-80-10
THE BEHAVIORAL IMPACTS OF FLEXIBLE WORKING HOURS
Transportation Systems Center
Marian Ott, Howard Slavin, and Donald Ward
PB80-191174
UMTA-MA-06-0049-79-12
Final Report February 1980 31 p.

Hours of labor, Flexible
Shift systems

This paper presents new results on the behavioral responses to flexitime, which is a system of flexible working hours under which workers are permitted to select their daily schedules within certain predefined limits. Flexitime has been implemented by an increasing number of firms and institutions in Europe and the United States, and is of particular interest as a transportation systems management strategy with potentially significant impacts on work schedules, travel behavior, traffic congestion, and energy consumption. This study is based on a flexitime experiment conducted at the U.S. Department of Transportation's Transportation Systems Center (TSC) in Cambridge, Massachusetts. TSC is a large government facility which employs more than 600 persons and is located in a dense and congested area of the Boston region, but which has high accessibility by all modes of urban transport. This study was designated to permit a rigorous assessment of individuals' activity and travel responses and their implications for transport planning.

DOT-TSC-UMTA-80-16
NOISE REDUCTION RETROFIT FOR A 'NEW LOOK' FLEXIBLE TRANSIT BUS: SERVICE BULLETIN
Tri-County Metropolitan Transportation District of Oregon, Portland
Michael C. Kaye
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control
PB80-226103
UMTA-OR-06-0005-80-1
Final Report September 1980 66p.

Buses—Design and construction
Noise control

This document presents instructions on how to apply a noise treatment to a contemporary city transit bus without extensive structural alteration. Baseline bus configuration, noise ratings, and performance benchmarks are presented for a Flexible 111DC-DO61 transit bus powered by a Detroit Diesel 8V-71N engine. The concepts and much of the hardware described in this report are transferable to similar buses. The information presented herein is of interest primarily to transit bus operators wanting to reduce noise by practical means, and to government agencies, manufacturers, and planners concerned with reducing the noise of buses in service at a moderate cost. In this report instructions are given on how to

retrofit the engine with a turbo-charger and ancillary hardware. Acoustic benefits and performance side-effects are given. One beneficial side-effect, because of turbo-charging, is reduced harmful exhaust emissions. Another, because of smaller injectors and reduced exhaust back pressure, is fuel conservation. The instructions with this report are complete with sources for manufactured components and raw materials, and with mechanical drawings for components to be locally fabricated. Illustrations and text direct installation as well as effects of noise ratings and performance side-effects are also presented. In this report practical application is coupled with theoretical explanation throughout.

DOT-TSC-UMTA-80-17,1
INCREASED RAIL TRANSIT VEHICLE CRASHWORTHINESS IN HEAD-ON COLLISIONS,
Volume I: Initial Impact
IIT Research Inst.
Edward E. Hahn
PB80-205727
UMTA-MA-06-0025-80-1
DOT-TSC-1052-1
Final Report June 1980 70p.
Local transit—Safety measures
Railroads—Cars—Safety measures

A specific goal of safety is to reduce the number of injuries that may result from the collision of two trains. In Volume I, a two-dimensional analytic simulation model of the leading cars of two impacting transit car consists is formulated. This model is capable of simulating the mechanics of head-on initial impact of two transit cars on straight level track. Specifically, the model is capable of establishing the critical parameters which govern whether cars crush, override, or crush with subsequent override. This simulation model is used to assess impact control devices currently in service, such as anticlimbers, couplers, and draft gear The report also presents a detailed experimental test plan for evaluating the strength and effectiveness of future designs of impact control devices which has been developed.

DOT-TSC-UMTA-80-17,2
INCREASED RAIL TRANSIT VEHICLE CRASHWORTHINESS IN HEAD-ON COLLISION.
Volume II: Primary Collision
IIT Research Inst.
Edward E. Hans, Steven C. Welgrave, and Theodore Liber
PB80-205743
UMTA-MA-06-0025-80-2
DOT-TSC-1052-2
Final Report June 1980 80p.
Local transit—Safety measures
Railroads—Cars—Safety measures

A specific goal of safety is to reduce the number of injuries that might result from the collision of two trains. In Volume II, an analytical model in two dimensions, longitudinal and vertical, of the primary collision of two impacting urban railcar consists is formulated. This model includes the formulation of the leading cars developed in Part 1 of this program, and the distribution of mass and nonlinear force-deformation relationships existing among major structural sub-assemblages. This model also is capable of determining the extent of crushing and/or override suffered by the individual cars in the consists, as well as the time histories of displacement, velocity, and acceleration in both the longitudinal and vertical directions. Methods are developed for generating the dynamic force-deformation relationships for structural sub-assemblages comprising the critical modules of railcars. These methods include finite-element analysis, scale modeling, and full-scale testing procedures including specifications for required testing equipment and instrumentation.

DOT-TSC-UMTA-80-17,4
INCREASED RAIL TRANSIT VEHICLE CRASHWORTHINESS IN HEAD-ON COLLISION.
Volume IV: IITrain User's Manual
IIT Research Inst.
Edward E. Hahn
PB80-205735
UMTA-MA-06-0025-80-4
DOT-TSC-1052-4
Final Report June 1980 233p.
Local transit—Safety measures
Railroads—Cars—Safety measures

A specific goal of safety is to reduce the number of injuries that may result from the collision of two trains. In Volume IV, a computer code for the simulated crash of two railcar consists is described. The code is capable of simulating the mechanics of head-on impact of two consists on straight level track. The simulation is limited to two dimensions, namely a vertical plane containing the length of the track. The user can model the individual car components or cars in a complex or as simple a manner as is warranted by the simulation results desired. Although specifically developed for transit cars, the code can also be used to simulate freight trains or intercity pasenger trains.

URBAN MASS TRANSPORTATION ADMINISTRATION

DOT-TSC-UMTA-80-22
NOISE CONTROL FOR RAPID TRANSIT CARS ON ELEVATED STRUCTURES: PRELIMINARY INVESTIGATION OF VEHICLE SKIRTS, UNDERCAR ABSORPTION, AND NOISE BARRIERS
Bolt Beranek and Newman, Inc.
C. E. Hanson, M. Schafer, D. Towers, and K. Eldred
PB80-213077
UMTA-MA-06-0099-80-4
DOT-TSC-16611
Final Report April 1980 61p.

Local transit—Noise control
Urban transportation—Noise control

In the report, procedures to reduce the propulsion system noise of urban rail transit vehicles on elevated structures are studied. Experiments in a laboratory use a scale model transit vehicle to evaluate the acoustical effectiveness of noise barrier walls, vehicle skirts, and undercar absorption. These experiments assume that the propulsion system noise is the only source of noise. Field measurement of urban rail transit vehicles at the Port Authority Transit Corporation (PATCO) in New Jersey provide additional data to compare the noise from elevated-structure and at-grade track sections. The results show that vehicle skirts and undercar absorption can provide a cost-effective noise reduction alternative to noise barriers if the propulsion system is the dominant noise source. The scale model results are only approximate and must be verified by full-scale demonstration tests. However, the potential value of the results can be demonstrated by applying the measured noise reductions in octave bands to the actual measured noise spectrum of the PATCO vehicle.

DOT-TSC-UMTA-80-25,1
MEASUREMENT OF WHEEL/RAIL FORCES AT THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY.
Volume I: Analysis Report
Transportation Systems Center
C. Phillips, H. Weinstock, R. Greif, and W. I. Thompson, III
PB80-212772
UMTA-MA-06-0025-80-6
DOT-MA-06-0025
June 1980 48p.

Local Transit—District of Columbia—Washington
Washington Metropolitan Area—Transit systems

Under the direction of the Urban Mass Transportation Administration (UMTA), measurements of wheel/rail forces were made in August 1979 by the Transportation Systems Center (TSC) with the assistance of Battelle Columbus Laboratories to determine the causes of excessive wheel/rail wear experiences by the Washington Metropolitan Area Transit Authority (WMATA) Metrorail System during its first three years of operation. In addition to measuring the absolute magnitude of the wheel/rail forces, it was the intent to compare alternative methods for relieving wheel/rail wear at WMATA and other transit properties. Measurements of wheel/rail forces were made at the Washington National Airport Test Site and the Brentwood Shop Test Site. This report describes the results of that effort.

DOT-TSC-UMTA-80-27,1
IMPROVED DESIGN OF TUNNEL SUPPORTS.
Volume I: Simplified Analysis for Ground-Structure Interaction in Tunneling
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering
Charles W. Schwartz, and Herbert H. Einstein
PB80-225154
Set: PB80-225147
UMTA-MA-06-0100-80-4
DOT-TSC-1489
Final Report June 1980 438p.

Tunneling—Design and construction
Tunnels—Design and construction

The purpose of this report is to provide the tunneling profession with improved practical tools in the technical or design area, which provide more accurate representations of the ground-structure interaction in tunneling. The design methods range from simple analytical and empirical methods to sophisticated finite element techniques as well as an evaluation of tunneling practices in Austria and Germany. Volume I describes a simplified analysis method for ground structure interaction in tunneling, which is necessary because of the indeterminate relationships which describe the realm of tunneling parameters. The method is geared toward hand calculations that incorporate the effects of three of the most significant factors influencing the ground structure behavior. The authors point out that it is doubtful that the complex interrelationships among the nearly countless variables in any real tunneling problem can ever be rigorously analyzed, even using the most sophisticated numerical techniques. As an alternative approach, the simpli-

fied method focuses on the essential elements of very complicated phenomena in order to isolate the three major factors that have an overriding influence on support loads. These factors are: (1) the relative stiffness of the support and ground mass; (2) the spatial lag or delay of support construction behind the tunnel face; and (3) the yielding of ground mass as its shear strength is exceeded. Using these factors, the intent of Volume I is to provide an analysis in which accentuated computational ease, coupled with sufficient accuracy, makes the simplified method a valuable and effective tool for use in preliminary design, for parametric studies in final design, and for updating the design during construction.

DOT-TSC-UMTA-80-27,2
IMPROVED DESIGN OF TUNNEL SUPPORTS.
Volume 2: Aspects of Yielding in Ground-Structure Interaction
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering
Charles W. Schwartz, Amr. S. Azzouz, and Herbert H. Einstein
PB80-225162
Set: PB80-225147
UMTA-MA-06-0100-80-5
DOT-TSC-1489
Final Report June 1980 79p.

Tunneling—Design and construction
Tunnels—Design and construction

Volume 2 focuses on a particularly complex and often misunderstood aspect of ground-structure interaction, which is ground yielding and loosening, and reports new findings in this area. The findings are based on previous research, on the knowledge gained during the development of the simplified analysis and application of the more sophisticated finite element techniques, and on specific studies of strain softening ground behavior. A conceptual review of ground yielding behavior, including outlines of appropriate analytical treatments, is addressed in the report and emphasis is placed upon the problematic phenomenon of loosening. In addition to providing some basic concepts of ground yielding, the report also describes and compares analytical solutions for plastic ground behavior. Finally, an analytical tool for treating strain softening behavior is provided. The authors point out that it is hoped that ground-yielding, and, consequently, ground-structure interaction, can be better understood and analytically treated, even if some aspects remain somewhat problematic.

DOT-TSC-UMTA-80-27,3
IMPROVED DESIGN OF TUNNEL SUPPORTS.
Volume 3: Finite Element Analysis of the Peactree Center Station in Atlanta
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering
Amr S. Azzouz, Charles W. Schwartz, and Herbert H. Einstein
PB80-225170
Set: PB80-225147
UMTA-MA-06-0100-80-6
DOT-TSC-1489
Final Report June 1980 111p.

Tunneling—Design and construction
Tunnels—Design and construction

Volume 3 contains the application of the three-dimensional (3-D) finite element program, Automatic Dynamic Incremental Nonlinear Analysis (ADINA), which was designed to replace the traditional 2-D plane strain analysis, to a specific location. The location is the Peachtree Center Station in Atlanta, Georgia. The purpose of the study was to demonstrate the practical use of such a methodology. Predictions of ground movements and stresses caused by the enlargement of the pilot tunnel to form the test chamber, and by the excavation of the main station cavern are displayed. Plots of calculated stresses and deformation are shown in a form suitable for practical comparisons with instrument readings. This application of the three-dimensional finite element model is intended to illustrate some of the advantages and limitations of such methods when used for design or to compare predicted movements with measured movements. The effectiveness of the 3-D analysis for design is constrained but not excluded by the time and total cost requirements of the analysis. The potential design savings will probably outweigh the analysis costs in cases where complex ground-structure interaction cannot be realistically modeled by other methods.

DOT-TSC-UMTA-80-27,4
IMPROVED DESIGN OF TUNNEL SUPPORTS.
Volume 4: Tunneling Practices in Austria and Germany
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering
Walter Steiner, Herbert H. Einstein, and Amr. S. Azzouz
PB80-225188
Set: PB80-225147
UMTA-MA-06-0100-80-7
DOT-TSC-1489
Final Report June 1980 469p.

URBAN MASS TRANSPORTATION ADMINISTRATION

Tunneling—Design and construction
Tunnels—Design and construction

Volume 4 documents and evaluates extensive information gathered on tunnel construction practices in Austria and Germany, identifies differences compared to U.S. practices, and describes new developments. The objective was to assemble all available information about the economic, contractual, and technical aspects of tunneling in these countries. The cost information includes general cost data as well as specific costs for tunnels recently constructed, and discusses the reasons why tunneling there is often more economical and technically innovative than it is in the United States. The contractual information is based on a review of contractual standards and procedures in these countries and contractual arrangements for selected projects. The technical information includes general information on design philosophy and construction procedures, and detailed information on analytical and empirical methods and design aspects. A large number of transmountain tunnels in Austria and subway tunnel sections in Germany were visited, and many discussions were held with owner-authorities, design firms, and contractors.

DOT-TSC-UMTA-80-27,5
IMPROVED DESIGN OF TUNNEL SUPPORTS
Volume 5: Empirical Methods in Rock
Running Review and Recommendations
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering
Walter Steiner, and Herbert H. Einstein
PB80-225196
Set: PB80-225147
UMTA-MA-06-0100-80-8
DOT-TSC-1489
Final Report June 1980 557p.

Tunneling—Design and construction
Tunnels—Design and construction

Volume 5 evaluates empirical methods in tunneling. Empirical methods that avoid the use of an explicit model by relating ground conditions to observed prototype behavior have played a major role in tunnel design. The main objective of this volume is to provide the tunneling profession with a review of empirical methods, and to also present some guidelines on what empirical methods are best suited for observational (adaptable) tunneling procedures.

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